apple service

LEVEL I
THE MACINTOSH™ OFFICE
TECHNICAL PROCEDURES
#072-0163

apple service

LEVEL I
THE MACINTOSH™
OFFICE
TECHNICAL
PROCEDURES
072-0163
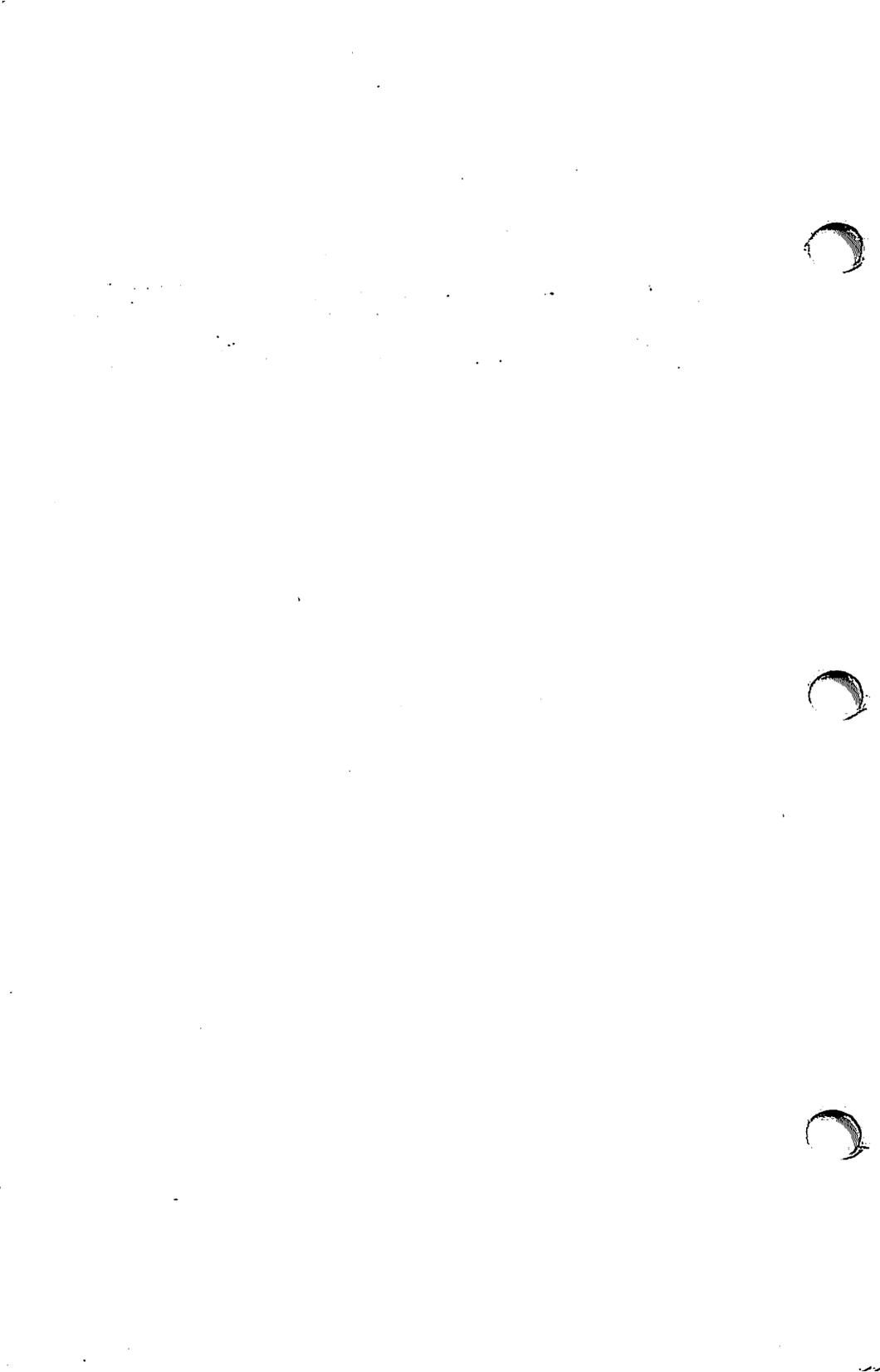
THE MACINTOSH™ OFFICE
TECHNICAL PROCEDURES

P/N: 072-0163

## Supplementary Materials for Macintosh Office Service

**1. The following videotapes are available to supplement the instructions in this binder:**

LaserWriter Introductory Technical Procedures (included in
    Macintosh™ Office Support Kit)   (P/N 075-0052)

LaserWriter Printer Pedestal Take-Apart   (P/N 075-0054)

LaserWriter Printer Theory of Operations, *Part 1*   (P/N 075-0060)
                                      Part 2   (P/N 075-0061)

LaserWriter Printer Troubleshooting   (P/N 075-0070)

2. Besides this binder, you will need the following printed reference materials to service a Macintosh Office:

Macintosh Office Quick Reference Guides   (P/N 072-0169)

AppleTalk™ Reference Guide: Cabling   (P/N 072-0172)
  the Multiroom Office
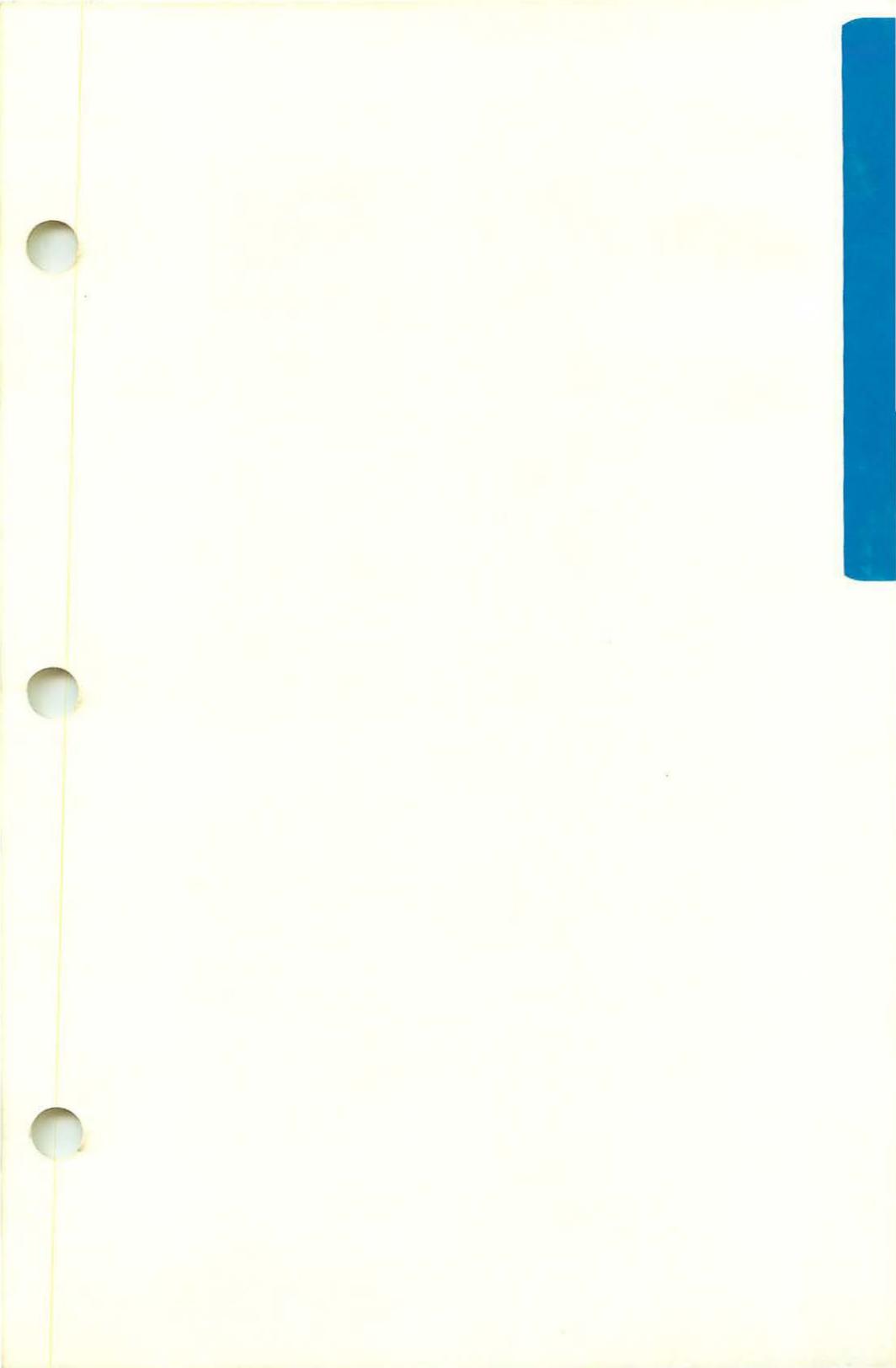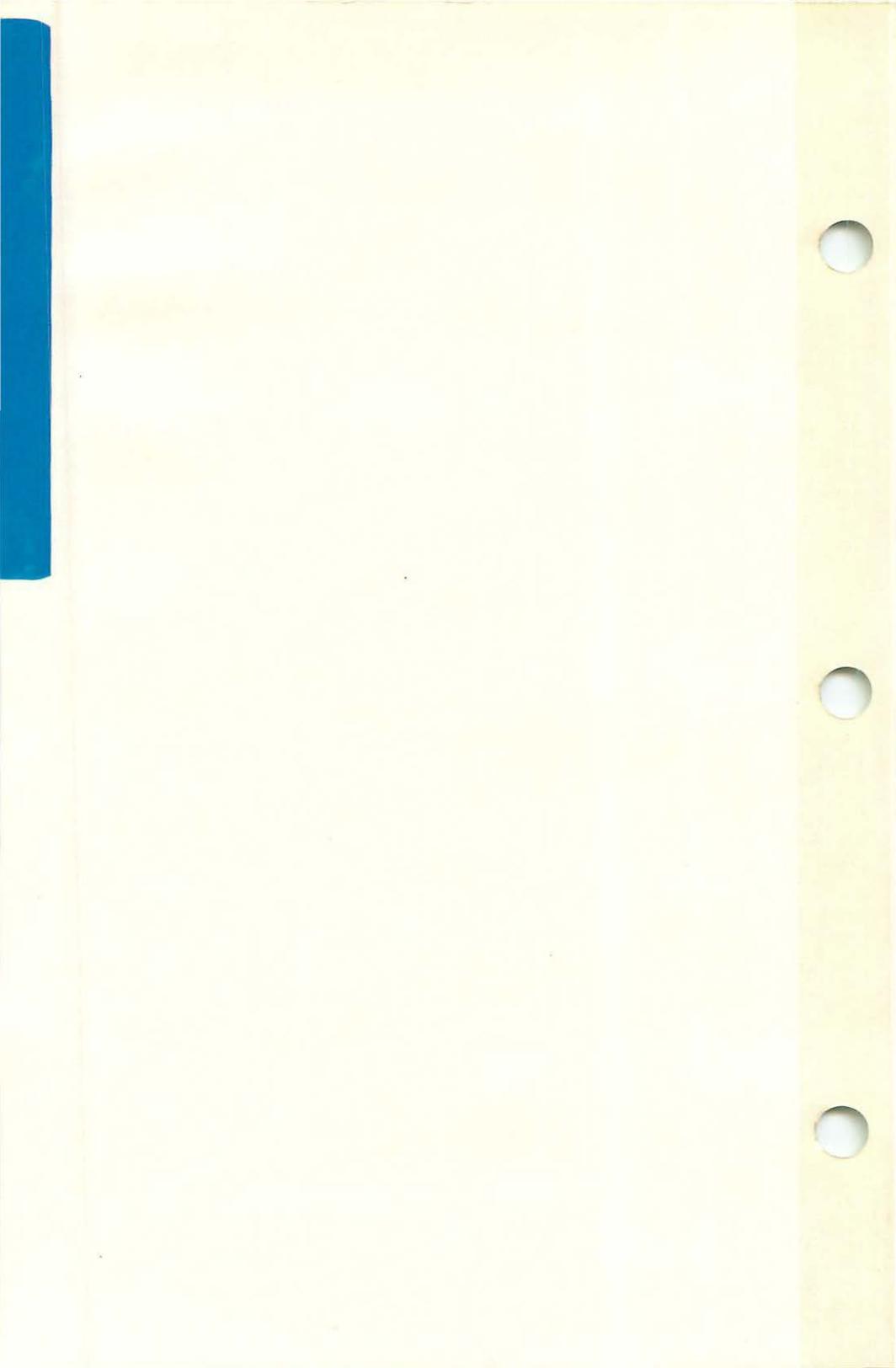
APPLE LASERWRITER PRINTER
TECHNICAL PROCEDURES

TABLE OF CONTENTS

NOTE: For LaserWriter Plus kit installation, diagnostics, and troubleshooting, see the **LaserWriter Plus** tab in this manual.

GENERAL INTRODUCTION: THIS MANUAL

The service procedures contained in this manual cover Level I troubleshooting and repairs for the Apple® LaserWriter Printer. Several of the procedures are demonstrated in the videotape **LaserWriter Introductory Service Procedures,** which is included in the LaserWriter Support Kit.

Installation instructions for the LaserWriter and the AppleTalk™ Personal Network are given in the <u>Macintosh Office Quick Reference Guides.</u> **Familiarize yourself with those guides before using this manual.**

Also familiarize yourself with the LaserWriter user's manual. It contains instructions on use and operator-level maintenance of the printer which <u>all service personnel should be aware of.</u>

In this manual, read section 1, **Basics,** before doing any work inside the printer. It explains how the printer works and gives diagrams locating its major assemblies. It also explains the printer's test prints and status lights and gives specifications for printer use and maintenance.

Sections 2 and 3, **Take-Apart** and **Adjustments,** contain step-by-step instructions for replacements and adjustments. Section 2 also contains **important safety information and Electrostatic Discharge precautions** that you need to know before working inside the printer. **Don't ignore these precautions. The printer's laser light can damage your eyes severely unless you observe the safety precautions, and static discharge can cause real problems with expensive printed circuit boards.**

Section 4, **Troubleshooting,** contains a systematic troubleshooting procedure and a complete set of troubleshooting tables. **In order to use the Troubleshooting section, you must know how to use a multimeter to measure voltages and resistances and to check electrical continuity.**

Section 5, **Preventive Maintenance,** covers cleaning and lubrication procedures that are recommended each time you service a LaserWriter.

Section 6, the **Illustrated Parts List,** includes all piece parts that can be purchased separately from Apple for the LaserWriter.

The **Appendix** contains photos that are referred to throughout the manual. **A wiring diagram of the printer is contained in the flap at the back of the binder.**
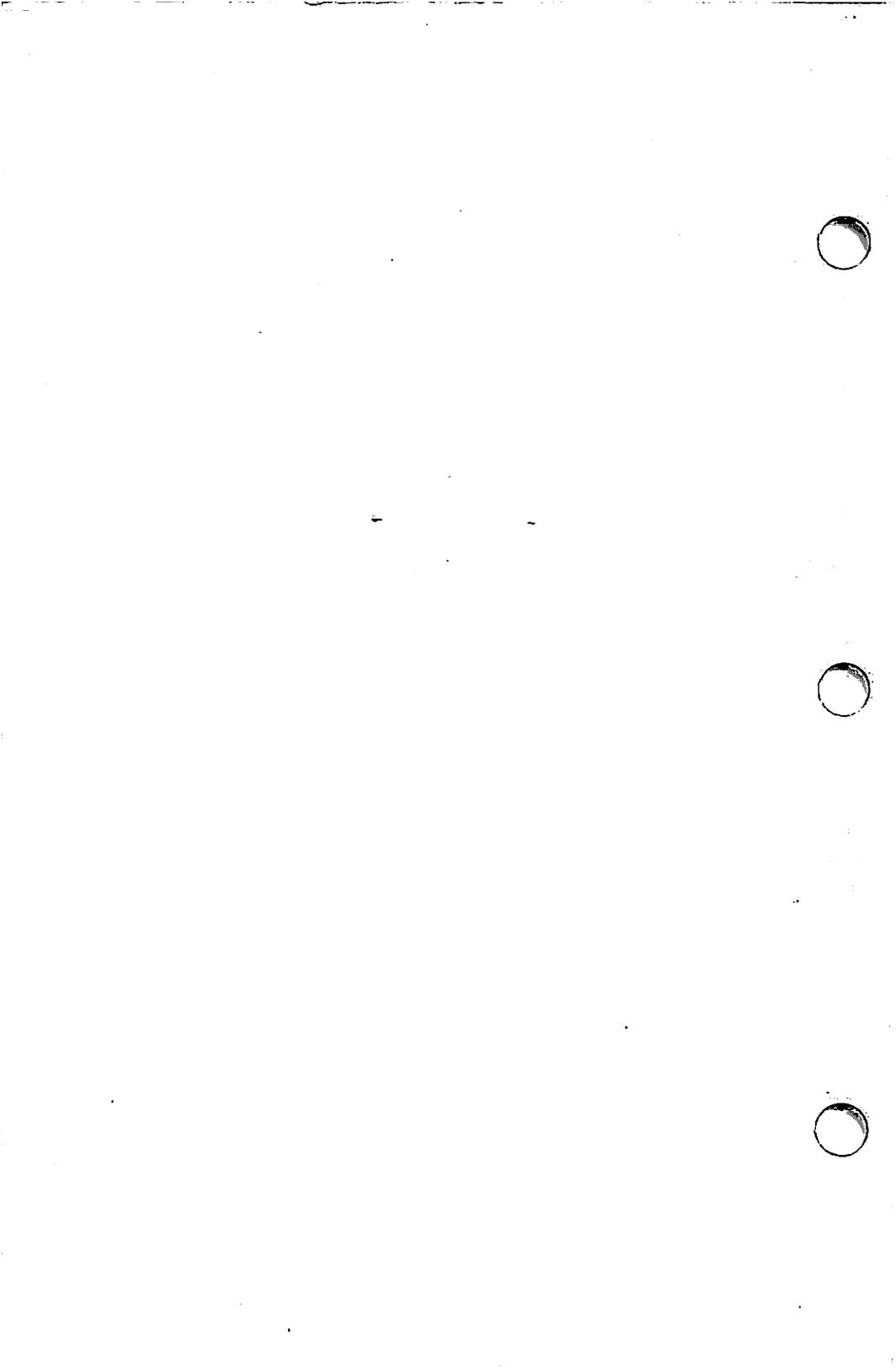
Apple LaserWriter Printer
Technical Procedures

Section 1 - Basics

Contents:

1.A — PARTS OF THE PRINTER

The figures on the following pages point out the major
assemblies in the LaserWriter printer. Refer to these
figures while reading section 1.B, Theory of Operations.
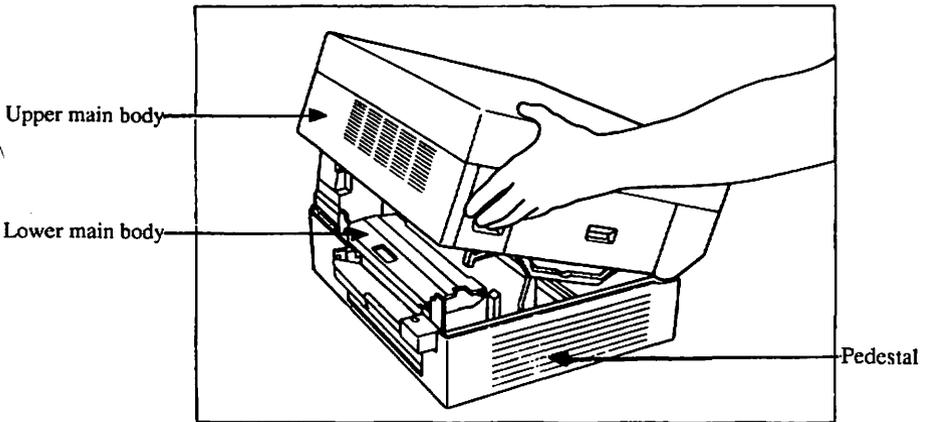
FIGURE 1-1
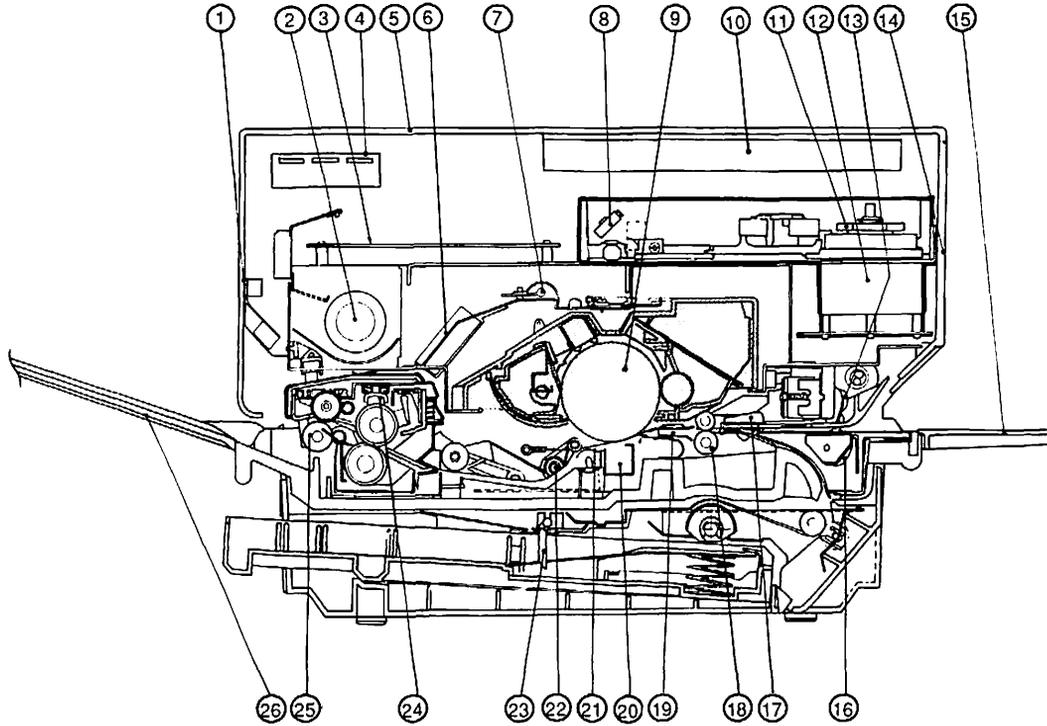
CROSS SECTION OF THE PRINTER (FRONT VIEW)

FIGURE 1-2

FIGURE 1-2: CROSS SECTION OF THE PRINTER (FRONT VIEW)

1. Left cover
2. Fan
3. DC controller PCB
4. Display panel
5. Top cover
6. Ozone filter
7. Preconditioning exposure lamps
8. Beam-to-drum mirror
9. Photosensitive drum
10. LaserWriter I/O board
11. Scanner mirror
12. Scanner motor
13. Upper manual pickup roller

14. Right panel
15. Manual feed tray
16. Lower manual pickup roller
17. Registration shutter
18. Feeder roller
19. Transfer guide assembly
20. Transfer corona assembly
21. Separation belt
22. Separation feeder unit
23. Paper detection arm
24. Fuser roller cleaner felt
25. Delivery roller
26. Print tray
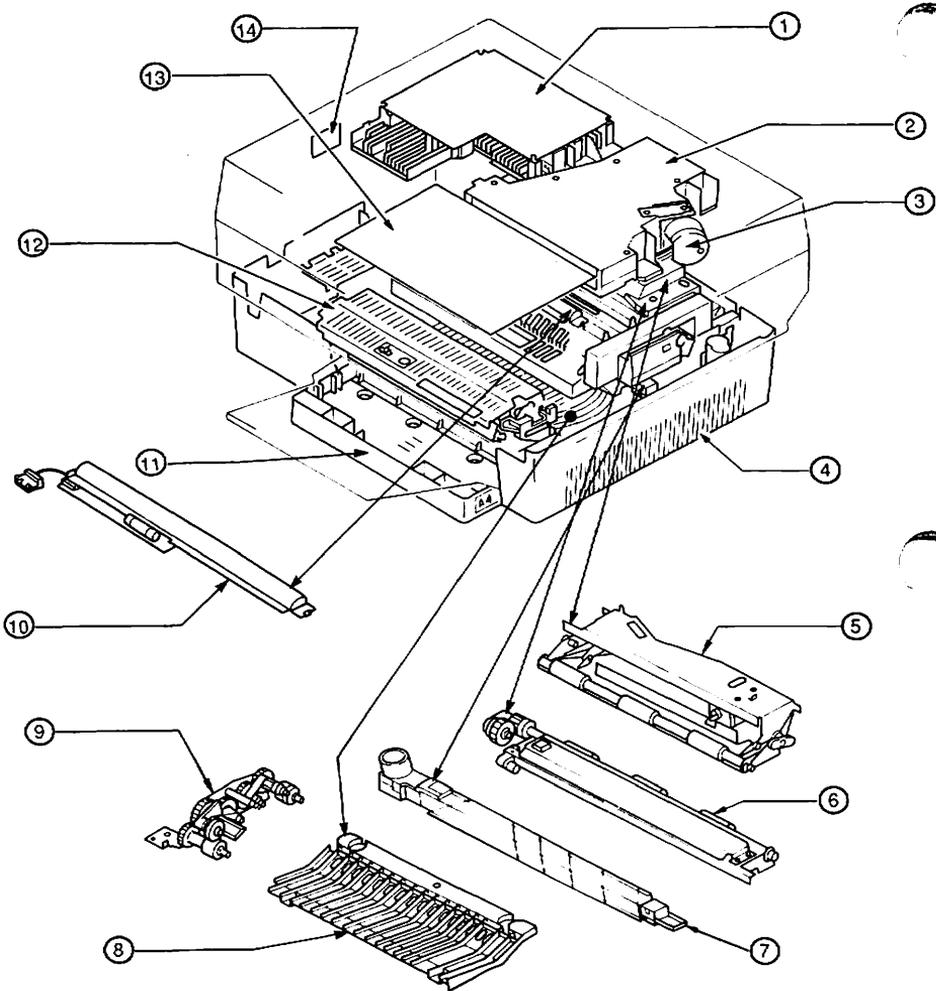
LOCATIONS OF MAJOR ASSEMBLIES

FIGURE 1-3

FIGURE 1-3: LOCATIONS OF MAJOR ASSEMBLY

(Figure shows printer with LaserWriter I/O board removed)

1. DC power supply/motor drive PCB

2. Scanner unit

3. Laser unit

4. Pedestal

5. Registration shutter assembly

6. Transfer guide assembly

7. Transfer corona assembly

8. Feeder guide assembly

9. Separation/feeder unit

10. Preconditioning exposure and print counter assembly

11. Paper cassette

12. Fuser assembly

13. DC controller PCB

14. Varistor PCB
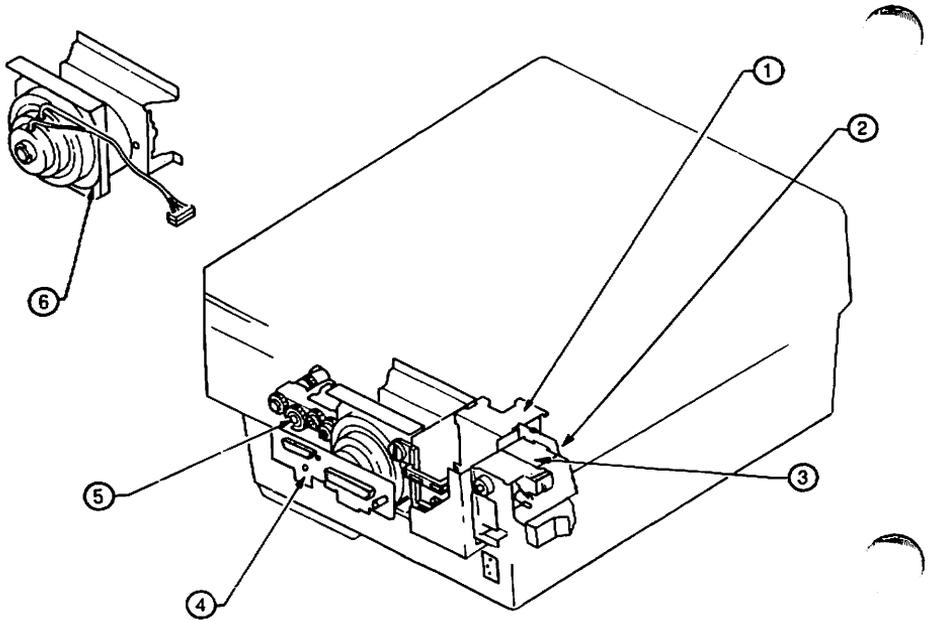
FIGURE 1-4

1. High voltage power supply

2. Power interlock assembly

3. AC driver PCB

4. Mounting connector plate
   ("Rear (I/O) Connector Plate")

5. Manual feed assembly

6. Main motor assembly

1.B - BRIEF THEORY OF OPERATION

The LaserWriter printer uses laser light, a sophisticated optical system, and a plastic powder called **toner** to produce its images. Using a dot matrix of 300 dots per inch (6.8 million per page), it can produce a variety of high-quality print fonts and graphics, either separately or on the same page. Computers can be connected to the printer either through the AppleTalk network or through the RS232/422 port.

The **LaserWriter I/O board** (see figures on preceding pages to identify parts)controls communications between the printer and external computers. It contains 1.5 megabytes of RAM and 500 kilobytes of ROM, plus a 68000 microprocessor. During printing, when a document is sent to the printer from an attached computer, the I/O board receives a description of each page in a language called PostScript". (ASCII files can also be accepted, but this discussion will be confined to normal printing from a Macintosh.) It then converts the PostScript commands into a bit image which it stores in RAM and then sends to the printer's **DC Controller board**. The DC Controller board controls the operation of the print mechanism and the **laser/scanner unit** to produce the actual printed page.

The semiconductor **laser** produces a beam of infrared light which is directed toward a rotating hexagonal mirror in the **scanner unit**. The scanner mirror reflects the beam across a revolving light-sensitive **drum** in the **Toner Cartridge**. As the drum rotates, the result is a raster scan, very much like that which forms the picture in a television set.

The drum is given a positive charge by the **primary corona wire** inside the toner cartridge. Wherever the light beam hits the drum, it neutralizes this positive charge on a tiny "dot" on the drum's surface. The pattern of dots produced by the laser's beam forms the image.

After being exposed to the laser scan, the drum rolls through the toner powder, which is contained in the same unit (the toner cartridge). The toner is positively charged, so it avoids the positive ("white") areas of the drum surface, but is attracted to the neutral (slightly negative) dots where the laser beam has struck the drum.

The drum, with its load of toner, then comes in contact with the paper. At this point, the paper is given a strong negative charge by the **Transfer Corona Wire**. This negative charge causes the toner to stick to the paper. As the paper travels forward, it is stripped off the drum by the **separation belt**. It then passes between two heated rollers in the **Fuser Assembly,** and the combination of heat and pressure fuses the toner onto the paper permanently.

1.C - PRINTER SPECIFICATIONS

Recommended Weights of Paper

Cassette feed: 16-21 lb.

Manual feed: Single-sided printing: 11-33 lb.
               Double-sided printing: 16-33 lb.

Cassette-Feed Information

1.   Maximum paper load: 0.4 inches

2.   Load paper with curl-side up, as in an office
     photocopier. Before loading paper, fan through the
     stack to ensure proper feeding.

3.   Store paper in its package in a dry location. Do not
     open a package of paper until you are ready to use it.

Manual-Feed Information

1.   It is possible to use paper sizes from 4" x 5.5" to
     8 1/2" x 14" in manual feed operation.

2.   Do not pull the paper from the manual feed guide when
     the printer begins feeding paper. Pulling the paper out
     does not abort printing, and it can damage the printer.

Double-sided printing

Double-sided printing is possible if manual feed is used for
the second side. (Attempting to print on the second side of
a printed page using cassette feed is likely to cause paper
jams.) Insert paper lengthwise along the guide on the manual
feed tray, with the side to be printed facing up.

Electrical Specifications

Line voltage: 115 Volts + or - 10% (North American model)
Line frequency: 60 Hz + or - 2 Hz. (North American model)
Power consumption:
     Operating: Max. 690 Watts
     Standby: Typical average is 120 Watts

Environment

1. Temperature: 50° F to 90.5° F.

2. Humidity: 20% to 80% relative humidity for optimum
   performance.

1.D - SETUP AND OPERATION

Setup and operation instructions for the LaserWriter are
given in the Macintosh Office Quick Reference Guides.   They
include the following topics:

1. Planning an AppleTalk network installation.
2. Setting up AppleTalk.
3. LaserWriter Components
4. Setting Up the LaserWriter: includes installing the
   toner cartridge and its cleaning pad, the paper trays,
   and the paper cassette.
5. Connecting devices to AppleTalk.
6. Using the Macintosh Office to Print: includes installing
   LaserWriter software on an application disk, fixing a
   "disk full" condition, and printing a document.
7. Print Quality Guide: a preventive maintenance and
   troubleshooting guide for users.

The Quick Reference Guides can help you guide users over the
telephone in troubleshooting problems that users can fix on
their own.

LaserWriter
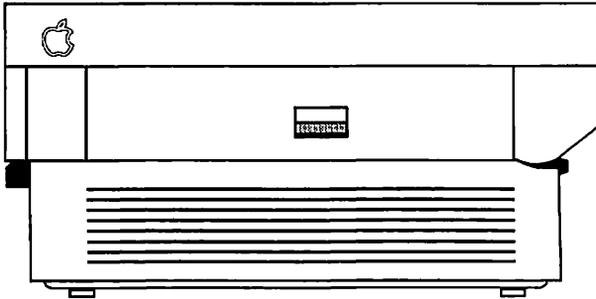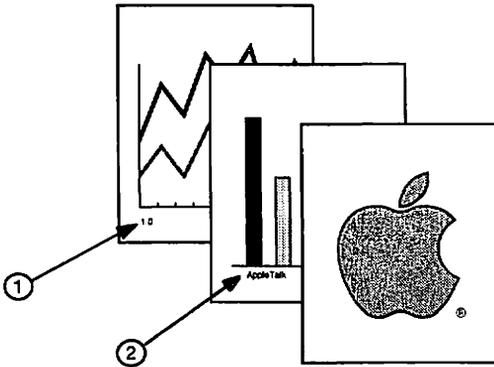
FIGURE 1-5:   USER TEST PRINT

1.E - PERFORMANCE EVALUATION: THE PRINTER TEST PRINTS

The LaserWriter has two test prints. The **service test print**
can be produced by jumpering two pins on the DC Controller
board. This print exercises the LaserWriter's printing
functions but does not involve the LaserWriter I/O board. It
is useful in service situations where a test print is
required but the I/O board has been removed. Instructions
for generating this print are given in the body of the manual
where appropriate. The print consists of black stripes on a
white background, covering the entire printing area of the
page. (See "Image Skew Adjustment" in section 3 for further
information.)

The **user test print,** reproduced in Figure 1-5, is produced
each time the printer's power switch is turned on. This test
print exercises the LaserWriter I/O board and contains
several types of information about the printer's performance.
The numbered items below refer to the numbered arrows in
Figure 1-5.

   1. The number printed here indicates the revision level
       of the printer's ROM.

   2. This square indicates the setting of the selector
       switch at the rear of the printer. If the selection
       is not "AppleTalk," the Baud rate appears at the top
       of the bar graph and the I/O port being used (9-pin
       or 25-pin) is specified at the bottom of the graph.

   3. This number represents the number of pages printed so
       far on this printer.

Aside from these items, the user test print can also tell
you:

  1. whether the printer is functioning: If the user test
      print is produced without problems, the printer is
      working correctly.

  2. whether the image is properly aligned to the paper: by
      measuring from the square border to the edge of the
      paper, you can tell whether the image is tilted further
      than is acceptable according to Apple's specifications.
      (See "Image Skew Adjustment" in Section 3.)
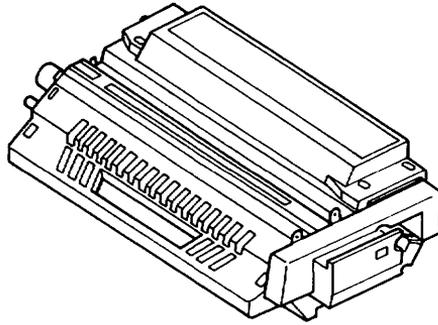
FIGURE 1-6
TONER CARTRIDGE,
EXTERNAL VIEW
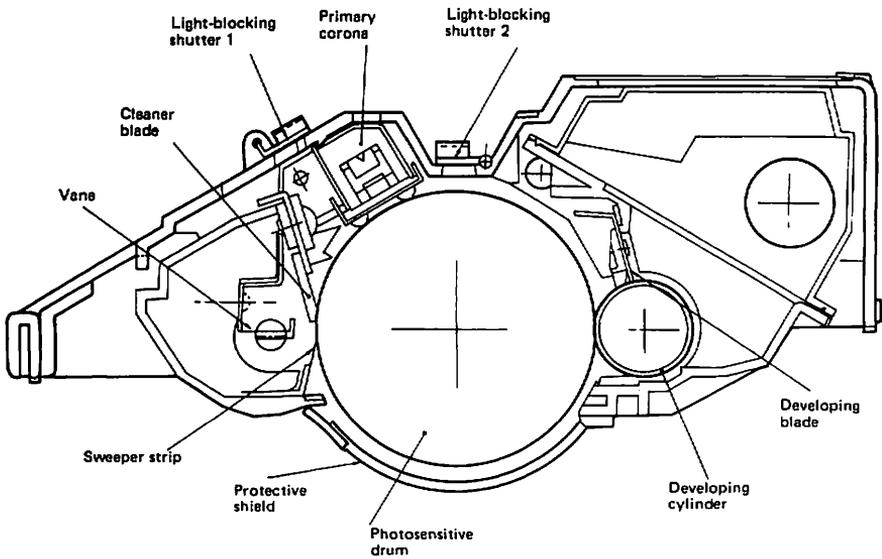
FIGURE 1-7: TONER CARTRIDGE (CROSS SECTION)

1.F - THE TONER CARTRIDGE

The toner cartridge (Figures 1-6 and 1-7) is a self-contained
unit that includes the photosensitive drum, the primary
corona wire (which charges the drum), a developing unit,
toner hopper, and drum cleaner (see Figure 1-7). The
cartridge cannot be disassembled.

The printing life of a cartridge is approximately 3,000
pages, but may vary according to the type of printing done:
for instance, graphics that include large black or shaded
areas will use more toner than ordinary text.

a. Protective Shield

The toner cartridge has a protective shield over the area
where the paper comes into contact with the drum. When the
cartridge is removed from the printer, this shield shuts
automatically, preventing light from entering. (If the drum
is exposed to light, blank areas and faint black stripes may
appear on prints.)

The shield is opened automatically when the toner cartridge
is inserted into the printer and the printer is closed. Do
not open the shield manually unless necessary, and do so only
in dim light.

b. Light-blocking Shutters

The two light blocking shutters protect the areas where the
preconditioning lamps "erase" the drum surface and where the
laser beam "paints" the image on the drum. These shutters
open automatically when the cartridge is inserted into the
printer. If the shutters do not close by themselves when you
remove a cartridge from the printer, close them manually.

c. Storage

1. The toner cartridge should be stored at a temperature
   between 32 and 95 degrees F in a relative humidity of
   35% to 85%. Higher or lower temperatures or humidities
   may reduce the storage life of the cartridge, as will
   storage in air pressure lower than 0.6 atmospheres or
   higher than 1 atmosphere.

   NOTE: The expiration date of the cartridge is specified
   on the cartridge box. The usable lifetime of a toner
   cartridge is 2 1/2 years from the date of manufacture.
   Cartridges more than 2 1/2 years old may give poor print
   quality.

2. Do not place cartridges in direct sunlight or near a window. Do not leave them inside an automobile for a long period in warm weather, even if the cartridges are still in their storage boxes.

3. Avoid storing cartridges in places where the temperature or humidity may change suddenly (for example, near an air conditioner or heater).

4. Avoid storing cartridges in dusty locations and places where they might be exposed to ammonia fumes or organic solvents. (Inform your cleaning staff not to use ammonia near the printer or near stored cartridges.)

5. If a cartridge has been stored at a low temperature, let it come up to room temperature before installing it in a printer. Otherwise, condensation can cause print quality problems.

d. **Handling Suggestions**

1. When installing a cartridge, hold it horizontally and rock it slowly back and forth 45°, to distribute the toner. (See Figure 1-8.)

2. If white areas occur on prints due to lack of toner, rock the cartridge back and forth to redistribute the toner. This can sometimes coax extra life out of a cartridge that is almost empty.

   CAUTION: To avoid toner spillage after a toner cartridge's seal is broken, hold it by the handle and rear only, as shown in Figure 1-8.
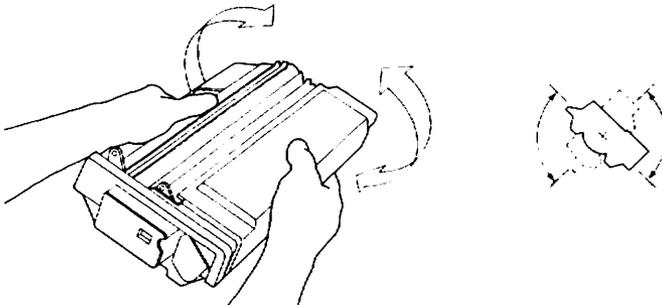
FIGURE 1-8

3. Never touch the surface of the photosensitive drum.   If
    the surface of the drum becomes dirty, open the
    protective shield and wipe it clean with a piece of
    flannel that has been liberally sprinkled with toner.
    Never wipe it with a dry cloth or paper towel, and never
    use solvent.

4. If the cartridge is left in strong light for a long
    time, white blanks or white stripes will appear on
    prints (even if the protective shield and shutters are
    closed.)   If this happens, stop the printer and wait a
    few minutes: thecartridge should be able to "recover"
    within this time.

    NOTE: Normal room light, measured a few meters from a
    window on an average day, is about 1,500 lux. Do not
    expose the photosensitive drum to light of this
    intensity for more than 5 minutes. If the drum is
    placed under these conditions accidentally, the
    cartridge can be stored in a dark place to "recuperate,"
    although an image may be retained on the drum for some
    time. Direct sunlight is 10,000 to 30,000 lux. A drum
    exposed to direct sunlight may be ruined.

1.G - STATUS LIGHTS

The printer has four status lights, three on the display
panel at the front of the machine and one on the rear (I/O)
connector plate.

1. The TEST light on the rear (I/O) connector plate (Figure
    1-9) comes on continuously (either steady or blinking)
    if the LaserWriter I/O board is malfunctioning. (If the
    board is functioning correctly, this light will blink
    once and then go out when the printer is turned on.)
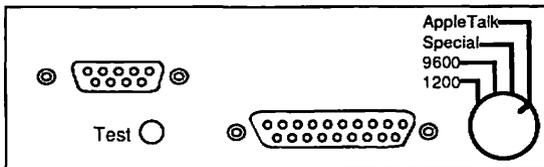
FIGURE 1-9:   REAR (I/O) CONNECTOR PLATE

2. Display panel LEDs (Figure 1-10):

    a) The green READY light blinks while the printer is warming up and then stays on continuously when the printer is ready to operate.

    b) The yellow PAPER OUT light stays on continuously when there is no paper in the paper cassette, or when the paper cassette is not installed. This light blinks when the printer is preparing to print a page. (With manual feed, this yellow LED lights steadily if there is no paper on the manual feed tray.)

    c) The red PAPER JAM light stays on continuously when a paper jam occurs. Printing is not possible until the jammed paper is removed.

Ready/wait   Paper out   Paper jam
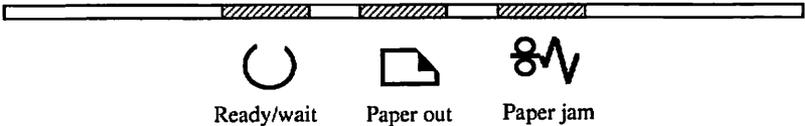
FIGURE 1-10:   DISPLAY PANEL LEDs

1.H - WHOLE UNIT EXCHANGE: PACKING AND SHIPPING INSTRUCTIONS

If you have to perform a whole-unit LaserWriter replacement, you will receive a replacement unit direct from Apple. To return the faulty unit to Apple, use the original shipping materials or the shipping materials from the exchange LaserWriter that you receive.

When shipping any LaserWriter to Apple, follow the directions below. **Failure to follow these directions can result in noncompliance charges.**

Installing the new printer:

1. If the replacement printer comes with new paper trays, paper cassette, and "Open Me First" box, remove them. These items should be returned to Apple with the old printer.

2. Remove the paper trays, paper cassette, and fuser-cleaning felt from the old printer and install them on the new printer.

3. Remove the toner cartridge from the old printer. **Do not install it in the new printer except at the customer's site. Never transport a printer with the toner cartridge installed: toner leakage can cause extensive damage to the printer.**

4. Give the new printer and the toner cartridge to the customer.

Sending the old printer back:

5. On the old printer, open the Fuser Assembly's green felt cover and install the plastic shipping tabs (attached to orange cards) on the pressure springs at either end of the Fuser Assembly. (You can get these from the replacement printer.) Then close the green felt cover.

6. **Make sure the toner cartridge and the fuser-cleaning felt have been removed from the old printer.**

7. Pack the old printer in its original shipping box (or the box that the new unit came in).

8. If you removed the paper trays, paper cassette, and "Open Me First" box from the replacement printer (see step 1), place them in the cavity in the upper foam packing piece.

9. Seal the box and send the old printer to your regional Service & Support Center.
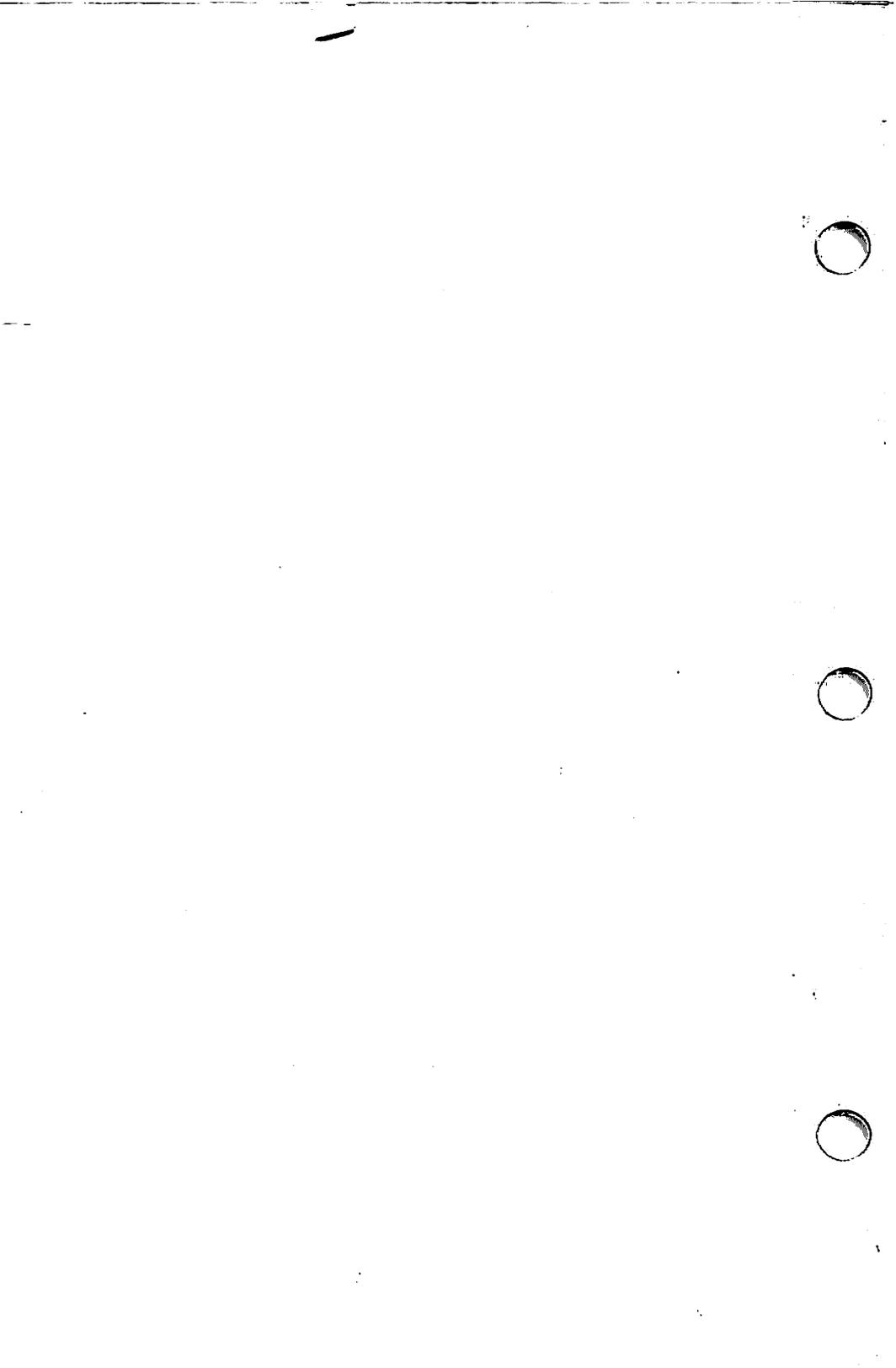
Apple LaserWriter Printer
Technical Procedures

Section 2 - Take-Apart

Contents:

(Items marked * are included in the videotapes that accompany
this manual.)

2.A - General Information

2.B - Upper Main Body of Printer

2.C - Lower Main Body of Printer

2.D - Printer Pedestal

2.E - Other Procedures

Apple LaserWriter Printer
Technical Procedures

Section 2 - Take-Apart

Contents:

(Items marked * are included in the videotapes that accompany
this manual.)

2.A - General Information

2.B - Upper Main Body of Printer

2.C - Lower Main Body of Printer

2.D — Printer Pedestal

2.E — Other Procedures

2.A – GENERAL INFORMATION

2.A.1 – EQUIPMENT NEEDED FOR LASERWRITER SERVICE

Phillips screwdrivers, magnetized:
    #2 head, stubby (1.25-inch shaft, 3-inch maximum total
        length)
    #2 head, medium (4-inch shaft)
    #2 head, long (6- or 8-inch shaft)
Long nose pliers (preferably curved)
diagonal cutting pliers
Medium flathead screwdriver (or other tool for prying)
snap-ring pliers, external, 19-30 mm
safety goggles
cable ties
Electrostatic discharge equipment (3M Velostat 8012 Field
        Service Kit or equivalent)
Allen wrench (2 mm)
spring hook (optional)

2.A.2 – MAIN SCREW TYPES USED

NOTE: Screws of types A, B, C, and D (See Figure 2-1) occur
both as "black" (anodized) and "silver" (conductive) screws
in the chassis. To preserve proper grounding and continuity,
replace "silver" screws only with other silver screws, and
black screws with black screws. Whenever you remove screws
from the printer, mark on the chassis which type of screw you
have removed, so that you can replace it with the same type.

A   B   C   D   E

10 mm   8 mm

Long   Long with Flange   Short   Short with Flange   Long with Unthreaded Top

FIGURE 2-1

DANGER - INVISIBLE LASER RADIATION WHEN OPEN.
AVOID DIRECT EXPOSURE TO BEAM.

ATTENTION - RAYONNEMENT LASER INVISIBLE SI OUVERT.
DANGEREUX DE REGARDER À L'INTÉRIEUR.

VORSICHT - UNSICHTBARE LASERSTRAHLEN WENN GEÖFFNET.
NICHT HINEINSEHEN.

Laserstrahl

⚠ **DANGER**

Laser assembly contains NO adjustable
or serviceable components.

Opening may cause damage to this
product or bodily injury including
blindness!

825-1125-A

Safety Labels: (Scanner unit) Warn against direct exposure to laser beam.

LR 49439
CERTIFIED ONLY TO CE CODE
CERTIFIE EN VERTU
DU CCE SEULEMENT

Listed
E.D.P. Equip.
660F

E73004

Apple Computer, Inc.
Cupertino, California 95014
Made in Japan

Apple Laser Printer
Model Number: M0156

Serial Number:
A

115 V
60 Hz
6.6A

Apple and the Apple logo are registered trademarks of Apple Computer, Inc.   RS1-8085 ▽Ⓢ

Product Label: (Outside of printer) Includes voltage information.

2.A.3 - SAFETY PRECAUTIONS

1. Always unplug the printer before taking it apart, unless you are testing the electronic assemblies.

2. **Never disconnect the optical fiber (see Appendix, Photo 1, #4) from the DC Controller board when the printer is running.** The fiber carries infra-red laser radiation, which you cannot see but which can permanently damage your eyes or your neighbor's eyes. Even if you don't look directly at the fiber, the light can enter your eyes by bouncing off reflective surfaces.

3. For the same reasons, **never open the laser access hatch (Photo 1, #9) or the scanner unit (Photo 1, #3) when the printer is running.** (Never open the scanner unit under any circumstances: it contains optical assemblies that must be protected from dust.)

4. The LaserWriter weighs over sixty pounds: Be careful in lifting it!

5. When the printer is running with its covers or panels removed, be careful where you put your hands. There are dangerous voltages on the DC Power Supply (Photo 1, #7) and the High Voltage Power Supply (Photo 1, #6).

6. Warning labels appear in locations on the printer wherever special service attention is needed (see illustrations at left and below). Obey the instructions on the labels.

```
Apple Computer, Inc.          Model Number: M0156
Cupertino, California 95014
Made in Japan

Manufactured:



This product conforms with NCDRH radiation performance standard, 21 CFR
Chapter 1 Subchapter J.

   CAUTION
    Warning           To prevent electrical shock, do not re-
                      move cover. No user serviceable parts
                      inside. Refer servicing to qualified
                      service personnel.

Apple and the Apple logo are registered trademarks of Apple Computer, Inc.    RS1-8086
```

Safety Label: (Bottom of printer) Cautions against opening by anyone other than qualified service personnel.

LaserWriter
Cover

Card Cage
Cover

LaserWriter
I/O Board
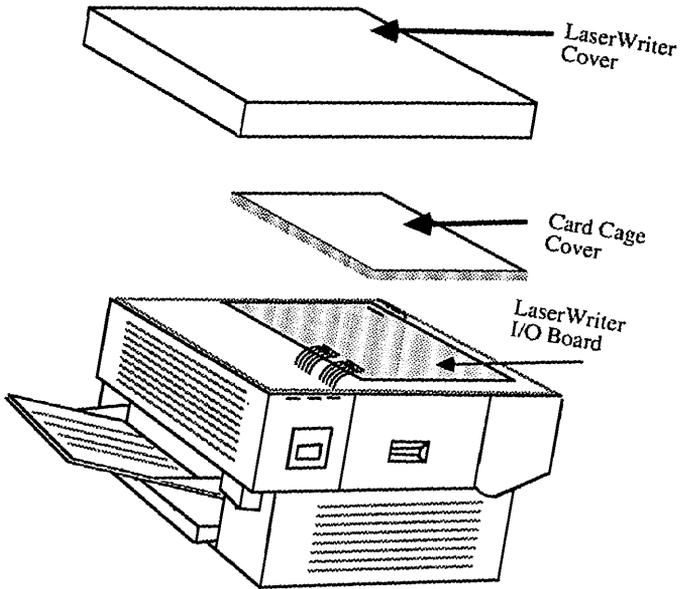
FIGURE 2-2

2.A.4 - ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

The LaserWriter I/O board (See Figure 2-2) is the most
expensive single module in the printer, and its components
are soldered into place. It is therefore very important to
protect the chips on the board from damage. Electrostatic
discharge can be an important factor in causing board
failures: even if the failures are not immediate and
dramatic, static zaps can degrade chips in such a way that
they fail weeks or months after exposure.

**APPLE WILL SOON BE RECOMMENDING MORE COMPREHENSIVE ESD
PROCEDURES.** Until that time, abide by the following basic
precautions to help minimize the possibility of board
failure.

1. Whenever possible, handle and transport boards safely
    enclosed in antistatic bags.

2. NEVER walk around with a board unless it is safely
    enclosed in an antistatic bag.

3. While handling a circuit board, do not touch another
    person, or anything else you do not need to touch, for
    that matter.

4. Do NOT place a bare board on any metal surface or on any
    other circuit board.

5. Do NOT bring ordinary plastic bags, foams (yes,
    especially those foam coffee cups!) or cushioning into
    the work area, and certainly never near a work station.
    The static fields generated by these items in particular
    carry enough voltage to damage sensitive circuitry.

6. Ideally, boards should be touched only by people wearing
    proper grounding apparatus. UNTIL SUCH APPARATUS IS
    AVAILABLE AT YOUR WORKSITE, discharge yourself by
    touching the metal part of the LaserWriter chassis
    before removing or replacing any board.

More comprehensive ESD information and related service
procedures will soon replace some of the interim items listed
above.

2.A.5 - OTHER PRECAUTIONS

1. Always remove the LaserWriter toner cartridge before
    removing anything else from the printer, to prevent
    damage to the cartridge. When you remove it, be sure
    the light-blocking shutters are closed, and cover the
    cartridge so that light will not damage it.

2. Use recommended weights and grades of paper for all
    tests. For best results, use 16-21 lb. paper, such as
    the standard paper used in office photocopiers. (See
    section 1.C for further paper specifications.)

3. Do not pull the paper from the manual feed guide when
    the printer begins feeding paper. Pulling the paper out
    does not abort printing, and it can damage the printer.

4. Never open the scanner unit under any circumstances: it
    contains optical assemblies that must be protected from
    dust. **Apple will not accept a scanner unit for exchange
    if it has been opened.**
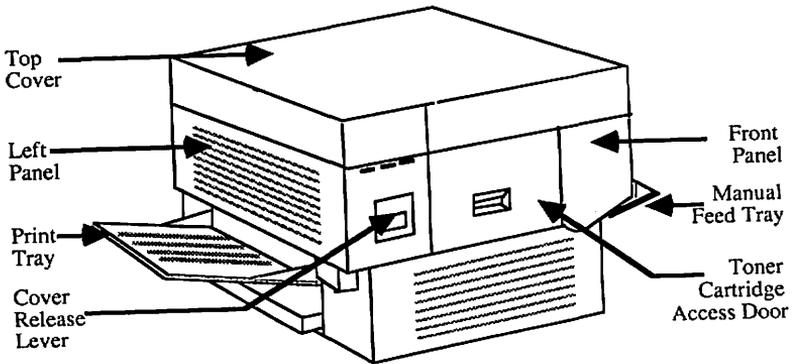
FIGURE 2-3: FRONT VIEW

2.B - UPPER MAIN BODY OF PRINTER

2.B.1 - COVERS AND PANELS

A. Top Cover (See Figure 2-3)

1. Open the printer (raise the upper main body by pressing up on the release lever).

2. Open the cartridge access door and remove the toner cartridge. Leave the cartridge access door open.

3. Remove the two top-cover screws inside the cartridge door.

4. Remove the two screws on the other side of the top cover.

5. Lift off the top cover.

B. Front Panel (See Figure 2-3)

1. Open the printer and the cartridge access door. Remove the toner cartridge.

2. Remove the four screws.

3. Lift off the panel, carefully disengaging it from the case-opening lever.

C. Right Panel (See Figure 2-4, next page)

1. Remove the front panel.

2. Close the printer.

3. Remove the two right-panel screws.

4. Lift off the panel.

Right Panel

Rear Panel

FIGURE 2-4: REAR VIEW

LaserWriter Cover

Card Cage Cover

LaserWriter I/O Board
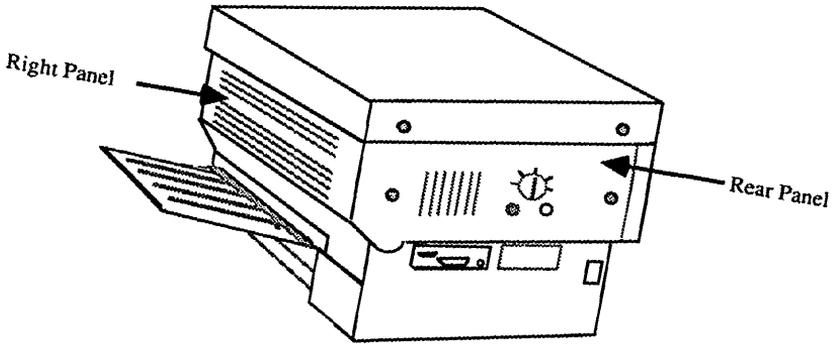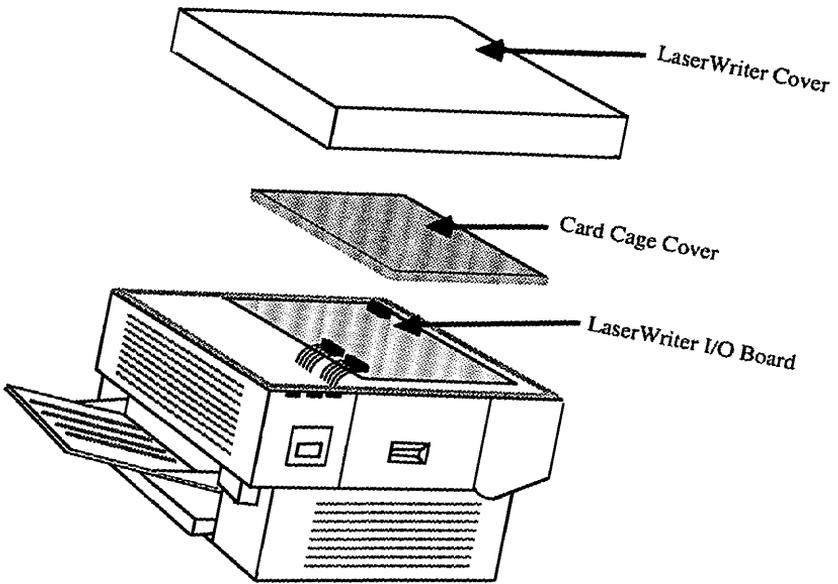
FIGURE 2-5

D. Rear Panel (See Figure 2-4)

1. Remove the front panel and right panel.

2. Remove the two screws and lift off the panel.

E. Left Panel

1. Remove the front, right, and rear panels.

2. Remove the four screws and lift off the panel.

To replace panels:

1. Fit the left panel on the chassis and install the four screws.

2. Do likewise for the rear panel, right panel, front panel and top cover.

   NOTE: The Apple logo on the top cover faces the front of the printer.

2.B.2 - LASERWRITER I/O BOARD (P/N 665-0270)

The LaserWriter I/O board (Figure 2-5) contains a 68000 microprocessor, 1.5 megabytes of RAM and 500K bytes of ROM. It controls communications between the printer and outside devices (computers and file servers) and contains the electronics that construct the printer's fonts.

1. Remove the Top Cover.

2. Remove the screws that hold the top of the card cage in place.

3. Lift the card cage cover off.

   CAUTION: Before touching any board, make sure you are properly grounded. **Static electricity can destroy expensive boards in an instant.**

4. Disconnect the three cables. **PULL ON THE CONNECTORS ONLY,** not on the cables.

If you are replacing the I/O board, go to step 5A. If you are removing the I/O board to gain access to other parts of the printer, skip to step 5B.

5A. To replace the I/O board:

NOTE: The I/O board is held down by plastic standoffs. On later versions of the LaserWriter, some plastic stand-offs may be replaced by metal fasteners. Remove any metal fasteners before trying to lift the board.

a) Pinch the plastic stand-offs to disengage the board.

b) Lift the board out, holding it **by the edges only,** and place it in a static-protective bag or on a workpad grounded to the LaserWriter. **Always make sure you are grounded to the LaserWriter before touching this board.**

c) Put the new I/O board into place, push it down so that the standoffs engage it, re-fasten any metal fasteners, and reconnect the three cables.

5B. **To remove the I/O board assembly to gain access to other parts of the printer**

a) Remove the screws that hold the card cage to the chassis.

b) Lift the board and card cage out carefully.
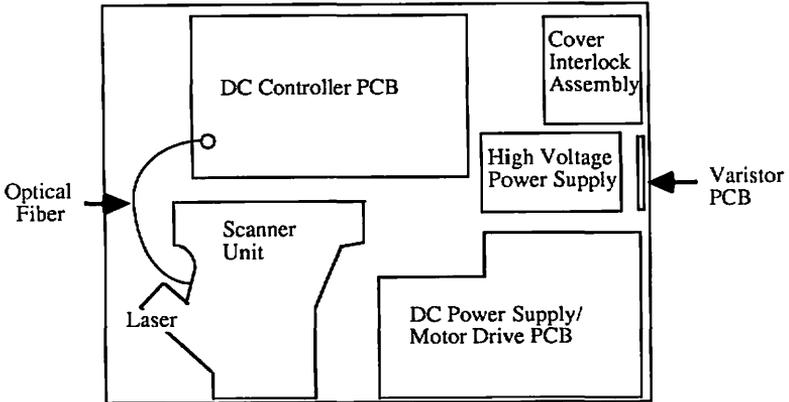
FIGURE 2-6: TOP VIEW WITH

LASERWRITER I/O BOARD REMOVED

2.B.3 - DC CONTROLLER PCB

The DC Controller board (see Figure 2-6) controls most of the print functions in the LaserWriter.

IMPORTANT: Replace the DC Controller board only with another Apple DC Controller board.

Remove

1. Remove top cover and LaserWriter I/O Board.

2. **CAUTION:** In this step, do not bend the optical fiber that comes from the laser. The fiber is part of the left-margin-detect circuitry. If bent, the fiber can break, and the printer will not be able to detect when the laser has reached the left margin of the page.

   Unplug all the connectors on the DC Controller PCB.

3. Release the board from its five nylon stand-offs and remove it.

Replace

1. Place the board on its five nylon connectors and push it down until they hold it in place.

2. Connect all cables to the board. The connectors are of different sizes: if you match them to their sockets exactly, you will have no problem. (The sockets labelled J213 and J205 are not used at this time.)

3. Reconnect the laser optical fiber and the eight-wire laser cable to the DC Controller board.

4. Replace the LaserWriter I/O Board and the top cover.

NOTE: When you install a new DC Controller Board in a printer, you must adjust the laser power. See the Laser Power Adjustment in **Section 3**.

RIGHT SIDE OF PRINTER

REAR OF PRINTER
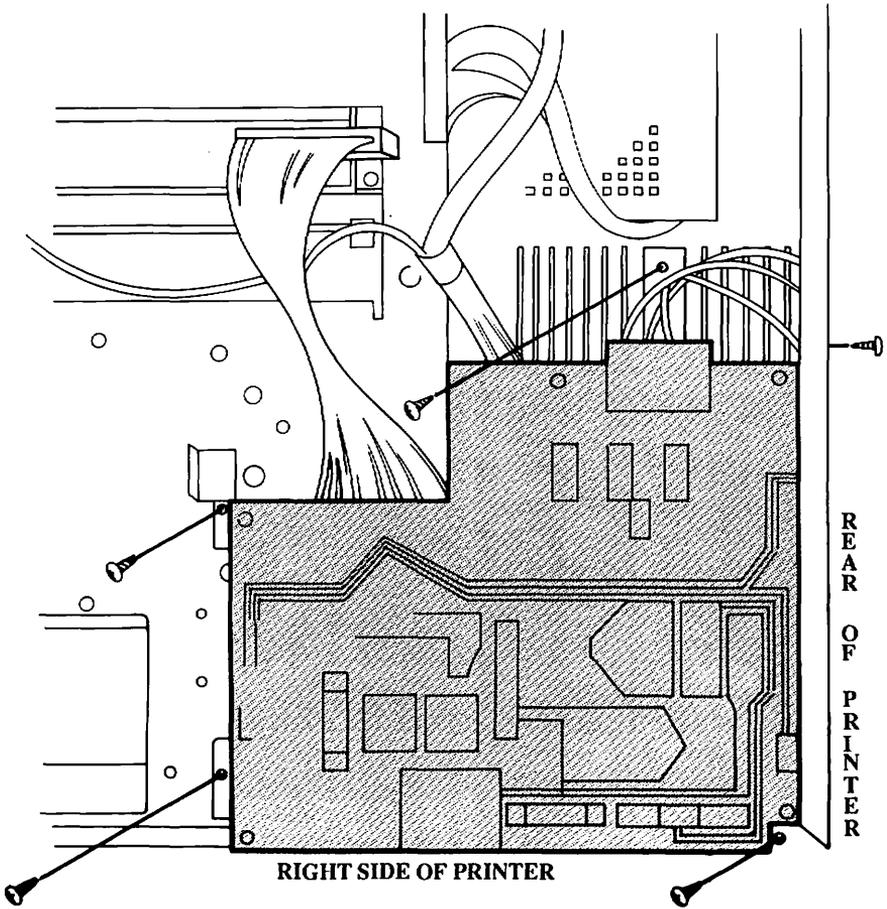
**FIGURE 2-7: DC POWER
SUPPLY MOTOR DRIVE PCE**

2.B.4 - DC POWER SUPPLY/MOTOR DRIVE PCB

The DC Power Supply/Motor Drive PCB (see Appendix, Photo 1, #7) has two major components. The Motor Drive circuit turns the main motor on and off according to a command from IC 208 on the DC Controller board. The DC Power Supply generates and outputs DC voltages and sequence control signals.

1. Remove the top cover and the LaserWriter I/O Board.

2. Open the printer and remove the toner cartridge and front panel.

3. Close the printer and remove the right panel and rear panel.

4. Remove the three connectors from the unit. **NOTE:** If necessary, use a flatblade screwdriver to help pry off the connectors, but do not pull on the wires.

5. Remove the five mounting screws **on the metallic part** of **the assembly (not** the five screws on the PCB) (see Figure 2-7) and lift the unit off the printer.

Replace

1. **IMPORTANT:** In this step, take care not to pinch the motor cable.

    Put the unit in position and replace the five long black mounting screws.

2. Connect the three cables to the unit. Make sure to connect the large cable to the DC Controller board.

3. Restore the panels and covers.
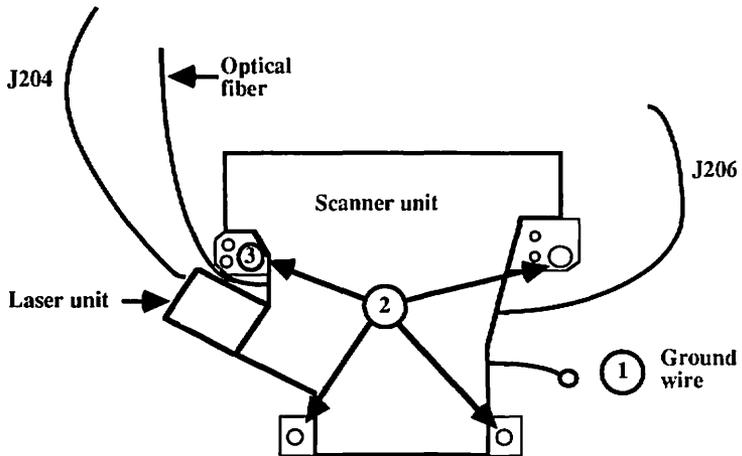
FIGURE 2-8

2.B.5 - LASER/SCANNER ASSEMBLY

The laser unit (see Appendix, Photo 1, #1) produces the
infrared laser beam. The scanner unit (Photo 1, #3) contains
a rotating hexagonal mirror that directs the beam along the
length of the photosensitive drum in the toner cartridge.

Remove

1. Remove the top cover and the LaserWriter I/O Board.

2. Unplug connectors J203 (the optical fiber), J204, and
    J206 from the DC Controller board (see Figure 2-8).

3. Disconnect the ground cable (see Figure 2-8, #1). Make
    sure to capture the star washer under the lug.

4. Remove the four large mounting screws (see Figure 2-8,
    #2). Make sure to remove the spacer and washers with
    the long screw nearest the laser (Figure 2-8, #3).

5. VERY CAREFULLY lift the laser and scanner unit straight
    up and out of the printer. Rest it upside down on a
    stable, static-free surface.

IMPORTANT: When you receive a new laser/scanner unit from
Apple, it will be shipped with a laser shorting connector on
the end of the laser cable. Install this connector on the
old laser unit before shipping it back to Apple for repair.
It prevents static electricity from damaging the laser unit.

Remove Laser Unit from Scanner Unit

To remove the laser unit, pull back the rubber cap and remove
the two 2mm Allen screws. Then pull the laser unit free.

Replace Laser Unit

1. Put the laser unit into position on the scanner unit;
    make sure the cable marked TB3 comes out on the same
    side as the optical fiber.

2. Put the two Allen screws in loosely, and then tighten
    them alternately so that the unit fits firmly into
    place.
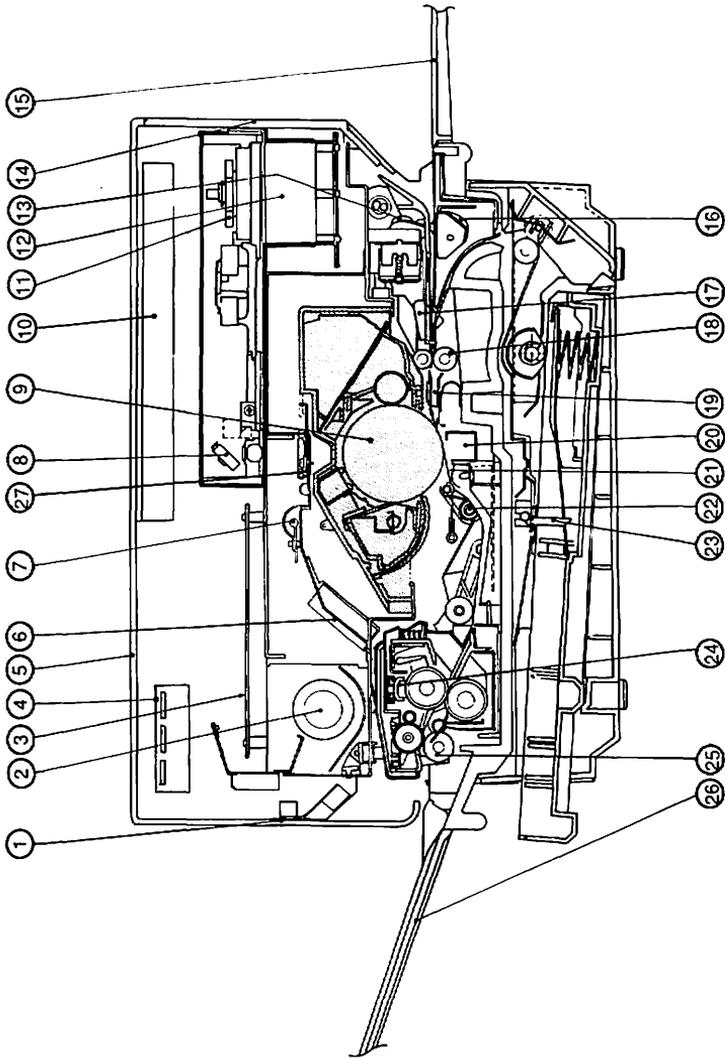
FIGURE 2-9

Replace Laser/Scanner Unit

1. Put the laser/scanner unit back into place. Make sure no cables are trapped beneath the unit.

2. Connect the ground cable to the hole nearest the right panel, making sure the star washer is under the lug.

3. Replace the four large mounting screws. **NOTE:** The long screw goes through the spacer and washers in the hole nearest the laser unit (see Figure 2-8, #3).

4. Reconnect the cables to DC Controller Board jacks J203, J204, and J206.

5. If this is a replacement unit, perform the Laser Power Adjustment (see Section 3, **Adjustments**).

2.B.6 - LASER BEAM BLOCKING SHUTTER

This shutter (see Figure 2-9, #27) is located beneath the laser and scanner units. It is opened mechanically when the toner cartridge is inserted into the printer, and should not need repair. To check it for cleaning and/or lubrication, remove the laser/scanner assembly, locate the shutter and make sure that it moves freely.
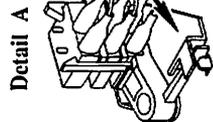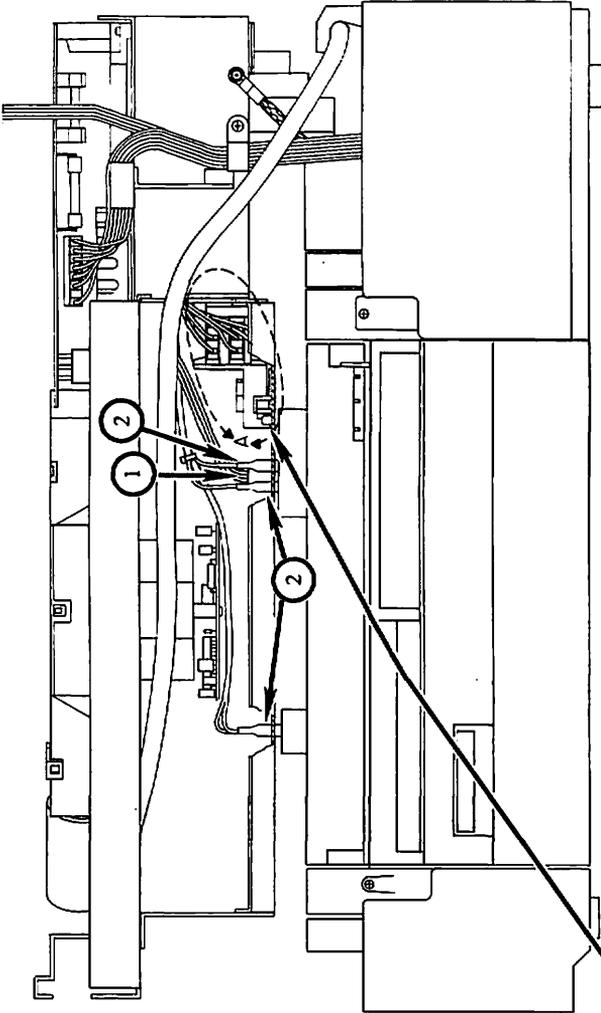
FIGURE 2-10: RIGHT SIDE OF PRINTER

WITH PANEL REMOVED

Detail A

2.B.7 - REGISTRATION SHUTTER ASSEMBLY

The registration shutter assembly is located in the upper "jaw" of the printer, near the hinges. When paper is fed into the paper path, either from the cassette or from the manual feed tray, the registration shutter stops the paper until all systems are synchronized and the edge of the paper is straight. Then the printer energizes the registration solenoid, which lifts the shutter and allows the paper to pass on to the toner cartridge.

Remove:

IMPORTANT: Before starting, locate the cartridge-detect microswitch assembly and note how the white plastic arm is seated between two metal tabs (see Figure 2-10, Detail A). This is your test for whether the assembly has been replaced correctly. If the white plastic arm is not properly seated, the printer will not function: it will "think" that the toner cartridge is not installed and the green READY light on the front panel will not come on.

1. Remove the Laser/Scanner Unit.

2. Remove the DC Power Supply/Motor Drive PCB Assembly.

3. Using long-nose pliers, remove the three-wire connector (see Figure 2-10, #1) and the four fast-on connectors (see Figure 2-10, #2).

4. Remove the two silver screws visible from the top through the two access slots (one on either side of the assembly).

5. Open the printer. The registration shutter assembly should be resting on the lower body of the printer.

6. Remove the green ground wire from the front side of the registration shutter, and lift the assembly out of the printer.

Replace

1. Put the shutter assembly in place on the lower body of the printer, and reconnect the ground wire.

2. Lift the shutter assembly into its place in the top of the printer. Check the white plastic arm of the microswitch unit to make sure it is correctly seated. (See Figure 2-10, detail A.)
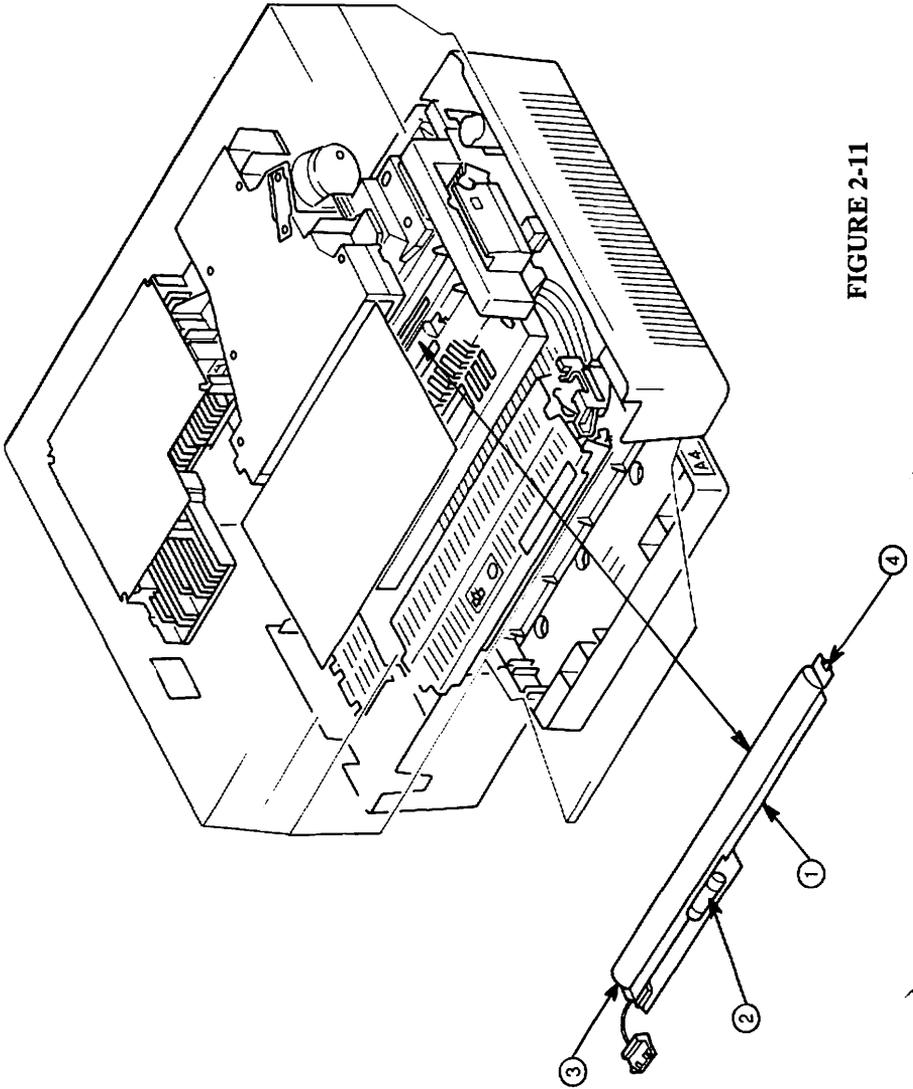
FIGURE 2-11

3. Holding the assembly in place with one hand, replace the two short flanged silver screws. **CAUTION:** You should not have to force the assembly into position. If the screw holes are not aligned correctly, reposition the whole unit.

4. Test for correct installation by closing and opening the printer. There should be no binding.

5. Replace the cable connector and the fast-on connectors.

6. Replace the DC Power/Motor Drive PCB.

7. Replace the Laser/Scanner Unit and all panels and covers.

2.B.8 - PRECONDITIONING EXPOSURE ASSEMBLY

The preconditioning exposure assembly (see Figure 2-11, #1) prepares the print drum in the toner cartridge for a new image. The lamps expose the print drum to a uniform light that neutralizes any leftover charges from the last print cycle, thus "erasing" the previous image from the drum.

The print counter (see Figure 2-11, #2, a fuse-like component that is part of the assembly) shows how many prints have been made on the printer since the counter was installed. Each numbered mark on the counter represents approximately 10,000 pages. When the mercury bubble in the counter reaches "10," the counter should be replaced.

It is not necessary to remove the assembly to view the counter; you can see it if you remove the ozone filter (see instructions for removing the ozone filter).

In these instructions, right and left are used with reference to Figure 2-11.

Remove

1. Remove the DC Controller PCB.

2. Remove the single mounting screw at the left of the assembly (see Figure 2-11, #3).

3. To remove the assembly, put one finger on the right side of the assembly and push to the left until the tab at the right (see Figure 2-11, #4) comes free.

4. Lift the assembly out of the printer.

Replace

When replacing this assembly, transfer the old print counter (which looks like a fuse) from the old assembly to the new, unless the old print counter reads "10." If the print counter reads "10," replace it.

1. Put the assembly in place. To seat it, gently push down on the tab at the right (using a pencil or similar pointed tool) while pushing the assembly to the right.

2. When the assembly is properly seated, replace the mounting screw.

3. Replace the DC Controller PCB.
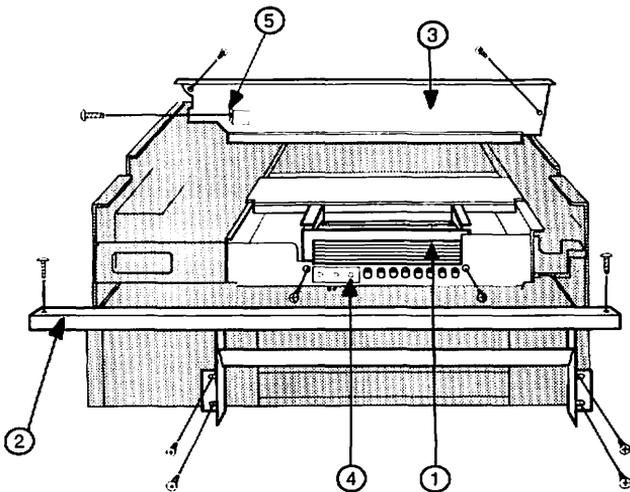
FIGURE 2-12

2.B.9 - FAN

The fan is located along the left side of the upper main body (see Figure 2-12).

Remove Fan

1. Remove the top cover, front panel, right panel, rear panel, and left panel.

2. Remove the LaserWriter I/O board and the DC Controller PCB.

3. Remove the left side-frame (see Figure 2-12, #2) by removing its six silver screws.

4. To remove the fan cover (the metal plate above the fan, see Figure 2-12, #3), remove the three screws and lift the fan cover out of the chassis.

5. Unplug the white fan cable at the rear of the fan and free it from its clamp. (**Don't** free the grey-and-white cable.)

6. Remove the two fastening screws and take out the fan.

Remove Paper-Detect Optical Sensor

1. Remove the fan.

2. Free the sensor cable from its clamp.

3. Open the printer.

4. The optical sensor assembly is attached to the center of the left side of the printer (see Figure 2-12, #4). Remove the single screw and the small metal plate, press the plastic clips together, and lift the assembly out.

Replace Sensor

1. With the printer open, place the sensor assembly in its slot so that the plastic clips snap into place.

2. Put the small metal plate in place (the tab points toward the rear of the printer), and install the screw.

3. Replace the fan.

Replace Fan

1. Put the fan into place.

FIGURE 2-13

Ozone
filter

FAN
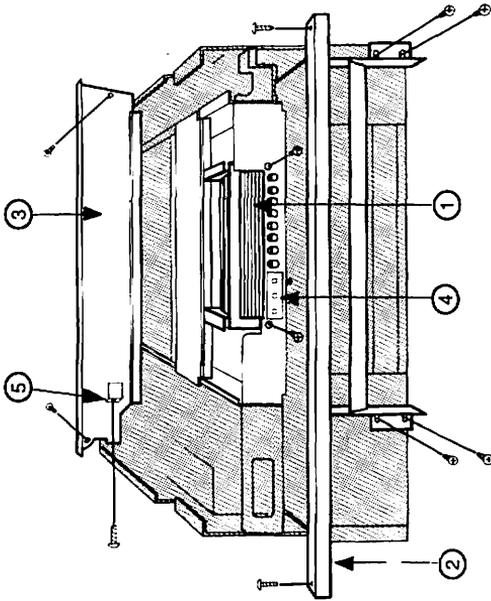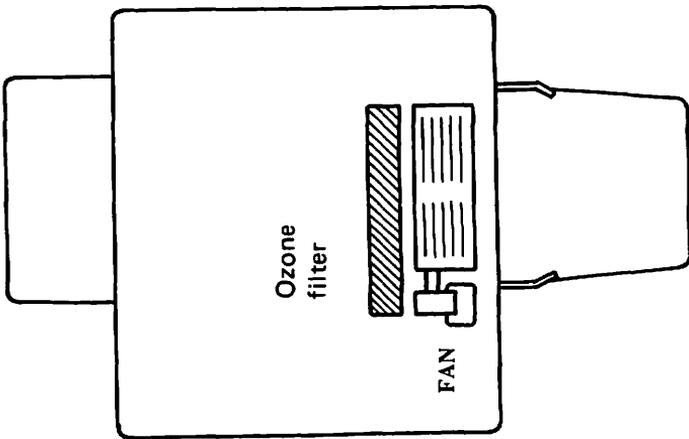
FIGURE 2-14

2. Put the fan cable into its clamp and reconnect it to its mate.

3. Install and tighten the two fastening screws.

4. Put the fan cover (see Figure 2-13, #3) into place (try different positions until you are sure it fits correctly: the tab for the side screw (see Figure 2-13, #5) fits <u>out</u>side the chassis frame) and install the three screws.

   NOTE: The screw on the side is easy to drop into the mechanism. To avoid that, start the screw by hand.

5. Replace the side frame and its six short silver screws.

6. Replace the DC Controller board, the LaserWriter I/O board, and all panels and covers.

2.B.10 - OZONE FILTER

The ozone filter sits below and behind the fan, just forward of the preconditioning exposure lamps and above the toner cartridge.

Remove

1. Open the printer and remove the toner cartridge.

2. Locate the ozone filter: it is a grey plastic piece located just above the toner cartridge, between the fan and the red plastic preconditioning exposure window (see Figure 2-14). You have to reach <u>under</u> the fan (and look under the fan) to find it.

3. Remove the fastening screw, move the ozone filter slightly up, and pull it out.

Replace

Put the ozone filter in place and install the single screw.

long black

Varistor
PCB

①

short
silver

short
silver

short black
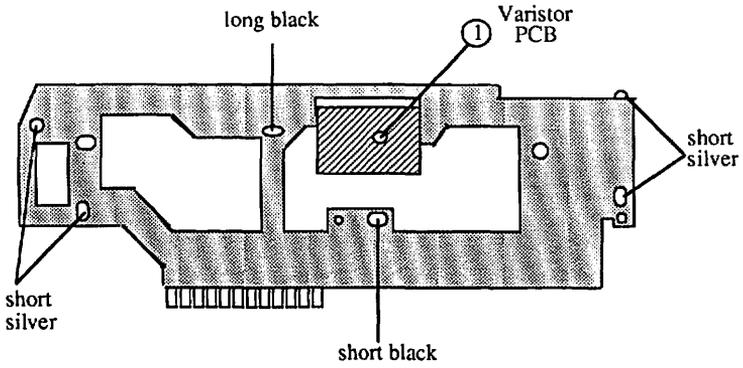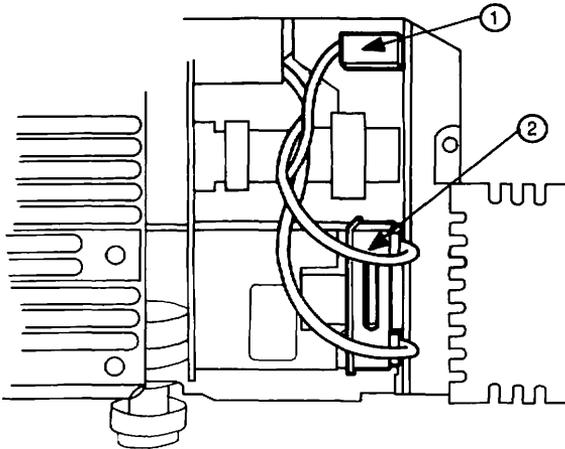
FIGURE 2-15

FIGURE 2-16: HIGH VOLTAGE POWER SUPPLY

2.B.11 - HIGH VOLTAGE POWER SUPPLY

The high voltage power supply (see Appendix, Photo 1, #6 for location) generates high voltage for the transfer corona wire and also for two elements in the toner cartridge: the primary corona wire and the developing assembly.

Remove

1. Remove the top cover, front panel, right panel, left panel, and rear panel.

2. Remove the rear chassis frame as follows:

    a) Remove the three connectors from the Varistor PCB (see Figure 2-15, #1 and Photo 1, #10).

    b) Mark the type of screw at each location on the frame with a pencil (e.g. "short silver," "long black"). Then remove screws and lift off the frame-piece. (See Figure 2-15).

3. Open the printer.

4. Remove the black flanged fastening screw from the High Voltage Power Supply cover and remove the cover -- wiggle it off: it's held on by friction from the wires trapped beneath it.

5. Disconnect the two connectors with thick red wires (see Figure 2-16, #1 and #2 -- one has two wires, the other has one) from the High Voltage Power Supply (use a screwdriver to help pry them off).

6. Disconnect J211 from the DC Controller board.

7. With the printer open, remove the single mounting screw and remove the power supply.

(IF PRACTICING THESE PROCEDURES, GO TO MAIN MOTOR REMOVAL BEFORE REPLACING THE HIGH VOLTAGE POWER SUPPLY.)

Replace

1. Attach the power supply to the chassis using a short black screw.

2. Attach the two large connectors to the power supply, and attach the eight-pin connector to J211 on the DC Controller board.

3. Put the power supply's cover into place. The edge of
   the cover fits into the white plastic guides on the
   chassis, and the two-wire Varistor cable fits beneath
   the cover. (The single green wire should not be beneath
   it.)

4. Replace the cover screw (short, black, with flange).
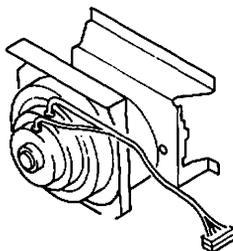
FIGURE 2-17

5. Replace the rear chassis frame, using the correct screws as you noted them on the frame. **NOTE:** The white plastic stud on the High Voltage Power Supply fits through a hole on the frame. This helps to position the frame.

6. Reconnect the three connectors to the Varistor PCB.

7. Replace the panels and covers.

2.B.12 - MAIN MOTOR

The main motor (Figure 2-17) turns the gears that run the paper feed mechanism, as well as the gear for the toner cartridge drum.

Remove

1. Remove the High Voltage Power Supply.

2. Unplug the motor connector from the DC Power Supply/Motor Drive PCB.

3. Remove the four large screws from the chassis.

4. Hold the motor as you remove the one small screw from the metal plate above the motor. Then free the cables by using long-nose pliers to release the cable clamp from the motor, and lift the motor out of the printer.

Replace

1. Attach the cable clamp to the motor, put the motor in place (be careful not to catch any wires beneath the motor), and install the small screw (long black type).

2. Install the four large screws.

3. Reconnect the motor cable to the DC Power Supply/Motor Drive PCB.

4. Replace the High Voltage Power Supply.
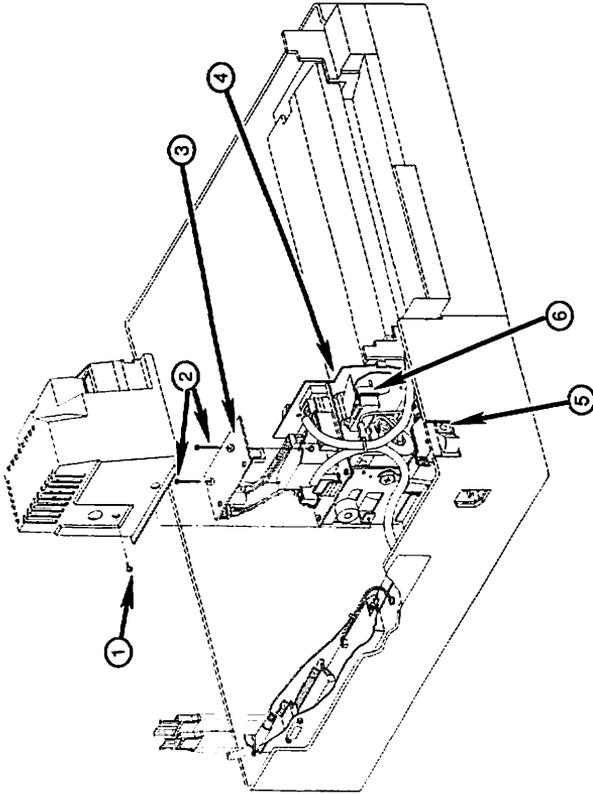
FIGURE 2-18

2.C - LOWER MAIN BODY OF PRINTER

2.C.1 - POWER INTERLOCK ASSEMBLY

The power interlock assembly consists of the AC Driver PCB, which is a two-board assembly (see Figure 2-18, #3 and 4); the main power switch (see Figure 2-18, #5); and the two microswitches (see Figure 2-18, #6), which cut off power to the printer when the printer is opened (upper main body raised).

AC DRIVER PCB

Remove

1. Remove the black flanged screw near the circuit breaker (see Figure 2-18, #1) and lift off the plastic assembly cover. The cover swings up and to the rear in an awkward manner, but don't worry -- just keep gently working at it and it will come off.

2. Unplug connectors J104 and J106.

3. Remove the two fastening screws (see Figure 2-18, #2).

4. Lift off the upper PCB. Clip the cable tie that holds the cable from the upper PCB and take the upper PCB out of the printer.

   NOTE: The 47-ohm resistor at position J107 on the upper PCB (the Fuser Heater Safety PCB) is mounted in a four-pin connector for easy replacement. This resistor acts as a fuse: if the heater bulb is defective (or seated improperly), or if there are excessive current require-ments, this resistor opens (blows) to protect the board.

5. Unplug the four connectors to the lower PCB.

6. Remove the two screws from the lower board and slide the lower board out of its slot.

Replace

1. Put the assembly in place, inserting the appropriate side of the lower board into the slot in the chassis.

2. Install the two lower-board screws (black).

3. Plug in the four connectors to the lower PCB and the one connector to the upper PCB.

4. With a cable tie, tie together the cables to J106, J102, and the connector that goes to the upper board.

5. Slide the plastic assembly cover over the assembly, making sure that all cables are beneath the cover. Make sure that the cover fits under the four metal tabs on the chassis and under the harness cover tab, and is properly seated (see Appendix, Photo 6).

6. Install the short black flanged screw in the cover.

Fuser assembly

Cover latch
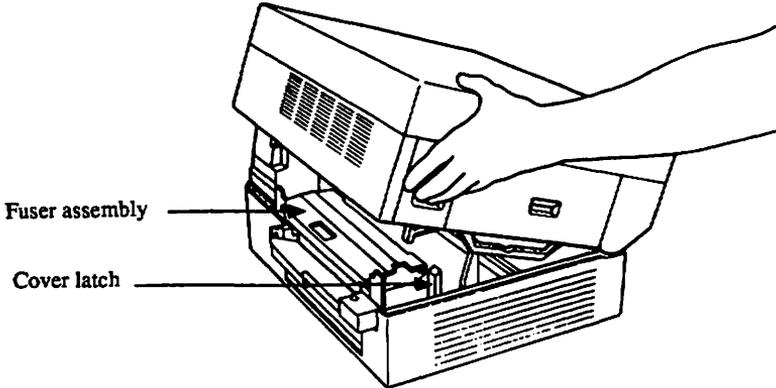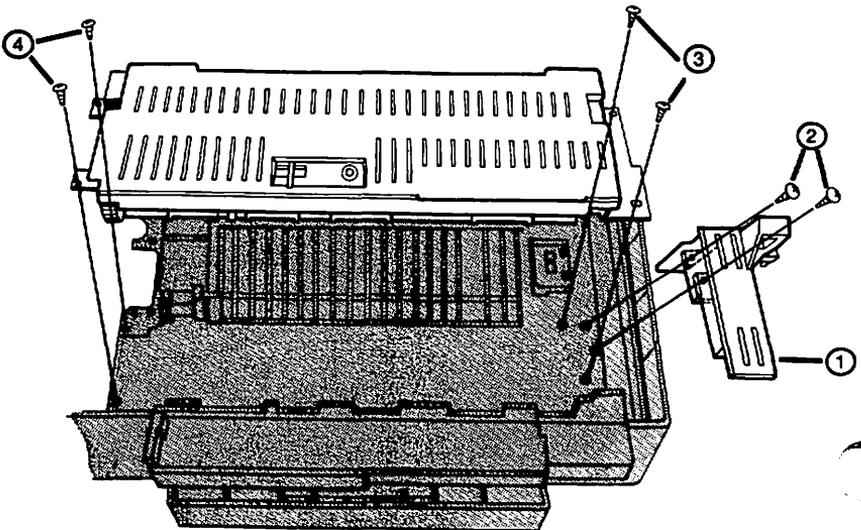
FIGURE 2-19

FIGURE 2-20

2.C.2 - FUSER ASSEMBLY (699-0306)

The Fuser Assembly (see Figure 2-19) consists mainly of two
rollers and a heater bulb. The combination of heat and
pressure provided by this assembly fuses the toner onto the
paper. The assembly also contains two sensors (the
thermistor and the thermoprotector) which allow the printer
to regulate the temperature of the rollers.

Remove Fuser Assembly

WARNING: If the printer has been in use, the fuser assembly
will be very hot. Wait until it cools down before working
with it.

1. Open the printer. Open the green cover of the fuser
    assembly and remove the cleaning felt by sliding it out
    to the right.

2. Locate the cover latch unit (a grey plastic piece at the
    front end of the assembly -- see Figure 2-19 and Figure
    2-20, #1). Remove the two black screws at the base of
    the cover latch unit (see Figure 2-20, #2) and lift the
    unit out of the printer.

3. Remove the two black screws at the front end of the
    fuser assembly (see Figure 2-20, #3).

4. Remove the harness cover (a flat grey plastic piece: see
    Appendix, Photo 6, #3) by removing the single screw and
    prying back on the plastic tab next to the Power
    Interlock Assembly (see Photo 6, #4).

5. Pull out and disconnect the fuser assembly connector
    from beneath the Power Interlock Assembly.

6. Remove the two screws from the brass-colored tabs at the
    rear end of the fuser assembly (see Figure 2-20, #4).

7. Lift up the assembly enough to remove the spade
    connector on the rear end.

8. Disconnect the spade connector at the front that comes
    from the white plastic-sheathed wire. (It is connected
    to a double lug that holds a spade connector from
    another wire. If the lug itself comes off, work the
    connector from the white plastic-sheathed wire free of
    the lug and replace the lug on its brass lug.)

9. Lift the assembly out of the printer.

Front

Mfg. mark
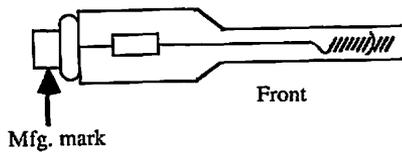
FIGURE 2-21

Replace Heater Bulb (Fuser Roller Heater)

CAUTION: When removing a heater bulb, be careful. If the bulb has broken, there will be sharp glass shards in the upper roller.

To remove the bulb:

1. Remove the black plastic end-piece from the front end of the fuser assembly by removing its two screws.

2. Carefully remove the bulb. (IF REMOVING A GOOD BULB, HANDLE IT BY THE ENDS ONLY. **NEVER** TOUCH THE BODY OF THE BULB.)

To install the bulb:

CAUTION: Be careful of the following things:

   a) Do not touch the body of the bulb with your hands: oil from your hands can cause hot spots and weaken the bulb.

   b) The glass nipple on the bulb should face downward, away from the cover of the assembly.

1. Holding the bulb by the end with the manufacturer's name (see Figure 2-21), insert it into the roller tube. Make sure that the leading end is seated on the small copper electrode at the far end of the assembly.

2. Replace the black plastic end-piece, seating its copper electrode in the end of the heater bulb. Replace the two short black screws in the end-piece.

IMPORTANT: The bulb must be securely seated on the copper electrodes at both ends. Otherwise, the 47-ohm resistor-fuse at position J107 on the Fuser Heater Safety PCB (the upper board of the AC Driver PCB) will open (blow) when you turn on the printer.

Replace Fuser Assembly

1. Put the assembly into place.

2. Attach the spade connectors (one at either end). Make sure to tuck the wires at the front end under the lip of the assembly, so that they do not interfere with installation of the cover latch unit in step 6.

3. Reconnect the cable and tuck it beneath the Power Interlock Assembly.

Fuser roller cleaner felt
Separation claw
Delivery roller
Delivery guide
Separation guide
Lower roller

Crossmember
Spring assembly & screw
Upper roller
Thermistor

Drive gear

Paper guide
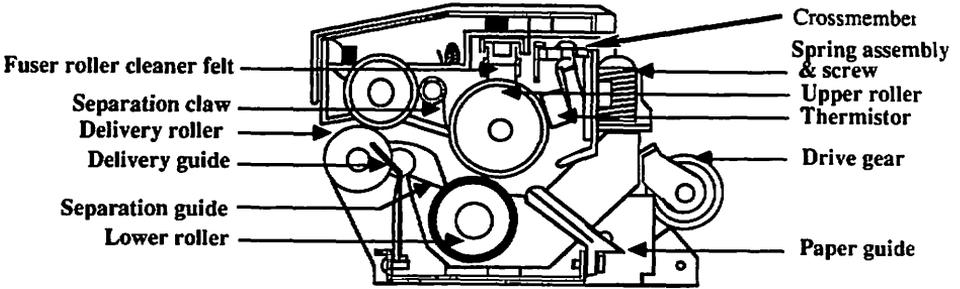
CROSS SECTION OF FUSER ASSEMBLY

FIGURE 2-22

Cable

Crossmember Assembly: Top View

Cable Clamp
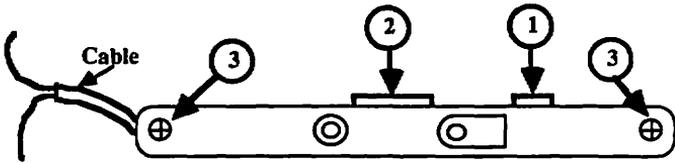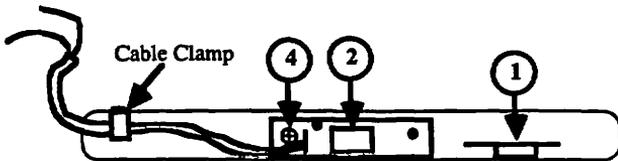
Crossmember Assembly: Bottom View

FIGURE 2-23

4. Reinstall the harness cover and its short black screw.

5. Reinstall the two long black screws at the rear of the assembly.

6. Put the cover latch unit back into place and reinstall the four long black screws at the front of the assembly.

7. Install the cleaning felt.

THERMISTOR AND THERMOPROTECTOR

The thermistor and thermoprotector are small sensors contained on the upper crossmember of the fuser assembly, touching the upper roller. They are just visible when you open the fuser assembly's green cover and look behind the upper roller (see Figure 2-22 and 2-23).

The thermistor (see Figure 2-23, #1) senses the upper fuser roller's surface temperature. This allows the DC Controller board to regulate the heater bulb.

The thermoprotector (see Figure 2-23, #2) protects the fuser assembly from excessive temperatures (over 245° C) by acting as a thermostat for the unit, shutting off the current to the heater bulb when the assembly gets too hot.

If the thermoprotector is incorrectly positioned (see illustration below), prints may show smearing or a vertical fogged line at 80-90 mm from the left side of the page. (See also **Section 4, Troubleshooting.**) To correct this problem, the thermoprotector must be cleaned or replaced and repositioned correctly.

In order to replace these parts, you must remove the upper roller from the fuser assembly.

CORRECT POSITION   WRONG POSITION
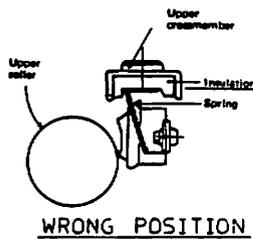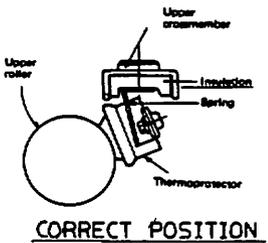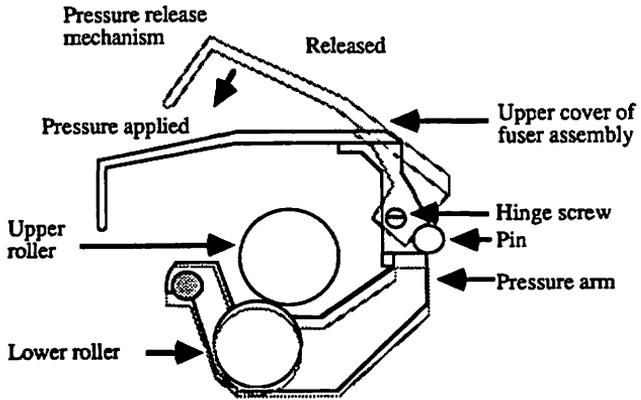
FIGURE 2-24

CROSS SECTION OF FUSER ASSEMBLY, SIMPLIFIED
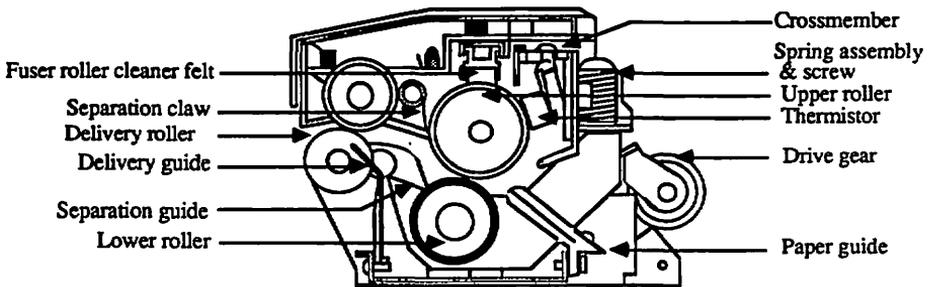
CROSS SECTION OF FUSER ASSEMBLY

FIGURE 2-25

Remove Upper Roller

1. Remove the black plastic end-piece from the front end of the fuser assembly by removing its two screws.

2. Carefully remove the heater bulb from the roller -- do not touch the glass except with a clean cloth -- and put it in a safe place.

3. Remove the green cover by removing the two hinge-screws that hold the cover to the fuser (see Figure 2-24).

4. Remove the screws that hold the two spring assemblies at each end of the fuser assembly. (Each spring assembly contains a white nylon spring holder and a small metal sleeve.) Remove the spring assemblies (see Figure 2-25).

5. Remove the steel plate from the rear of the fuser as follows:

   a) Loosen but do not remove the screw that clamps the white cable to the plate. Free the cable.

   b) Remove the spring from the steel plate. (To avoid losing it, remove it entirely from the assembly and put it aside.)

   c) Remove the two screws that attach the steel plate to the rear of the fuser, and remove the plate.

6. Remove the retaining ring from the geared end of the roller by using needlenose pliers. (The gear teeth are plastic; do not push against them when prying the ring off.)

7. Remove the gear from the tube.

8. Remove the two screws from the roller bearing at the other end of the fuser assembly. Pull out the roller, being extremely careful not to scratch any of the exposed surfaces.

9. If the replacement roller does not have a bearing attached, remove the bearing on the old roller by carefully prying off the retaining ring. Then install the bearing and the retaining ring on the new roller.
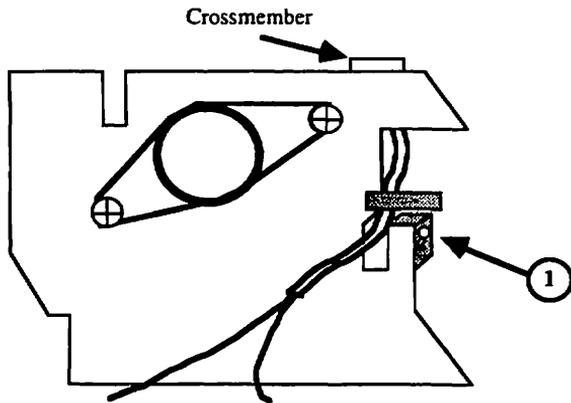
Crossmember

Fuser Assembly: Front View

FIGURE 2-26

Cable

Crossmember Assembly: Top View

Cable Clamp
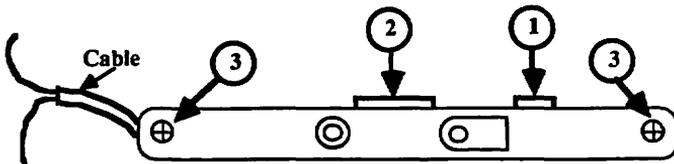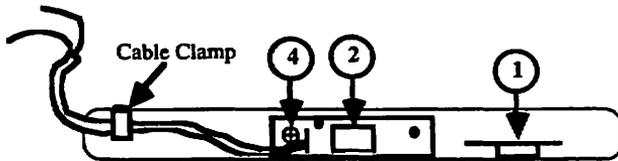
Crossmember Assembly: Bottom View

FIGURE 2-27

Remove Thermistor and Thermoprotector

1. Remove the upper roller (see instructions above).

2. Locate the upper crossmember assembly (see Figure 2-26 and 2-27). The crossmember contains thermistor and thermoprotector (see Figure 2-27, #1 and 2). Remove the crossmember as follows:

   a) Remove the two screws (one at each end) (Figure 2-27, #3).

   b) Disengage the white cable from the fuser assembly and lift out the crossmember assembly.

3. Remove the black cover of the crossmember assembly by removing its two screws.

4. **To remove the thermistor,** disengage one of its two tabs from its hole, using needlenose pliers.

5. **To remove the thermoprotector,** remove the screw farthest from the thermistor (Figure 2-27, #4) and lift the thermoprotector assembly out of the crossmember assembly.

Cleaning and Lubrication

The thermistor and thermoprotector can be cleaned with MEK (methyl ethyl ketone, $CH_3CO-C_2H_5$).

Crossmember

Fuser Assembly: Front View

FIGURE 2-28

Upper
crossmember

Upper
roller

Insulation

Spring
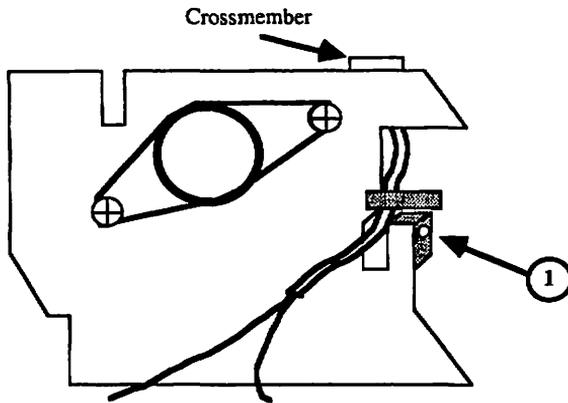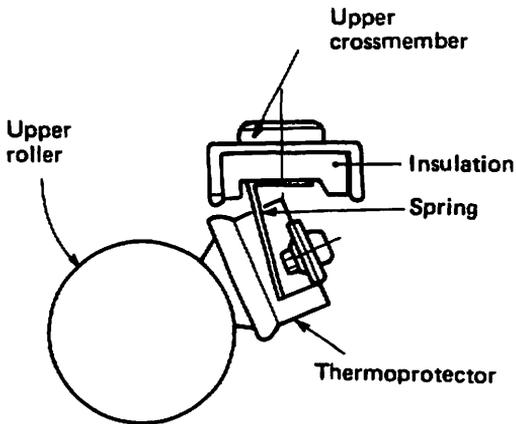
Thermoprotector

FIGURE 2-29

Replace Thermistor and Thermoprotector

1. **To install a new thermistor:**

   Seat the thermistor gently, using needlenose pliers to help seat its tabs in their holes.

2. **To install a new thermoprotector:**

   a) Seat the new thermoprotector assembly in the crossmember, and install the single short black screw.

   b) Attach the cable connector to the last screw hole in the crossmember, so that it holds the cable in place.

3. Replace the black cover on the crossmember assembly and install its two screws (black screws with unthreaded top).

4. Reinstall the crossmember assembly as follows:

   a) Seat the assembly on the fuser assembly.

   b) Route the small cable under the small half-clamp at the gear-end of the crossmember assembly.

   c) Route the large cable attached to the black plastic end-piece as shown in Figure 2-28, #1.

   d) Install the two small black screws, one at either end of the crossmember.

5. Reinstall the upper roller (see instructions below).

Replace Upper Roller

1. Carefully install the roller in the fuser assembly, inserting the side without the bearing first.

   When replacing the roller, check that the thermistor and thermoprotector touch the tube evenly when the tube is rotated (see Figure 2-29). If the contact is not even, check to see if the springs on the thermistor or thermoprotector are bent or broken, and adjust them if possible; otherwise, replace the thermistor or thermoprotector (see instructions above).

2. Align the screw holes on the roller bearing with the holes in the fuser. Install the two short black screws.
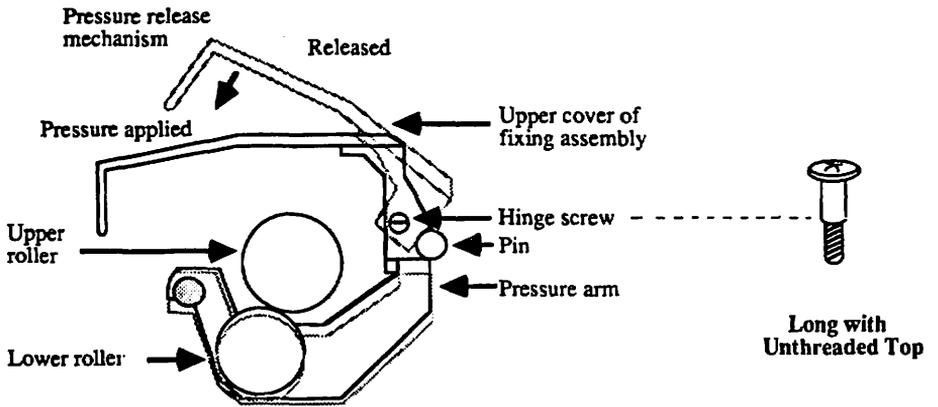
FIGURE 2-30

3. Replace the gear on the roller so that the inner tooth
   on the gear lines up with the slot in the tube. The
   side of the gear where the inner tooth is flush with the
   surface of the gear should face outward. Replace the
   retaining ring to hold the gear on the shaft.

4. Replace the steel plate on the end of the fuser assembly
   as follows:

   a) Place the plate on the assembly so that the two screw
      slots line up with the screw holes on the assembly,
      and install the screws.

   b) Attach one end of the steel spring to the tiny hole
      in the plate (from below); attach the other end to
      the hole in the lower gear plate. Make sure that the
      ends of the spring are securely seated in the holes.

   c) Clamp the white plastic cable under the small cable
      clamp on the plate, pulling the cable so that there
      is very little slack, and tighten the screw.

5. Reinstall the two spring assemblies, one at each end of
   the fuser. Make sure that the small metal sleeve and
   nylon spacer are on the screw before you install it.

6. Replace the green cover and its two short black hinge-
   screws (see Figure 2-30). Check for free motion of the
   cover and loosen screws if necessary.

7. Reinstall the heater bulb in the roller, being careful
   of the following:

   a) Do not touch the body of the bulb with your hands:
      oil from your hands can cause hot spots and weaken
      the bulb. Hold the bulb by the end with the
      manufacturer's name.

   b) The end marked with the manufacturer's name goes in
      last. (If the tube is installed backwards, the toner
      will not be fused properly to the paper.)

   c) The glass nipple on the bulb should face downward,
      away from the thermistor and thermoprotector.

   d) **The leading end must be seated on the copper
      electrode at the far end of the assembly.** Otherwise,
      the resistor assembly at position J107 on the AC
      Driver PCB will open (blow) and have to be replaced.

8. Place the black plastic end-piece over the front end of
   the tube, seating the copper electrode in the end of the
   heater bulb. Replace the two short black screws in the
   end piece.

Hinge plate

Registration shutter

Ground wire

Retaining pin

Torsion bars
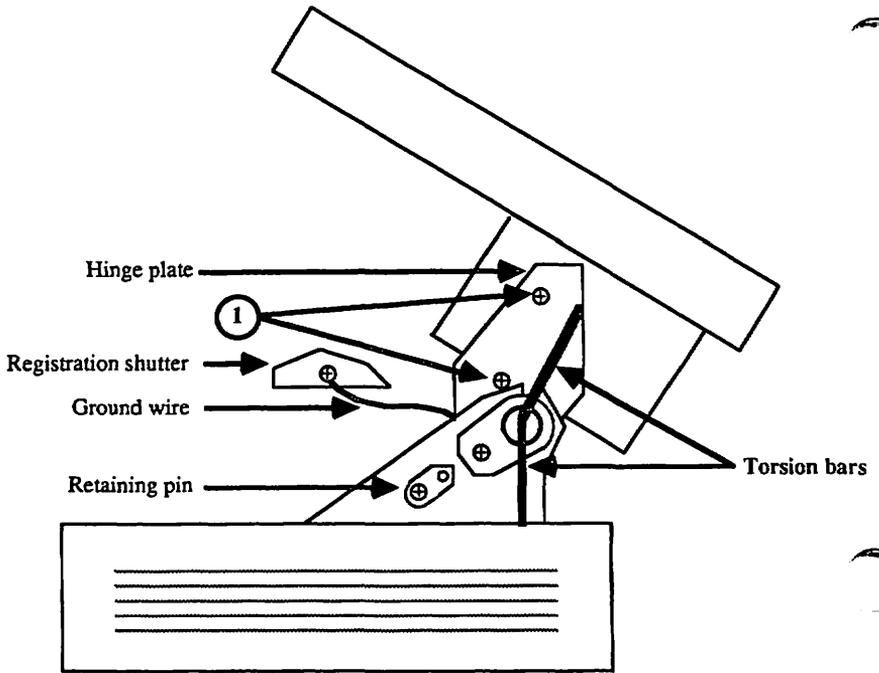
FIGURE 2-31

2.C.3 - TRANSFER GUIDES

The transfer guides (see Appendix, Photo 2, #1) consist of plates and rollers that guide the paper toward (and between) the toner cartridge drum and transfer corona assembly. If the transfer guides become bent, print may be light on some areas of the page (because the paper will be too far from the transfer corona wire).

NOTE: If you do not have a stubby screwdriver, you will have to remove all panels, the rear frame, and the high voltage power supply and main motor before performing this removal and replacement.

1. Open the printer and remove the toner cartridge.

2. Remove the separation belt.

3. To allow the printer to open wider, remove the two retaining pins (one at each side) (see Figure 2-31). **HINT:** Push down on the upper main body while removing the pins, to relieve pressure on them.

4. Remove the two screws and lift out the lower guide plate (see Photo 2, #2). [The roller pressure spring (Photo 2, #3) comes off when you do this.]

5. Loosen the screw on the bearing holder (see Photo 3, #1), move the bearing holder to the side, and lift out the transfer guide.

Replace

1. Put the transfer guide back into place, reposition the bearing holder, and tighten the screw on the bearing holder.

2. Put the lower guide plate back into place. **Reinstall the roller pressure spring and the ground wire above it, and then the screw.**

   NOTE: There are two important grounding elements for the transfer guides: 1) the roller pressure spring and the ground wire that connects to it (see Photo 2, #3) and 2) the ground wire that connects (via a faston connector) to the lug just behind the transfer corona (see Photo 3, #3).

3. Restore the two retaining pins to their places. **HINT:** Push down on the upper main body while replacing the pins.

4. Install the separation belt.

2.C.4 - FEEDER GUIDE

The feeder guide (see Appendix, Photo 2, #6) is a piece of
ridged metal that guides paper from the transfer corona to
the fuser assembly. At one end of the feeder guide is the
static eliminator (Photo 2, #5), a row of sharp metal teeth
that remove excess static charge from the print material.
(Some high-resistant print material, such as mylar
[transparencies], develops a high electric charge on its rear
surface during transfer. When the print separates from the
drum at a high speed, this charge can be rearranged, causing
toner particles on the other side to move around, producing
what look like "water spots" on the print. The static
eliminator prevents this.)

Remove

Open the printer and remove the toner cartridge. Then locate
the feeder guide, remove its four screws, and lift it out.

Replace

1. Position the feeder guide and tighten the screws fully.

2. Loosen the screws one-eighth to one-quarter turn. (If
    the screws are too tight, the feeder guide may warp,
    causing smearing of the print.)

2.C.5 - SEPARATION/FEEDER UNIT

The Separation/Feeder Unit (see Photo 2, #8) separates the
paper from the toner cartridge print drum and guides the
paper to the Fuser Assembly.

Remove

1. Open the printer and remove the toner cartridge and the
    separation belt.

2. Remove the harness cover (see Photo 4, #1).

3. Remove the fuser assembly (Section 2.C.2.)

4. Remove the feeder guide. (Section 2.C.4.)

5. Remove the ground wire from the separation/feeder unit
    (short silver flanged screw).

6. Remove the two large black screws; then remove the
    separation/feeder unit.

Replacement is the reverse of removal. Take care not to
damage the separation belt when installing it.

2.C.6 - TRANSFER CORONA ASSEMBLY

As the paper passes over the transfer corona (see Appendix,
Photo 5, #6), the corona wire gives the paper a static charge
which attracts the toner from the print drum. If the corona
wire breaks, the printing will be too light across the entire
page. You can replace the entire assembly, or just the wire.

Remove Assembly

1. Open the printer.

2. Remove the separation belt (see Photo 5, #1).

3. Remove the transfer roller (see Photo 5, #2)
    by removing its one screw and lifting out
    the transfer roller.

Screw

Transfer Roller

4. `Remove the screw at the front end of the assembly (see
   Photo 5, #3) and lift the assembly toward the front of
   the printer and out.
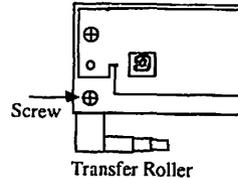
Replace Assembly

1. Put the assembly back into place and install the long
    black screw. **WARNING:** Be careful not to cut your
    fingers on the anti-static teeth next to the assembly:
    they are sharp!

2. Put the transfer roller in position (its two studs fit
    into holes in the brass-colored plate above it) and
    install its black self-tapping screw.

3. Reinstall the separation belt.

Restring Corona Wire

You will need corona wire and, for the guide wire, nylon
wire. You will also need a spring hook, needlenose pliers,
and diagonal cutters.

1. Remove the corona assembly from the laser printer.

2. Place the unit in front of you so that the corona
    terminal (see Photo 5, #5) is on the right hand side.

3. Remove both the corona wire termination covers (see
    Photo 5, #4 and #5) by unsnapping them and lifting them
    clear of the assembly.
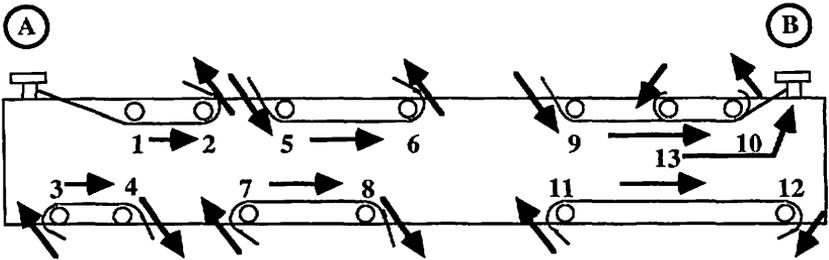
BOTTOM VIEW

1. Fasten the guide wire with screw A.
2. Pass wire around pin 1 and pin 2 to pin 3.
3. Continue routing the guide wire as shown in the diagram.
4. Pass the wire from pin 13 to screw B, and tighten screw B.
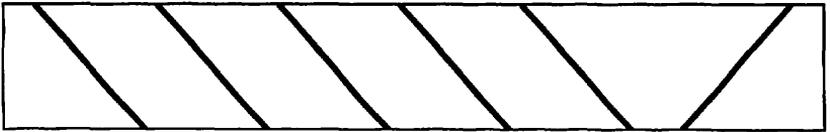
TOP VIEW AFTER GUIDE WIRE RESTRINGING;
TERMINAL END IS ON RIGHT HAND SIDE

FIGURE 2-32: CORONA ASSEMBLY

4. Remove the tension spring from the end of the broken corona wire and set it aside.

5. Remove the guide wire (nylon wire) by loosening the screws that hold it to the corona assembly.

6. Remove the broken corona wire from the corona assembly.

7. Take the new corona wire, fold back approximately a 1/4" length, and make six to eight half-turns to form a loop at the end of the wire.

8. Hook the loop over the plastic retaining pin at the left end of the assembly (see Figure 2-33)

9. Stretch the wire along the length of the corona assembly until it just reaches the leftmost brass-colored part of the corona wire terminal, and cut off any excess wire.

10. Using the same procedure as in step #7 above, form a loop at the end of the corona wire.

11. Hook one end of the spring onto the loop and the other end onto the corona wire terminal (see figure below). **The wire should be taut enough to remain straight, and should have no kinks.**

12. Replace the corona wire termination covers. (The small cover has a lip that fits under the lip of the assembly.)

13. Restring the guide wire as shown in Figure 2-32.

14. Install the corona assembly in the laser printer.
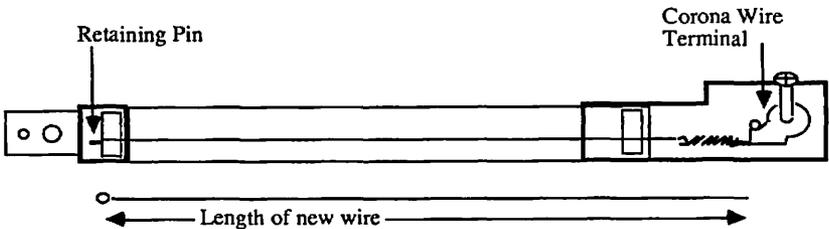
FIGURE 2-33: RESTRINGING THE TRANSFER CORONA WIRE
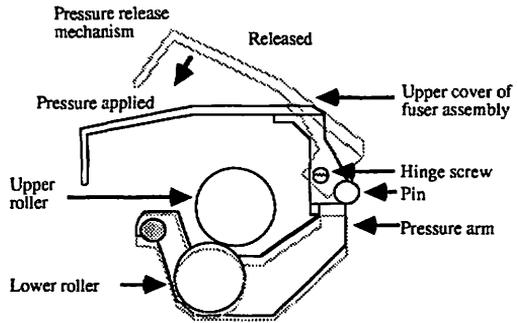
FIGURE 2-34

CROSS SECTION OF FUSER ASSEMBLY, SIMPLIFIED
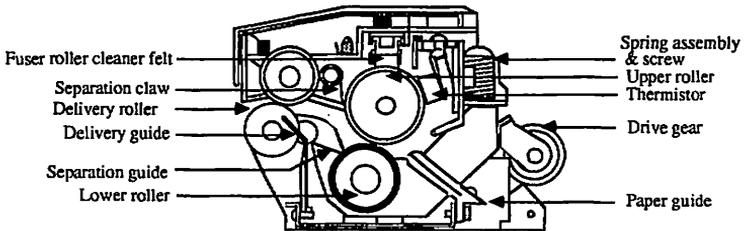
FIGURE 2-35

CROSS SECTION OF FUSER ASSEMBLY

2.C.7 - FUSER ROLLERS

The rollers in the fuser assembly may need replacement after long service. To check for roller wear, perform the Nip Width measurement (see Section 2.E.1, below).

Remove Upper Roller

1. Remove the black plastic end-piece (right fuser bracket) from the front end of the fuser assembly by removing its two screws.

2. Carefully remove the heater bulb from the roller -- do not touch the glass except with a clean cloth -- and put it in a safe place.

3. Remove the green cover by removing the two hinge-screws that hold the cover to the fuser (see Figure 2-34).

4. Remove the screws that hold the two pressure spring assemblies at each end of the fuser assembly. (Each spring assembly contains a white nylon bushing and a small metal sleeve.) Remove the pressure spring assemblies. (Figure 2-35)

5. Remove the steel plate from the rear of the fuser as follows:

   a) Loosen but do not remove the screw that clamps the white cable to the plate. Free the cable.

   b) Remove the spring from the steel plate. (To avoid losing it, remove it entirely from the assembly and put it aside.)

   c) Remove the two screws that attach the steel plate to the rear of the fuser, and remove the plate.

6. Remove the grip ring from the geared end of the roller by using needlenose pliers. (The gear teeth are plastic; do not push against them when prying the ring off.)

7. Remove the gear from the tube.

8. Remove the two screws from the roller bushing at the other end of the fuser assembly. Pull out the roller, being extremely careful not to scratch any of the exposed surfaces.
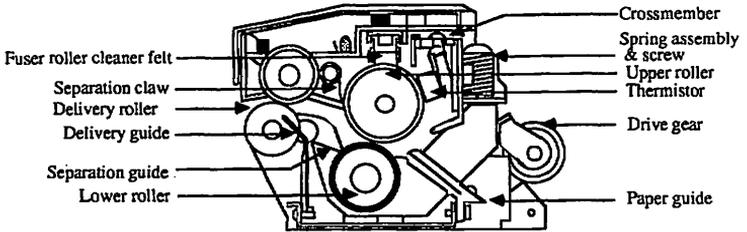
FIGURE 2-36

CROSS SECTION OF FUSER ASSEMBLY
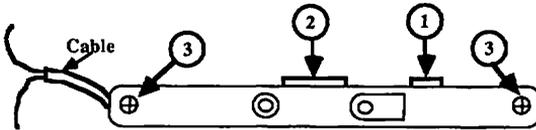
Crossmember Assembly: Top View
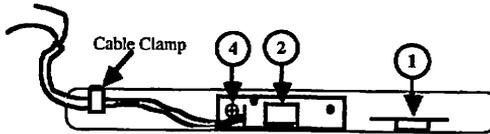
Crossmember Assembly: Bottom View

FIGURE 2-37
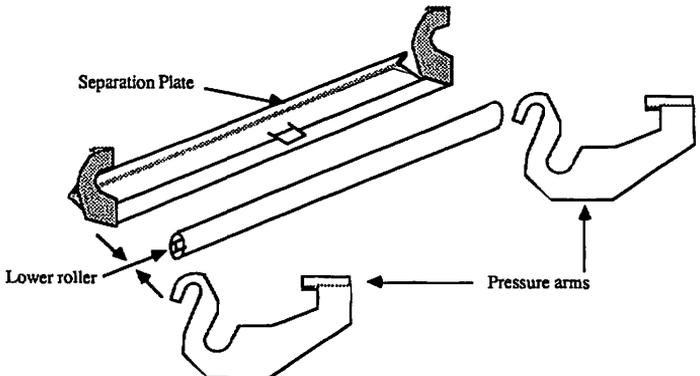
FIGURE 2-38

9. If the replacement roller does not have a bushing
    attached, remove the bushing on the old roller by
    carefully prying off the grip ring. Then install the
    bushing and the grip ring on the new roller.

Remove Lower Roller

1. Remove the upper roller (see instructions above).

2. Remove the upper crossmember assembly (see Figure 2-36
    and 2-37) as follows:

    a) Remove the two screws (one at each end).

    b) Disengage the white cable from the fuser assembly and
       lift out the crossmember assembly.

3. Remove the lower paper delivery guide (gray plastic) by
    removing the two screws holding it to the fuser
    assembly. (One of the screws has a small copper washer
    under it: make sure to capture it.)

WARNING: In the next step take care not to cut your fingers
on the sharp edges of the separation plate.

4. To remove the lower roller, lift the roller, the two
    pressure arms (one at each end -- see Figure 2-38), and
    the shiny separation plate up out of the assembly.
    (This is not easy: be prepared to fumble with it a
    bit.)

Replace Lower Roller:

1. Make sure the small plastic bushings are in place at
    each end of the lower roller, with the flange end
    towards the roller. Place the two metal pressure arms
    (one at each end) on the bushings, in the direction
    shown in Figure 2-38).

WARNING: In the next step take care not to cut your fingers
on the sharp edges of the separation plate.

2. Hook the separation plate onto the bushing shaft at each
    end of the lower roller, in the direction shown in
    Figure 2-38.
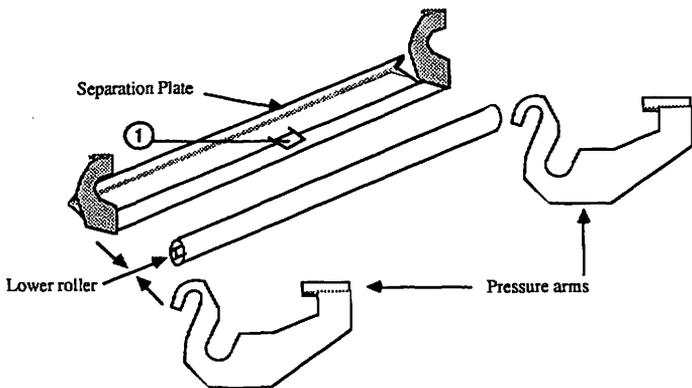
FIGURE 2-39
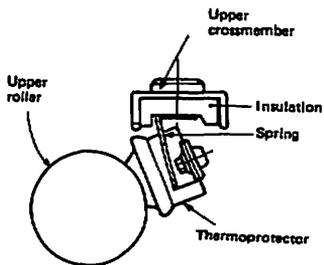
FIGURE 2-40

3. Place the roller assembly into the fuser assembly as follows:

   a) Use a piece of masking tape to hold the roller assembly together.

   b) Move it <u>under</u> the metal arms on the fuser assembly.

   c) Insert the tab on the back of the separation plate (Figure 2-39, #1) into the slot in the center of the fuser assembly plate (between the central black rollers).

   d) Hook the ends of the pressure arms on the two slotted bushings at each end of the fuser assembly.

   e) Remove the masking tape.

4. Reinstall the gray plastic lower delivery guide and the two small screws. Do not forget to place the copper washer under the screw closest the geared end of the fuser.

5. Reinstall the upper crossmember assembly by its two black screws, making sure that the front white plastic cable is routed through the small slot between the pressure arm and the fuser chassis. The rear white plastic cable is routed below the small curved flange on the upper crossmember.

6. Reinstall the upper roller.

Replace Upper Roller

1. Carefully install the roller in the fuser assembly, inserting the side without the bushing first. (If there is no front bushing on the replacement roller, transfer the bushing and grip ring from the old roller to the new.)

   When replacing the roller, check that the thermistor and thermoprotector (the two gold colored components on the top bar of the assembly) touch the tube evenly when the tube is rotated (see Figure 2-40). If the contact is not even, check to see if the springs on the thermistor or thermoprotector are bent or broken, and adjust them if possible; otherwise, replace the thermistor or thermoprotector (see instructions below).

2. Align the screw holes on the roller bushing with the holes in the fuser. Install the two short black screws.
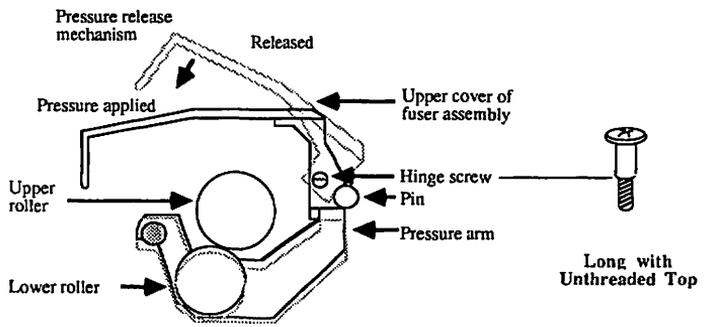
FIGURE 2-41

3. Replace the gear on the roller so that the inner tooth on the gear lines up with the slot in the tube. Make sure the outer side of the gear (where the tooth is flush with the surface of the gear) faces outward. Replace the grip ring to hold the gear in place.

4. Replace the steel plate on the end of the fuser assembly as follows:

   a) Place the plate on the assembly so that the two screw slots line up with the screw holes on the assembly, and install the screws.

   b) Attach one end of the steel spring to the tiny hole in the plate (from below); attach the other end to the hole in the lower gear plate. Make sure that the ends of the spring are securely seated in the holes.

   c) Clamp the white plastic cable under the small cable clamp on the plate, pulling the cable so that there is very little slack, and tighten the screw.

5. Reinstall the two spring assemblies, one at each end of the fuser. Make sure that the small metal sleeve and nylon bushing are on the screw before you install it.

6. Replace the green cover and its two short black hinge-screws (see Figure 2-41). Check for free motion of the cover and loosen screws if necessary.

7. Reinstall the heater bulb in the roller, being careful of the following:

   a) Do not touch the body of the bulb with your hands: oil from your hands can cause hot spots and weaken the bulb. Hold the bulb by the end with the manufacturer's name.

   b) The end marked with the manufacturer's name goes in last. (If the tube is installed backwards, the toner will not be fused properly to the paper.)

   c) The glass nipple on the bulb should face downward, away from the thermistor and thermoprotector.

   d) **The leading end must be seated on the small copper electrode at the far end of the assembly.**

8. Place the black plastic end-piece (bracket) over the front end of the tube, **being especially careful to seat the copper electrode in the end of the heater bulb.** Replace the two short black screws in the end piece.
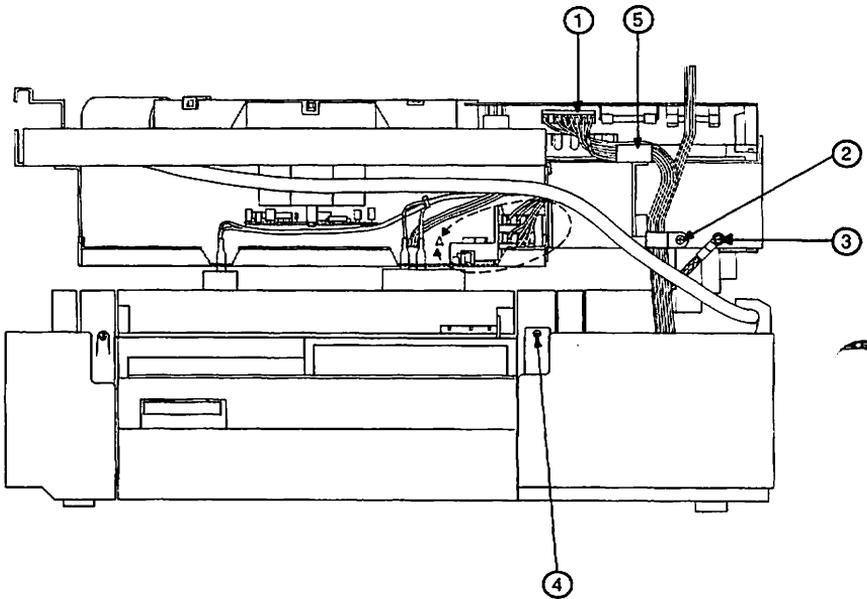
FIGURE 2-42

2.D - PRINTER PEDESTAL

2.D.1 - REMOVE PRINTER FROM PEDESTAL

The printer pedestal contains the automatic paper-feed mechanism (Cassette Pickup Assembly - see Appendix, Photo 7, #1), two transformers (Photo 7, #2 and 3), the Interface (I/F) Regulator (Photo 7, #4), and the paper-out sensor assembly (Photo 7, #5).

1. **Make sure that the printer is unplugged and that the toner cartridge, paper trays, and paper cassette are removed.**

2. Remove the top cover and the front, right, rear, and left panels.

3. Ground yourself and remove the LaserWriter I/O board.

4. Disconnect the cable from J501 on the DC Power Supply/Motor Drive PCB (Figure 2-42, #1).

5. Remove the plastic clamp that holds the cables from the last two steps (Figure 2-42, #2).

6. Disconnect the silver-braided ground wire from the upper main body (Figure 2-42, #3).
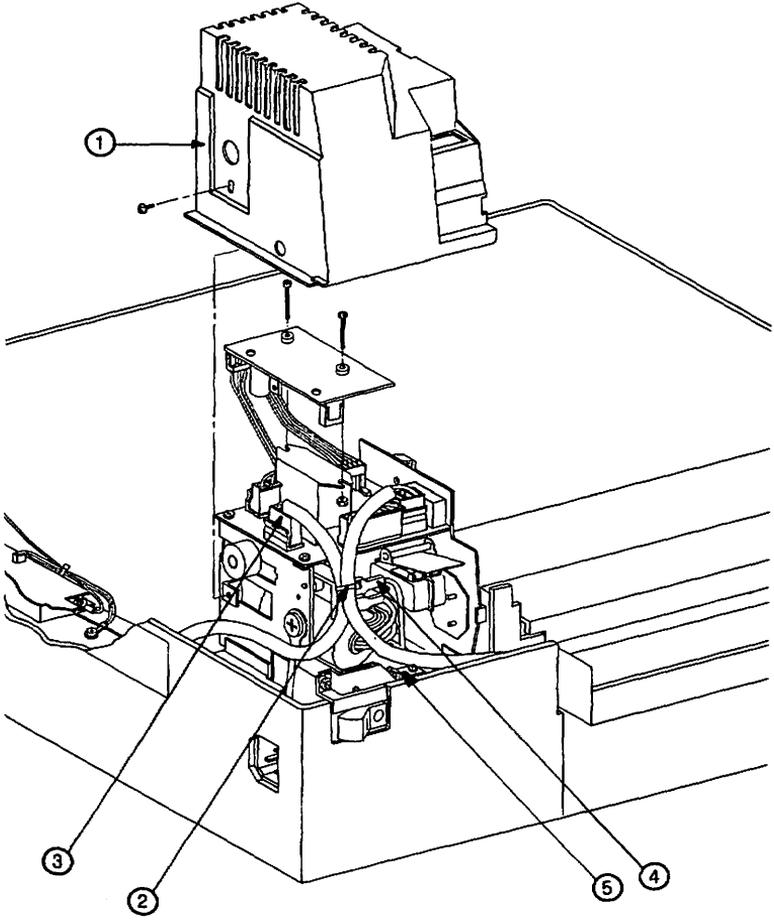
FIGURE 2-43

7. Open the printer and remove the power interlock assembly cover (see Figure 2-43, #1).

8. Clip the cable tie that holds the three large cables together (Figure 2-43, #2).

9. Unplug the large black cable from J103 (Figure 2-43, #3). (You may need to pry it up with a screwdriver blade.)

10. Above the power switch you will find four black wires that attach by spade connectors to the power interlock assembly (Figure 2-43, #4). Disconnect the two upper wires.

11. Remove the screw and wedge at the base of the power interlock assembly (see Figure 2-43, #5).

12. Remove the silver screw from the metal tab next to the Power Interlock Assembly. (See Appendix, Photo 6, #10.)
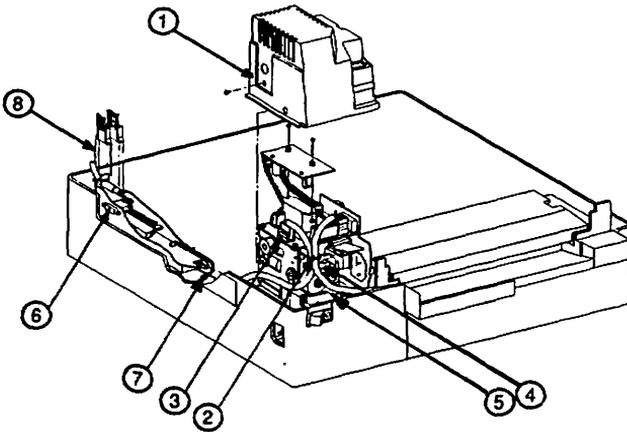
FIGURE 2-44
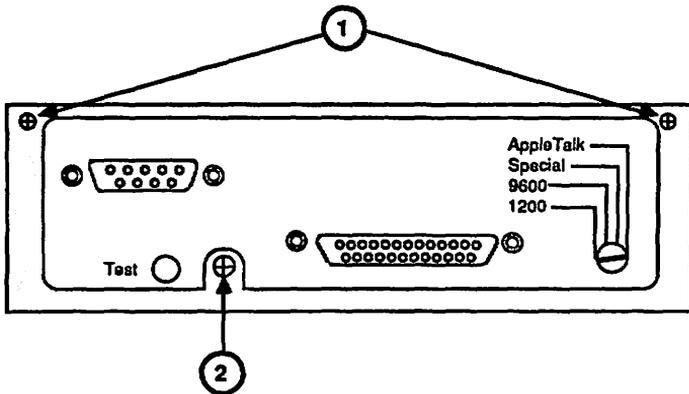
FIGURE 2-45

13. Remove the mounting connector plate (Figure 2-44, #6) as
    follows:

    a) Disconnect the grey-and-white ground wire that comes
       from the mounting connector plate (Figure 2-44, #7)
       by removing its grey screw.

    b) Clip off the cable tie that holds the large cable
       (I/O cable) to the mounting connector plate.

    c) Remove the two silver mounting screws (Figure 2-45,
       #1) and loosen the screw at the bottom of the plate
       (Figure 2-45, #2).

    d) Lift the connector plate out. Leave it connected to
       its cable and push it out the hinged side of the
       printer so that you can close the printer cover
       without damaging it.

14. Unplug the two white-and-black cables from the
    connectors behind the mounting connector plate (Figure
    2-44, #8).

15. Remove the screw from the metal tab at the rear of the
    manual feed assembly (Figure 2-46, #4).

16. Open the printer and remove the two main pedestal screws
    (Appendix, Photo 4, #5)
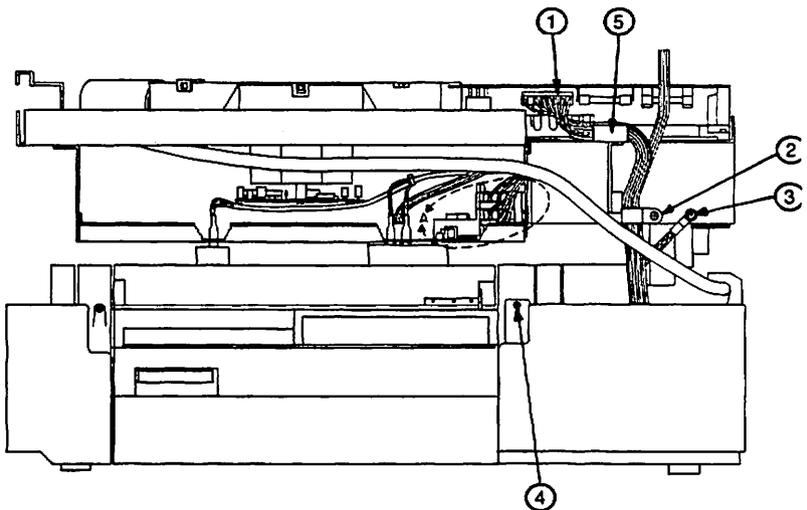
FIGURE 2-46

CAUTION: Make sure that you have disconnected all cables and screws mentioned in the preceding steps before continuing. ‖

17. Taking care not to damage any components, close the printer.

18. **WARNING:** Be careful not to strain your back in this step.

Locate the hand-holds at the left and right sides of the printer (on the plastic by the manual feed entrance and the paper exit). Grasping the top part of the printer at these areas, carefully lift the printer out of the pedestal and set it down on a stable work surface.

2.D.2 - LASERWRITER I/O POWER SUPPLY (INTERFACE REGULATOR)

The LaserWriter I/O Power Supply (formerly called the Interface Regulator - see Appendix, Photo 7, #4) is located at the opposite end of the pedestal from the two transformers. It supplies voltage for the LaserWriter I/O board.

Remove

1. Remove the printer from the pedestal (see section 2.D.1).

2. Remove the two silver screws from the I/O Power Supply. Lift up the power supply. The replaceable fuse will be clearly visible. In 110 volt LaserWriters, the fuse is 5 amp, 125 v; in 220 volt LaserWriters, the fuse is 5 amp, 250 v. ‖

Replace

Put the power supply back into place and replace the screws (long silver flanged screws).

2.D.3 - CASSETTE PICKUP ASSEMBLY

Remove Assembly:

1. Remove the printer from the pedestal (section 2.D.1).

2. Remove the four screws from the large copper grounding strip and remove the strip.

3. Locate the four screws (Appendix, Photo 7, #6) on the cassette pickup assembly. Mark the type of each screw on the assembly, and then remove the screws and the manual feed guide tab (Appendix, Photo 7, #7).

Pickup direction
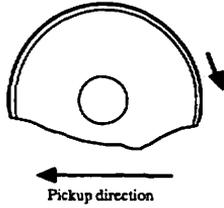
FIGURE 2-47: PICKUP ROLLER

Gear box
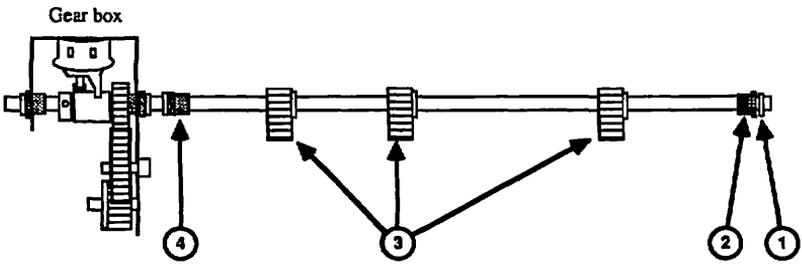
FIGURE 2-48: ROLLER SHAFT
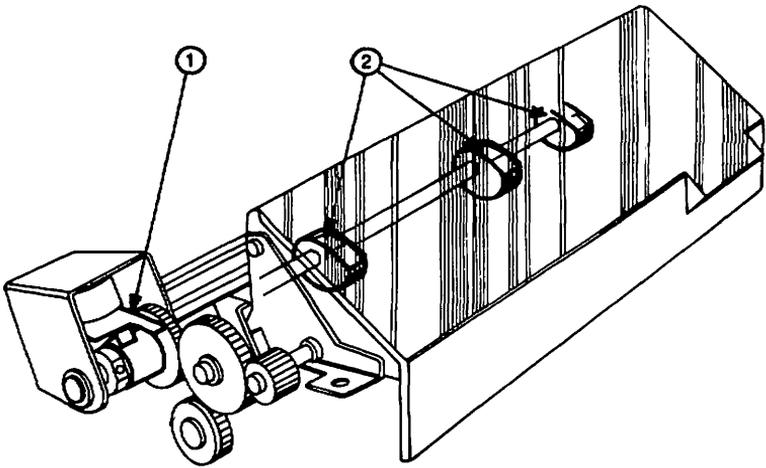
FIGURE 2-49

4. **IMPORTANT:** Locate the solenoid (Appendix, Photo 7, #8) and mark one of the solenoid lead wires and its connector, so that you can connect the leads to the correct poles when reinstalling. (Polarity matters.)

5. Disconnect the solenoid leads.

6. Lift the six long wires out of the way, and lift the assembly up and out of the printer.

To remove pickup rollers:

The pickup rollers are the half-moon shaped rollers that pick up the paper (see Figure 2-47, 2-48, 2-49).

1. Turn the cassette pickup assembly so that the pickup rollers are facing you.

2. Using grip ring pliers and safety goggles, remove the grip-ring at the end of the roller shaft (Figure 2-48, #1); then slide off the bushing (Figure 2-48, #2).

3. On the other side of the roller shaft, slide the bushing (Figure 2-48, #4) out of its slot in the frame, and lift up the roller shaft part way. Unhook the spring that holds it to the other side of the assembly, and lift it free.

4. Remove the three E-rings and pickup rollers (Figure 2-48, #3). **IMPORTANT:** Do not lose the small metal rods that keep the rollers in place.

To replace pickup rollers:

1. Put the new rollers in place, as follows:

   a) Make sure the side of the roller with the slot and the part number is facing the gear assembly.

   b) **IMPORTANT:** Make sure the projection on the white plastic gear is engaging the pawl (gear-stop) on the solenoid (see Figure 2-49, #1). With the gears in that position, turn the roller so that the FLAT side faces up (see Figure 2-49, #2).

   c) Reinstall the metal rod and E-ring.

2. Put the roller shaft back into place, making sure the bushing (Figure 2-48, #4) is fully inserted in its slot, so that it holds the shaft in place. (The bushing has a small tooth that must be positioned in the slot opening.)

3. Re-attach the spring.

Gear box

FIGURE 2-50

Control ring

Clutch spring

Pickup roller gear

Setscrew

Driven drum

Driving drum
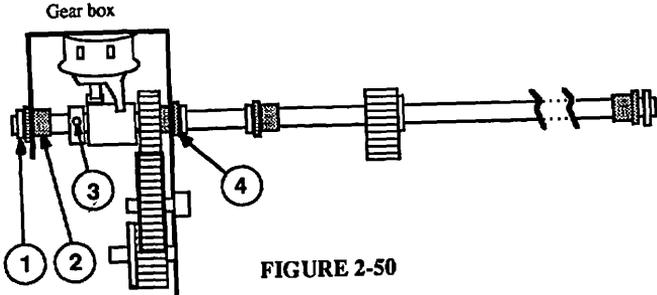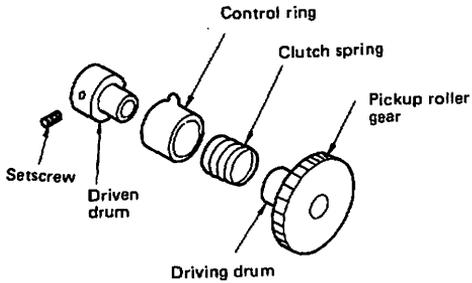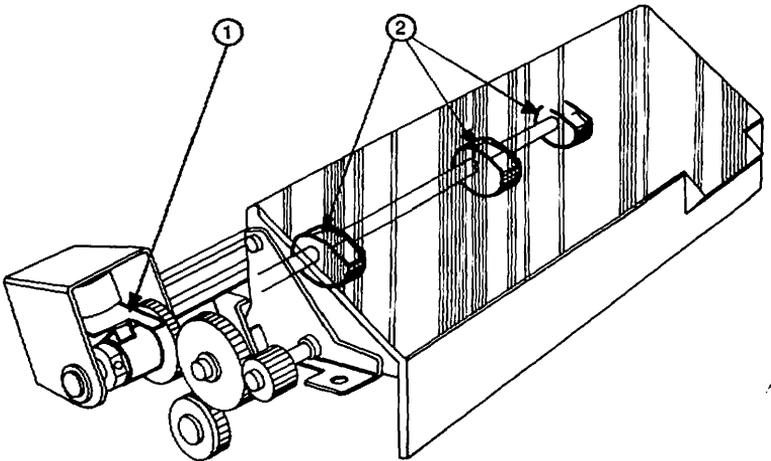
FIGURE 2-51

FIGURE 2-52

4. On the other end of the shaft, reinstall the bushing and
    the grip ring. **IMPORTANT**: Do not install the grip ring
    too snugly: it will prevent the roller shaft from
    turning freely. Leave a little play (about 1/2 mm)
    between the ring and the bushing.

To remove the pickup control clutch:

1. Remove the pickup roller shaft [see "To remove pickup
    rollers" (previous page), steps 1-3].

2. Remove the E-ring and black bushing from the end of the
    clutch assembly (Figure 2-50, #1 and 2); then remove the
    2 mm setscrew (Figure 2-50, #3) and pull the roller
    shaft out to free the clutch. **NOTE**: Make sure to
    capture the thin brass washer next to the pickup roller
    gear.

Lubrication

The clutch comes apart as shown in Figure 2-51. To
lubricate, remove the spring and oil the inside of the spring
thoroughly with tellus oil (P/N 970-0006). Then reassemble.

To replace the clutch

1. Start the roller shaft through the hole in the large
    side of the gear box. Install the thin brass washer,
    then the clutch assembly, facing as in Figure 2-50.

2. Make sure the black bushing (Figure 2-50, #4) is fully
    seated in its slot in the gear casing (note the tooth on
    the bushing). Then install the other bushing (Figure 2-
    50, #2) and its E-ring.

3. Hold the control ring (see Figure 2-51) so that its
    tooth firmly engages the pawl on the solenoid and the
    gears mesh (see Figure 2-52, #1). Turn the pickup
    roller shaft so that the flat side of the pickup rollers
    is facing up (see Figure 2-52, #2). Tighten the
    setscrew to hold this position.

Replace Cassette Pickup Assembly

1. Put the assembly back into place.

    NOTE: The brass colored tab on the cassette pickup
    assembly goes <u>under</u> the metal plate (Appendix, Photo 7,
    #9).
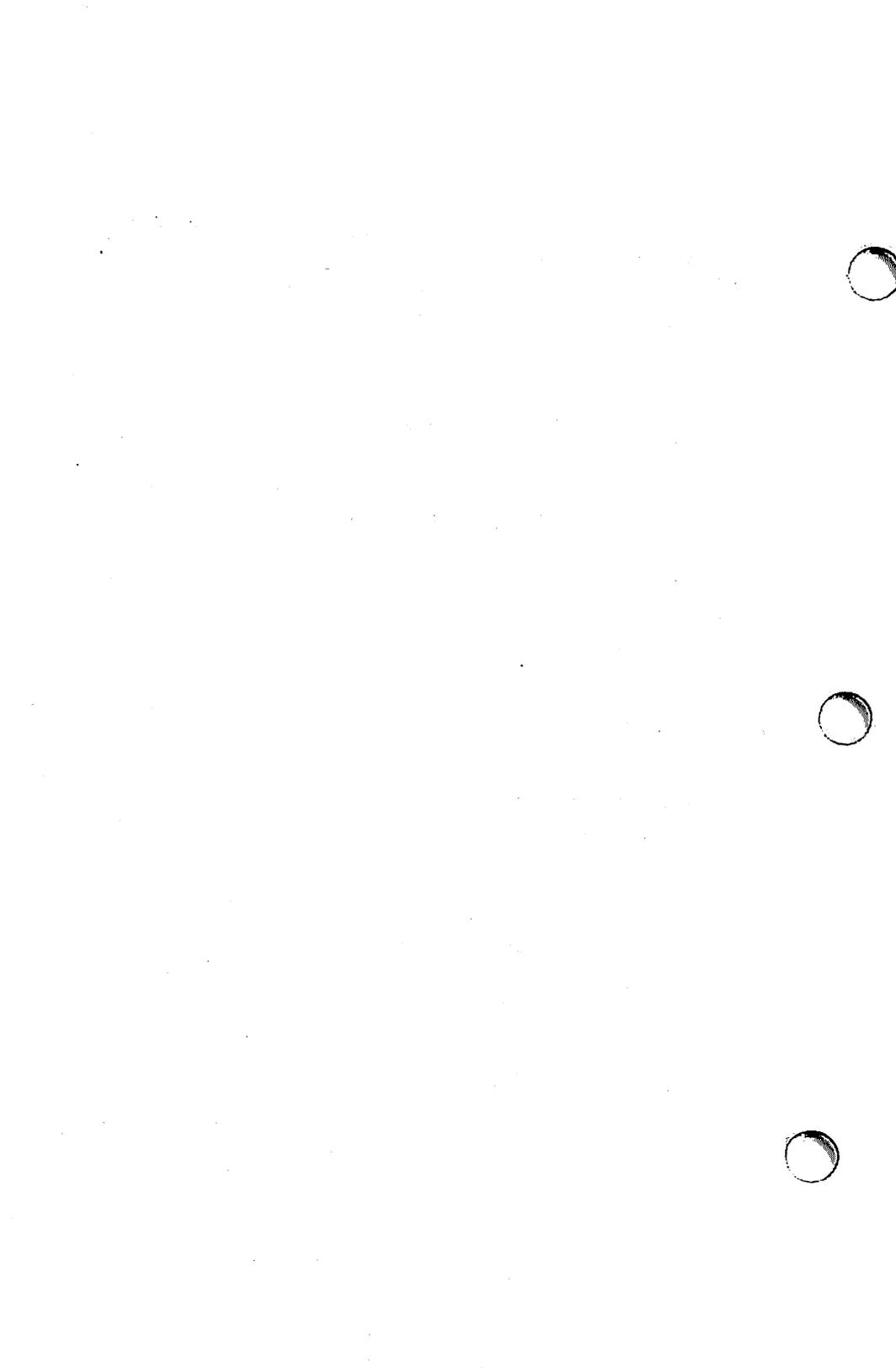
2. Reconnect the solenoid leads to the proper terminals.
   CAUTION - The terminals break easily. Don't force!

3. Route the solenoid lead wires so that they will not be
   caught in the gears.

4. Replace the manual feed guide tab (Appendix, Photo 7,
   #7)

5. Replace the four screws (Appendix, Photo 7, #6).

6. Route the red, blue and brown wires over the tape on the
   assembly and press them down until the tape holds them
   in place.

7. Replace the copper ground strip and its four short
   silver screws.

2.D.4 - PAPER-OUT SENSOR (PS2)

Overview: When the paper in the cassette runs out, the paper
detection arm (Appendix, Photo 7, #5) descends and blocks the
light from the paper-out photosensor (PS2). This tells the
printer that there is no more paper, and the PAPER OUT
indicator on the display panel lights.

1. Remove the printer from the pedestal (see section
   2.D.1).

2. Point the black plastic arm upwards (Appendix, Photo 7,
   #5) and slide it out of its groove.

3. The plastic piece immediately beneath the arm you
   removed is the sensor. Disconnect the cable connector
   from the sensor.

4. Remove the sensor's mounting screw and lift the sensor
   out.

Replace

1. Put the new sensor in place and install the mounting
   screw.

2. Connect the cable connector to the sensor.

3. Restore the black plastic arm to the sensor assembly.

4. Replace the printer in the pedestal (see section 2.D.5).
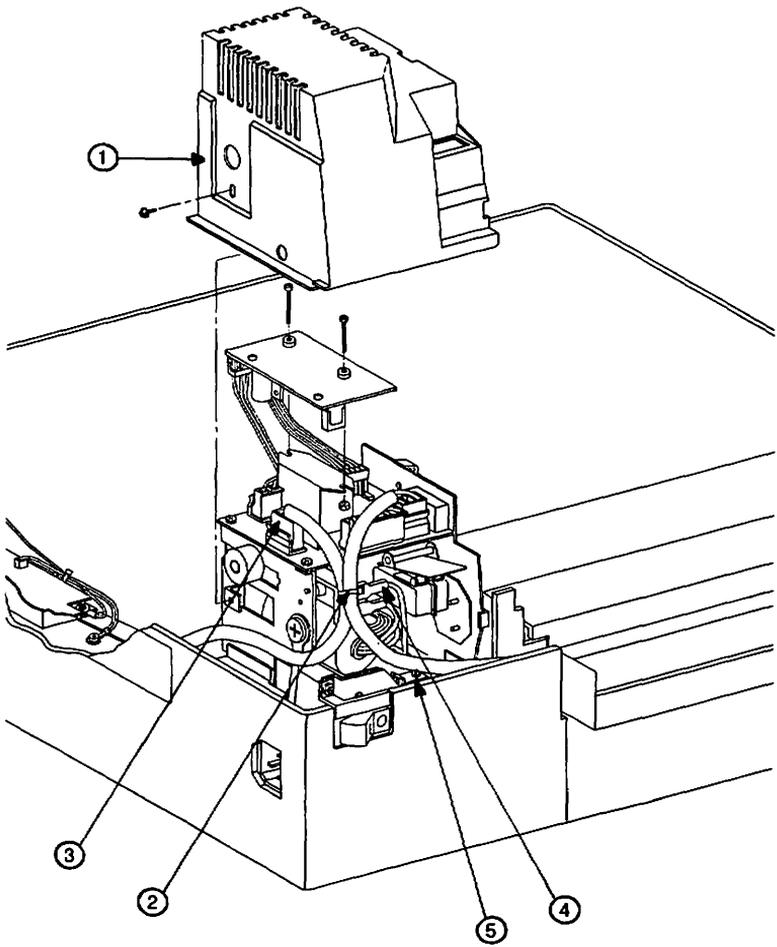
FIGURE 2-53

2.D.5 - REPLACING THE PRINTER IN THE PEDESTAL

1. **Check that all components in the pedestal have been replaced.**

2. Arrange the pedestal cables as follows and use masking tape to hold them in place:

   a) The two black wires with spade connectors should be between the power switch slot and the metal tab to the right of the slot (as you face the slot) (see Appendix, Photo 7, #10).

   b) The large black-sheathed wire should exit above the Apple logo on the metallic printer label (see Appendix, Photo 7, #11).

   c) The other cables should hang over the right side of the printer (see Appendix, Photo 7, #12).

   Make sure all wires inside the pedestal are routed so as to avoid being pinched when the printer is replaced on the pedestal.

3. Lift the printer back into position on the pedestal and carefully lower it into place. DO NOT PINCH ANY CABLES!!

4. Make sure the printer is correctly seated, as follows:

   a) **Check that each cable is routed as described above. Make sure that it can reach its connector and move it around a little -- you should be able to move all cables easily.**

   b) Make sure that the power switch is fully seated, and that the power cord can be inserted in its connector (but do **not** leave the power cord inserted).

5. Open the printer.

6. Replace the wedge at the base of the Power Interlock Assembly and install its long black screw (Figure 2-53, #5).

7. Connect the two black wires with spade connectors to their terminals on the Power Interlock Assembly (Figure 2-53, #4). **CAUTION:** There are two double-pronged connectors for these wires. Attach one wire to each connector -- not both wires to the two prongs of a single connector. Make sure you are using the upper connectors.
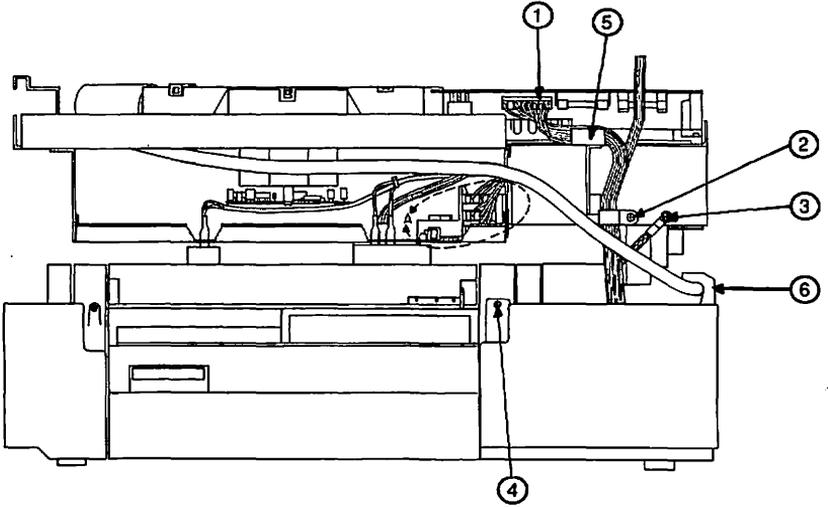
FIGURE 2-54

8. Attach the large black cable to J103 on the Power
    Interlock Assembly.

9. Using a cable tie, tie together the three cables to the
    Power Interlock Assembly, as they were before (see
    Figure 2-53, #2).

10. Install the Power Interlock Assembly cover and its
    single black flanged screw. (Make sure the cover fits
    under the four metal tabs at its sides and the plastic
    tab on the harness cover.)

11. Replace the short silver screw in the metal tab next to
    the power interlock assembly (Appendix, Photo 6, #10).

12. Replace the mounting connector plate as follows:

    a) Open the printer and put the plate back into place.

    b) Install the two short silver mounting screws and
        tighten the screw at the bottom of the plate.

    c) Route the large cable under the corner of the
        mounting connector plate and fasten it there with a
        cable tie. (See Figure 2-54, #6.)

    d) Connect the ground wire to the printer chassis
        (chrome plate) with the short thick black screw.

13. Connect the two white-and-black cables to the sockets
    near the mounting connector plate.

14. Close the printer and connect the silver-braided ground
    wire to the second hole from the end of the hinged side
    of the printer, using a short silver flanged screw.

15. Connect the cable to the DC Power Supply board (route it
    over the silver arm, Figure 2-54, #5).

16. Tie together the cables to the LaserWriter I/O board and
    the DC Power Supply board with the large cable clamp,
    which attaches to the third hole from the end of the
    hinged side of the chassis. (Use a long flanged black
    screw.)

17. Replace the extra-long black screw in the tab at the
    rear of the Manual Feed Assembly (Figure 2-54, #4).

18. Replace the two main pedestal screws.

19. Ground yourself and replace the LaserWriter I/O board.
    Make sure to reconnect the three cables to the board.
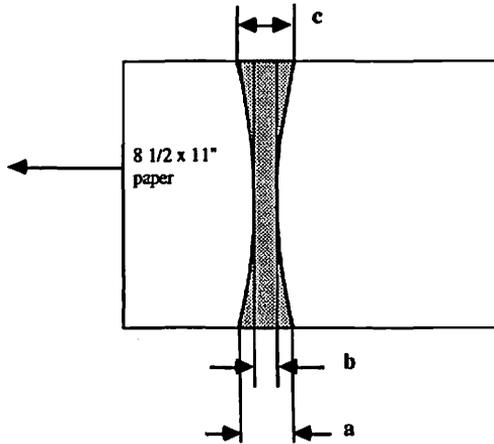
Width	Measure when upper and lower rollers are hot.
b	2-3 mm.
|a-b|	Under 0.5 mm
|a-b|	Under 0.5 mm
|b-c|	Under 0.5 mm

FIGURE 2-55

20. Replace the panels and covers.

21. Apply power to the printer and make a test print.

2.E - OTHER PROCEDURES

2.E.1 - NIP WIDTH MEASUREMENT

The nip width measurement should be performed when irregular fusing is a problem. The measurement shows whether the fuser assembly's rollers are exerting uniform pressure on the prints. If they are not, the lower roller should be replaced. If that fails to fix the problem, the pressure springs should be replaced.

To measure:

NOTE: Take measurements when the rollers are hot; wait 15 minutes after turning power ON before making a measurement.

1. Start a service test print by momentarily shorting together pins 1 and 2 on J205 on the DC Controller board.

2. Switch the power OFF when the leading edge of the print appears at the paper delivery port.

3. Pull the leading edge forward slightly and wait 10 seconds; then pull the print completely from the fuser assembly.

The result of this procedure is a glossy strip on the paper where the rollers rested. The strip should be 2 to 3 mm wide at its center (Figure 2-55, measurement b), and should spread out no more than .5 mm at either edge (see Figure 2-55, measurements a and c).

4. Measure the width of the glossy section where the rollers were pressing on the paper (see Figure 2-55). If it meets specifications, rollers are acceptable. If it fails, replace the lower roller and measure nip width again. If nip width is still outside specifications, replace the pressure spring assemblies on either side of the fuser assembly.
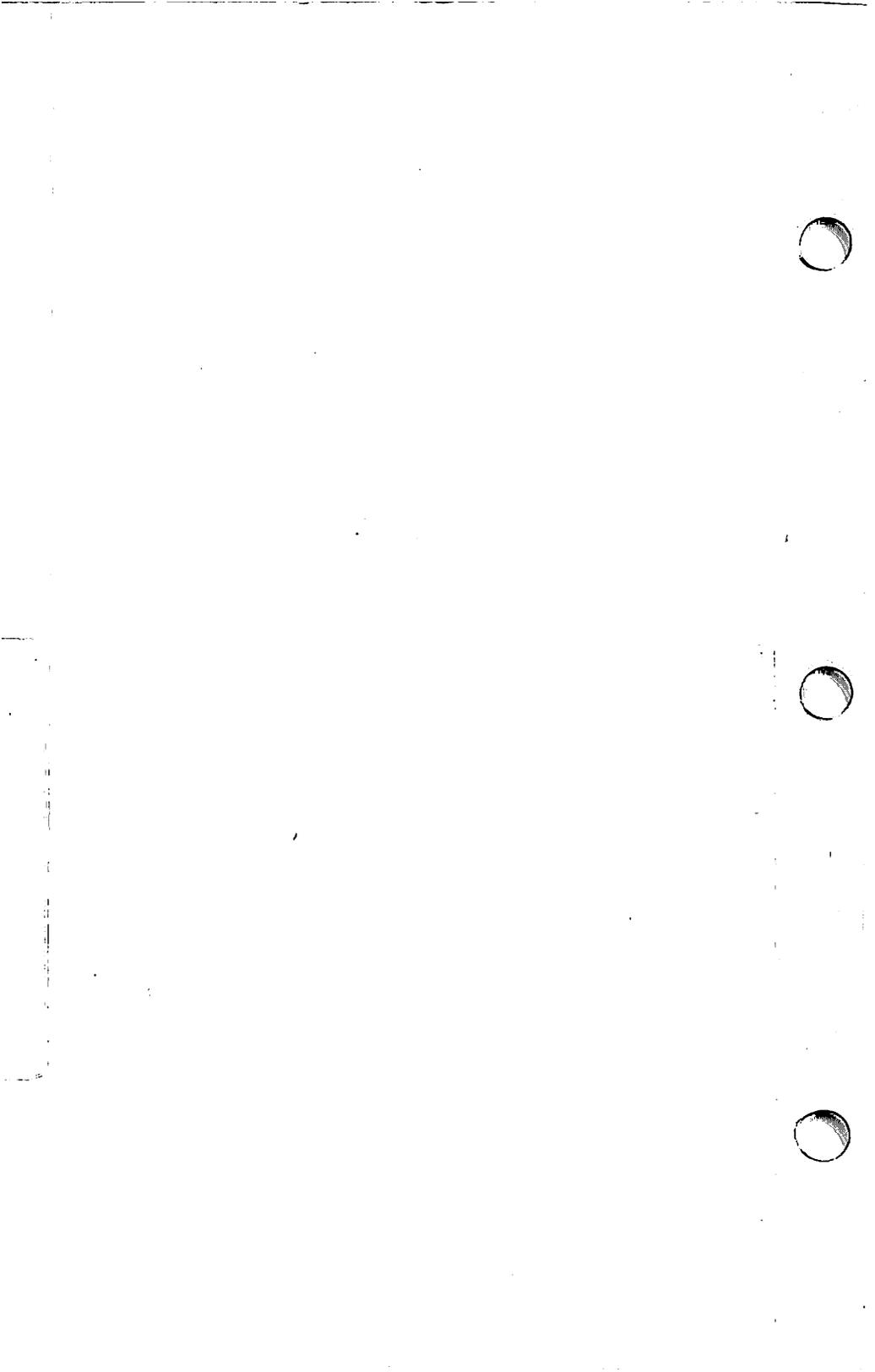
Apple LaserWriter Printer
Technical Procedures

Section 3 - Adjustments

Contents:

NOTE: For part numbers of these adjustments, see the Price
pages of your Apple Service Programs Manual.

.
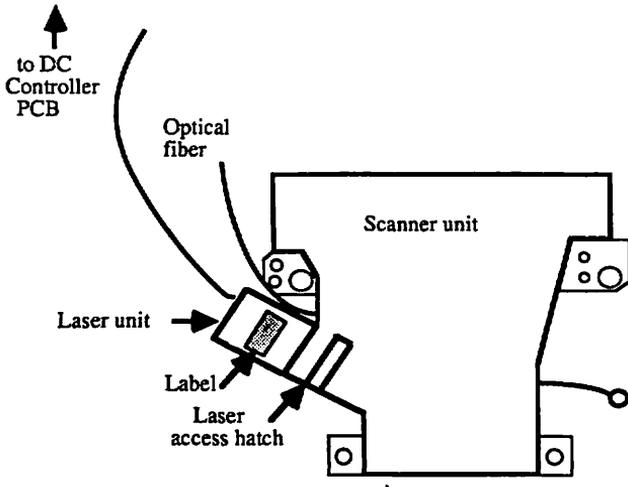
FIGURE 3-1
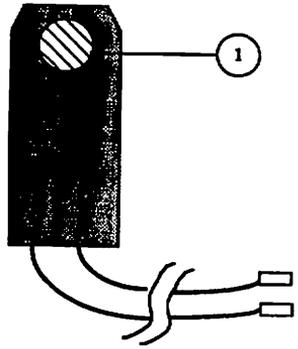
FIGURE 3-2

3.A LASER POWER ADJUSTMENT

Laser power should be adjusted after replacing the DC
Controller board or the laser unit (see Appendix, Photo 1, #1
and #5). It should also be adjusted if the image is
consistently too light or too dark and if that problem cannot
be fixed by using the print density adjustment dial or
changing the toner cartridge. (In general, however, adjust
laser power as seldom as possible. Frequent adjustment
increases the chances of damaging the laser chip.)

This procedure requires a multimeter and the laser power
checker (see Figure 3-2), which comes in your LaserWriter
Spares Kit.

WARNING: Review the Safety procedures in section 2.A.3
before continuing, and remove all jewelry (including dangling
necklaces) before performing this adjustment.

1. **IMPORTANT: Switch the power off.**

2. Remove the top cover and the LaserWriter I/O board and
    card cage.

3. Open the laser access hatch on the scanner unit. (See
    Figure 3-1.)

4. Insert the Laser Power Checker (Figure 3-2) into the
    access hatch with the detector (Figure 3-2, #1) facing
    the laser. **WARNING:** Make sure the Laser Power Checker
    is fully inserted, so that none of the laser light can
    escape from the access hatch.

5. Connect the Laser Power Checker to a digital multimeter
    as follows:

    a. Connect the black lead from the Laser Power Checker
        to the multimeter socket marked "COMMON."

    b. Connect the red lead from the checker to the
        multimeter socket marked "VOLTS" or "V."

    c. Select the "VOLTS" button on the multimeter, set the
        multimeter range to 200mv, and turn the multimeter
        on.

    NOTE: If the multimeter does not make good contact, or
    if the meter range is wrong, the power of the laser
    cannqt be measured accurately. Be sure the leads are
    plugged in correctly.

FIGURE 3-3: CONNECTOR LOCATIONS ON THE DC CONTROLLER PCB

FIGURE 3-4

3.A LASER POWER ADJUSTMENT

Laser power should be adjusted after replacing the DC
Controller board or the laser unit (see Appendix, Photo 1, #1
and #5). It should also be adjusted if the image is
consistently too light or too dark and if that problem cannot
be fixed by using the print density adjustment dial or
changing the toner cartridge. (In general, however, adjust
laser power as seldom as possible. Frequent adjustment
increases the chances of damaging the laser chip.)

This procedure requires a multimeter and the laser power
checker (see Figure 3-2), which comes in your LaserWriter
Spares Kit.

WARNING: Review the Safety procedures in section 2.A.3
before continuing, and remove all jewelry (including dangling
necklaces) before performing this adjustment.

1. IMPORTANT: Switch the power off.

2. Remove the top cover and the LaserWriter I/O board and
    card cage.

3. Open the laser access hatch on the scanner unit. (See
    Figure 3-1.)

4. Insert the Laser Power Checker (Figure 3-2) into the
    access hatch with the detector (Figure 3-2, #1) facing
    the laser. WARNING: Make sure the Laser Power Checker
    is fully inserted, so that none of the laser light can
    escape from the access hatch.

5. Connect the Laser Power Checker to a digital multimeter
    as follows:

    a. Connect the black lead from the Laser Power Checker
        to the multimeter socket marked "COMMON."

    b. Connect the red lead from the checker to the
        multimeter socket marked "VOLTS" or "V."

    c. Select the "VOLTS" button on the multimeter, set the
        multimeter range to 200mv, and turn the multimeter
        on.

    NOTE: If the multimeter does not make good contact, or
    if the meter range is wrong, the power of the laser
    cannqt be measured accurately. Be sure the leads are
    plugged in correctly.

FIGURE 3-3: CONNECTOR LOCATIONS ON THE DC CONTROLLER PCB

FIGURE 3-4

6. Disconnect the cable from J209 on the DC Controller board (see Figure 3-3).

7. Connect a jumper between pins 5 and 6 on J209.

8. If a new DC Controller board is being installed, turn VR202 (see Figure 3-3) all the way counterclockwise, to start with the lowest possible setting.

9. Switch the power on and wait about one and a half minutes for the printer to warm up. The green power light should flash during the warm-up period. You may proceed to the next step when the green light stays on steadily.

10. Momentarily connect a jumper between J209 pin 7 and pin 6; record the reading on the meter and remove the jumper. (**CAUTION**: Leaving the jumper on too long may burn out the laser.)

11. Repeat step 10 two more times. Calculate the average of the three readings to determine the laser power output.

12. Compare the averaged reading to the reading shown on the laser label (see Figure 3-4).

13. If the laser output is within the range indicated on its label (the voltage indicated next to the figure "300," plus or minus 1 millivolt), no adjustment is necessary, so you may skip the next three steps (step 14, 15, and 16) and continue with step 17.

14. Before making any adjustment, make sure that the jumper between J209 pin 7 and pin 6 is removed. Then, if the laser output is too high, turn VR202 a little counterclockwise. If the laser output is too low, turn VR202 a little clockwise. Move the resistor in very small increments.

15. Install the jumper and measure the laser output as before (steps 10, 11, and 12).

16. If the laser output is now within the range indicated, no further adjustment is required. If it is not, repeat steps 14 and 15 until the adjustment is within the indicated range.

17. **Turn power off** and remove all jumper wires.

18. Remove the Laser Power Checker and **close the access hatch securely**.

19. Reconnect J209 to the DC Controller board.

20. Reinstall the LaserWriter I/O board and the top cover.

21. Turn the printer on and verify correct operation by waiting for the automatic test print to be generated.

Top edge of paper

A   B

Leading Edge of Image

LaserWriter
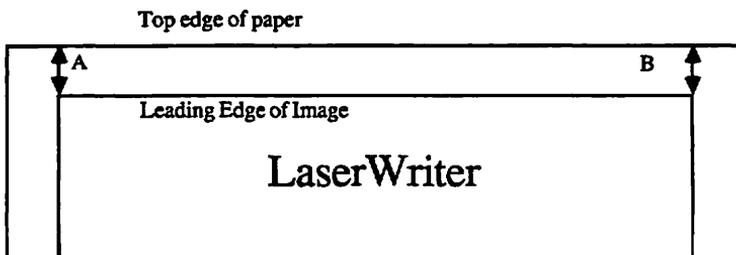
FIGURE 3-5

3.B   IMAGE SKEW ADJUSTMENT

If there is a large registration problem -- that is, if the
image on the page looks very skewed -- the cause is probably
the paper cassette or some other part of the paper feed path
(worn or dirty rollers can cause registration problems).   But
if it is a small skew in the position of the horizontal lines
of print -- just a millimeter or two -- you can fix it by
adjusting the position of the laser/scanner unit.   Changing
the position of the unit changes the angle of the horizontal
lines on the printed page with respect to the vertical lines.
Only horizontal skews can be corrected by this procedure.

If skewing problems occur when using the types and weights of
paper recommended for the LaserWriter, the adjustment is
covered under warranty.   If the problem only occurs with
paper that is <u>outside</u> the recommended types or weights, be
sure to warn the user that adjusting the printer for unusual
weights of paper is not covered under warranty and that it
may cause skewing problems when the recommended types of
paper are used.

To Check Adjustment:

1.   Make sure the type of paper recommended by the user's
     guide is loaded into the paper cassette (ordinary
     duplicator paper is acceptable).   Then generate a user
     test print by turning the printer off and then on again.

     NOTE: If you are adjusting the printer to work with a
     specific type of paper that is outside the printer's
     usual paper specifications, be sure to use that paper
     for the test.

2.   **Horizontal line specifications:**   Measure the distance
     from the top left and right corners of the image to the
     top edge of the paper (See Figure 3-5).   The difference
     between the two measurements (left and right) should be
     no more than 1 millimeter.

     If the difference is greater than specified, or if the
     customer wants a more exact adjustment, perform the
     adjustment procedure until the print is satisfactory.
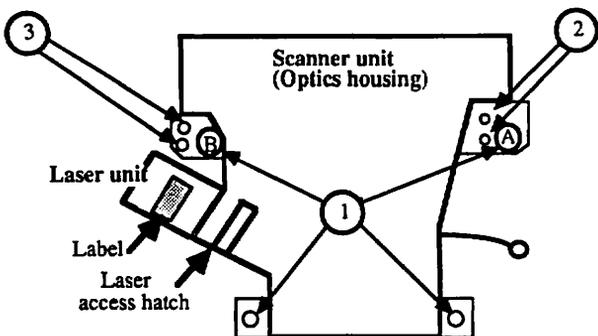
FIGURE 3-6

To Adjust the Image:

NOTE: The order of steps given below is different from the order shown in the videotape **LaserWriter Introductory Service Procedures.** Both orders will work, but for best results, follow these written procedures, which match the videotape **LaserWriter Adjustments.**

1. Switch the printer OFF and remove the top cover.

2. Remove the LaserWriter I/O board.

WARNING: Make sure the laser access hatch (Figure 3-6) is securely closed and the optical fiber is attached to the DC Controller board (see Appendix, Photo 1, #4) before continuing. When the power is on, remember not to touch the DC Power Supply board or the High Voltage Power Supply area (see Photo 1, #6 and 7).

3. Turn on the power and wait until the green ready light comes on steadily.

4. Make a service test print by momentarily jumpering pins 1 and 2 on J205 on the DC Controller board -- just touch the two pins together with the end of an insulated screwdriver. Only do this for an instant: otherwise the prints will keep coming out.

Scanner unit (Optics housing)

Laser unit

Label

Laser access hatch
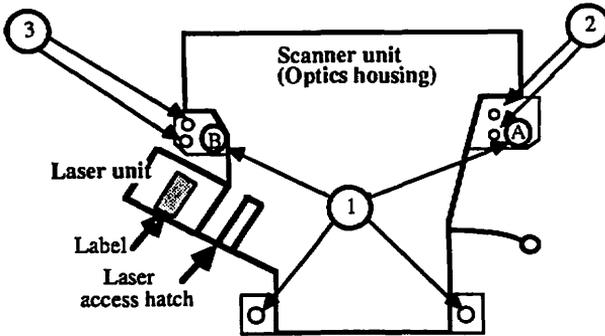
FIGURE 3-7

5. To make the scanner unit movable, loosen the four large
    mounting screws (Figure 3-7, #1) and the two sealed
    screws closest to the laser (Figure 3-7, #3).

6. Rotate the scanner unit around screw A (see Figure 3-7):
    rotating the unit clockwise makes the horizontal line
    incline counterclockwise, and vice versa.

7. Make another service test print by jumpering pins 1 and
    2 on J205. Then measure the image skew as directed
    above.

    Repeat steps 6 - 7 until the adjustment is satisfactory
    or until you are unable to move the unit any further.

Stage Two

If you cannot achieve optimum adjustment using steps 1-7,
continue with the following steps.

8. Tighten the two sealed screws you had loosened earlier
    (Figure 3-7, #3) and loosen the two sealed screws on the
    other side of the scanner unit (Figure 3-7, #2).

9. Rotate the scanner unit around screw B (see Figure 3-7):
    rotating the unit clockwise makes the horizontal line
    incline counterclockwise, and vice versa.

10. Make another service test print by jumpering pins 1 and
    2 on J205. Then measure the image skew as directed
    above.

    Repeat steps 9 - 10 until the adjustment is
    satisfactory. If necessary, return to steps 5 - 7 for
    further adjustments.

Final check

When the adjustment is satisfactory, carefully tighten all
screws. Turn off the power to the printer and put back the
LaserWriter I/O board. To verify your adjustment, generate a
user test print by turning on the power, and measure the
image skew as directed above.

Be sure to confirm that no part of the image is missing. The
adjustment procedure shifts the position of the leading edge
of the picture, and if it is shifted too far, the leading
edge of the image may be moved entirely off the page.
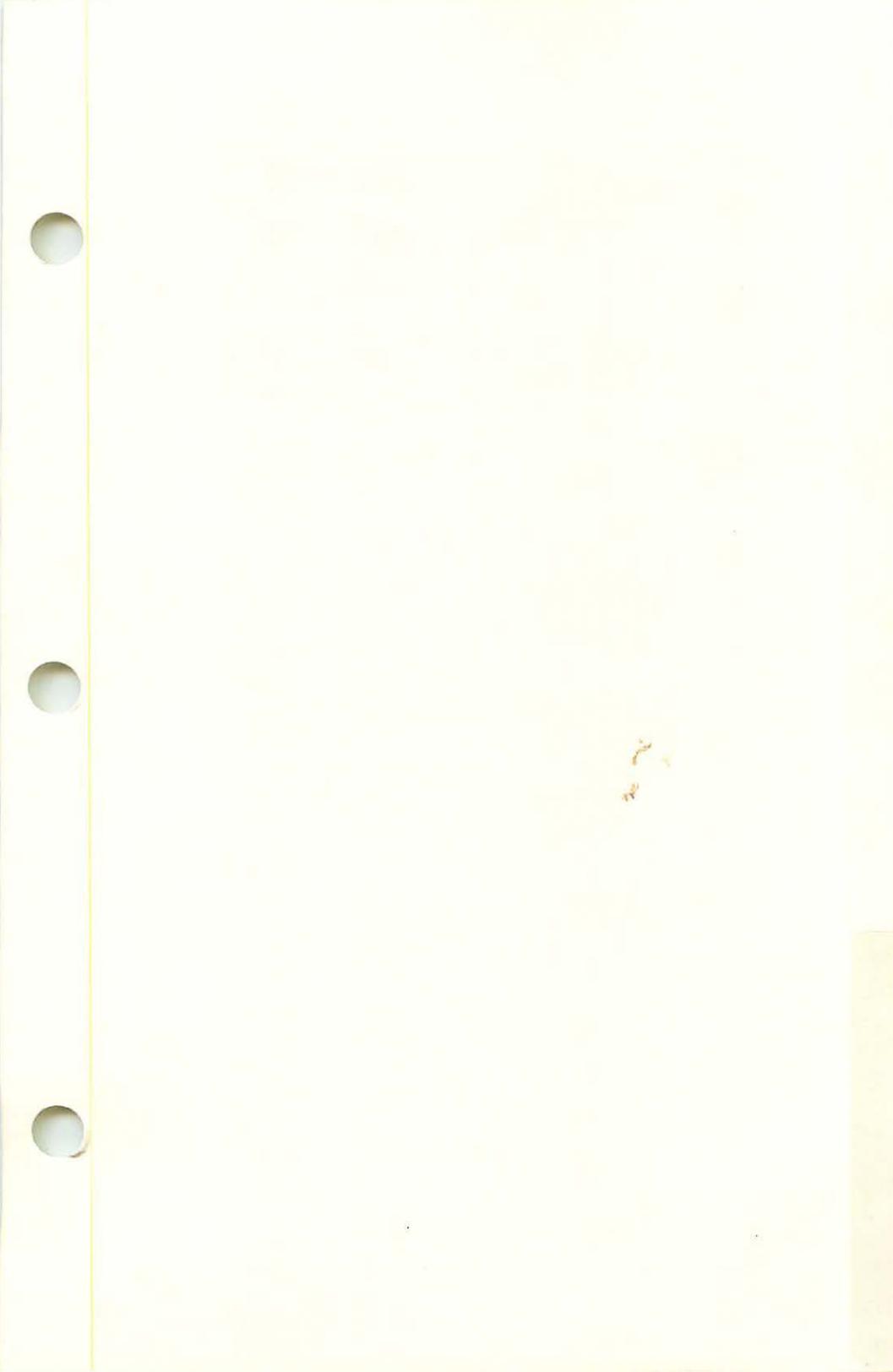
TROUBLESHOOTING THE LASERWRITER PRINTER

HOW TO USE THE TROUBLESHOOTING SECTION

Introduction:

Use this section, along with your knowledge of Theory of Operations, as a guide in diagnosing and repairing LaserWriter printer failures.

There are three check procedures:

(1) **Pre-Power-On Check** - This check procedure should be done first. It is a checklist of important items to check before beginning to troubleshoot the printer.

(2) **LaserWriter Functional Check** - This check procedure should be done after the Pre-Power-On Check. It is a *brief* comprehensive check of the LaserWriter. If the problem is in the print engine (everything on the printer except the LaserWriter I/O PCB) this check will refer you to the Print Engine Check.

(3) **Print Engine Check** - This procedure should be done only if referred to by the LaserWriter Functional Check. It takes you through a step by step check of each function on the printer. When the malfunction is observed, the procedure will branch you to one of the troubleshooting tables. These tables are actually independent procedures to help you troubleshoot specific functions of the machine.

Equipment Needed to Troubleshoot the LaserWriter Printer:

1. Multimeter.

2. LaserWriter Spares Kit.

3. All of the equipment listed in the Take-Apart section under General Information.

Skills Needed to Troubleshoot the LaserWriter Printer:

1. You must be able to use the voltmeter and ohmmeter functions of the multimeter.

2. You must be able to use your knowledge of the LaserWriter to recognize and interpret abnormal operation. For more information on the operation of the LaserWriter, see the Theory of Operations materials.

3. You must be able to find connectors and pins on the LaserWriter Wiring Diagram (found in the pocket at the end of this manual) and then locate those items on the printer.

4. You must be able to follow basic electrical safety precautions for working with AC line voltage in power supplies.

To Troubleshoot the Printer, Follow These Steps:

1. Check for proper installation and functioning by following

    (1) the Pre-Power-On Checklist and
    (2) the LaserWriter Functional Check.

    If a problem is observed, the Functional Check will refer you to (3) the Print Engine Check, or directly to one of the Troubleshooting Tables. The Print Engine Check will further define the problem to the specific function that is failing and refer you to the appropriate Troubleshooting Table to isolate the problem to a replaceable part.

2. When the printer is repaired, perform the Service Technician Maintenance procedure found in the Preventive Maintenance section of this manual.

How to Use the Procedures in This Section:

The following example explains how to read the Troubleshooting Tables.

A- THERE IS NO POWER: (Procedure)				
Step	Check	Result	Action	Explanation
1	Is the printer plugged in?	NO	Plug in the printer.	(Explanations for the troubleshooting steps are located on the opposite page.)
2	Is the printer firmly closed?	NO	Close the printer.	
3	Is the required voltage supplied at the AC outlet?	NO	Nothing is wrong with the printer. Take steps to provide an adequate power supply.	

To solve a problem, begin at step one and perform the check explained there.

If the result is *not* as indicated in the "Result" column, go to the next step number. But if the result *is* as indicated in the "Result" column, perform the action indicated in the "Action" column and observe what happens.

If you have a question about the step (why it's being done, how the machine is supposed to behave, etc.), refer to the explanation for that step on the opposite page. If the problem is not eliminated, continue to the next step.

Test Prints:

There are two test prints produced by the LaserWriter:

(1) User Test Print -   If the LaserWriter I/O PCB is installed, this test print is automatically produced when the power is turned on (unless the protocol switch is set to "Special").

(2) Service Test Print -   This test print is produced when pins 1 and 2 of J205 on the DC controller PCB are jumpered. It is sometimes called the internal or print engine test print.

Pin Numbering on the LaserWriter

The pin numbering system used on the LaserWriter's printed circuit boards has one potentially confusing feature: blank pin positions, which occur on several jacks, are not counted in numbering the pins. This system is followed consistently throughout the printer, so the following example, illustrating the general rule, applies to all jacks with blank pin positions.
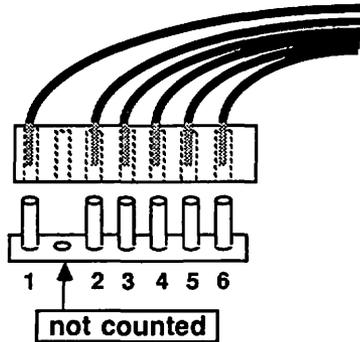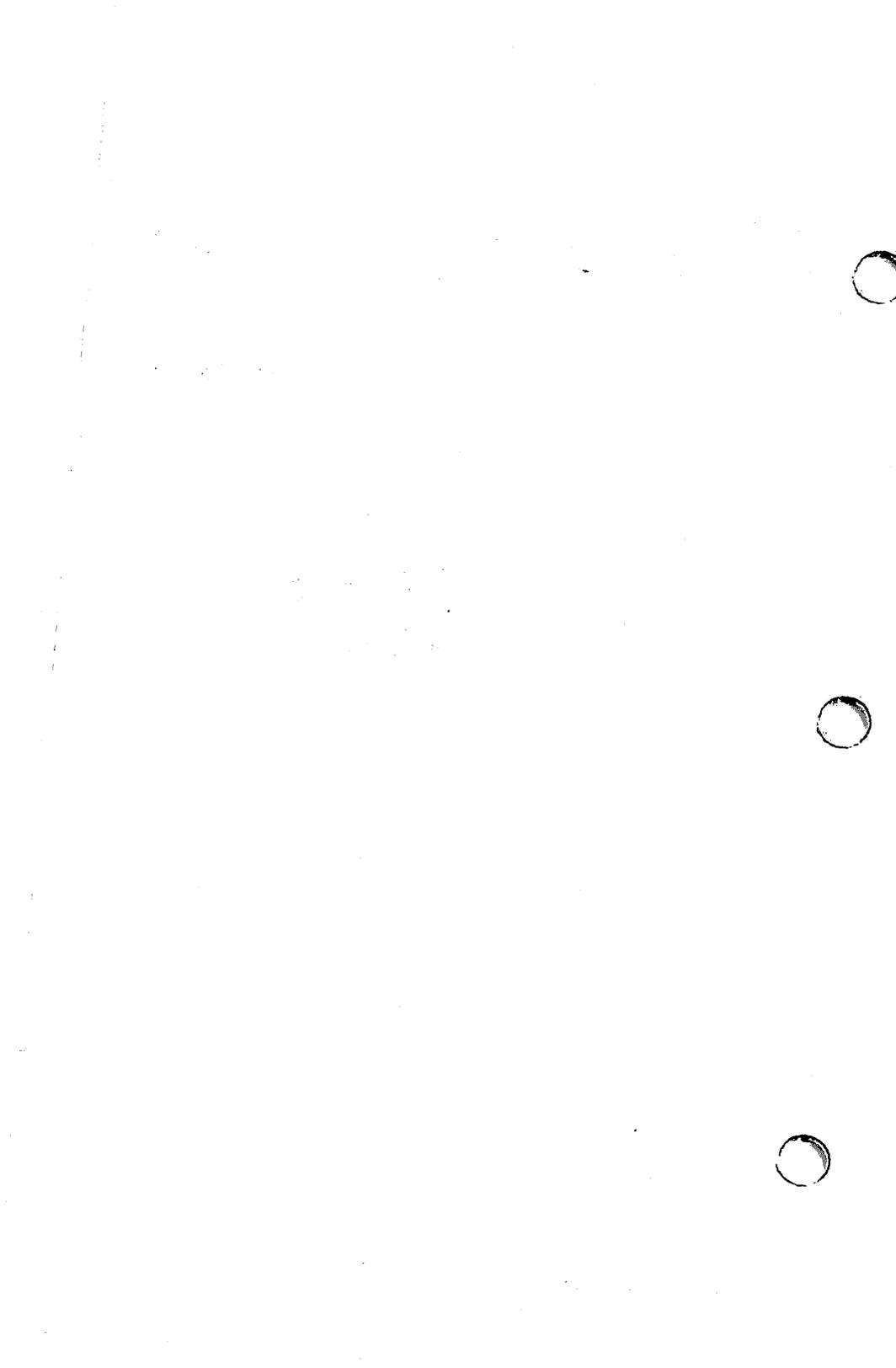
CHECK PROCEDURES
(1) Pre-Power-On Check:

_____ Line Voltage OK (115 VAC plus or minus 10%)

_____ Printer installed on solid level surface

_____ Room temperature between 50 - 90° F (10 - 32.5° C)

_____ Humidity between 20% and 80%

_____ Printer not located near: water tap

boiler

humidifier

open flame

dusty location

_____ Printer not exposed to ammonia gas (produced by Diazo copiers or cleaning solutions)

_____ Printer not exposed to direct sunlight

_____ Printer is installed in a well-ventilated area

_____ Cables and connectors OK

_____ Toner cartridge is installed and OK (replace if indicator is red)

_____ Fuser roller cleaner felt in place and not dirty

_____ Print density adjustment dial set to center

_____ Protocol selector switch (on back of printer) set to *AppleTalk*

_____ Paper cassette properly loaded with paper (not more than 10mm high)

_____ Paper is 16-21 lb. standard photocopier paper

_____ Transfer corona wire OK (check for broken or dirty wire)

_____ Separation belt OK (check for nicks or broken belt)

_____ No visible problems

(2) LaserWriter Functional Check: (Procedure)

Step	Check	Result	Action
1	**PRINTER SET-UP** Is the printer properly set up as listed in the Pre-Power-On Checklist?	NO	Properly set up the printer.
2	**USER TEST PRINT** Turn the printer off and wait one minute. Then turn the printer on and wait three minutes. If the I/O PCB has been upgraded with the LaserWriter Plus ROMs, refer to *Section 3, Troubleshooting*, of the *LaserWriter Plus Technical Procedures* (behind the *LaserWriter Plus* tab) before continuing.		
	a. Is the Apple user test print produced and is print quality OK?	YES	Go to step 4 of this procedure.
	b. Is the Apple user test print produced but the print quality defective?	YES	Try several more prints to see if the problem persists. If it does, replace the toner cartridge, turn off the printer for one minute, then turn it back on to obtain another test print. If the problem is still there, go to table Q.
	c. Is an Apple user test print produced at all?	NO	Turn off the printer. Remove the LaserWriter I/O PCB and jumper pins 1 and 2 of J205 on the DC controller PCB to produce the service print. If the service test print is not produced, go to the Print Engine Check procedure. If the service print *is* produced, go to step 3.
3	**LASERWRITER I/O PCB** Reinstall the LaserWriter I/O PCB. On the LaserWriter I/O PCB, disconnect P3 from J3 (the power input to the LaserWriter I/O PCB) then turn on the printer and check for +5 volts between pins 1 and 3 of P3. Check for +5 volts between pins 2 and 4. Is there +5 volts between both sets of pins?	YES NO	Replace the LaserWriter I/O PCB with a known good one. Go back to step 1 and begin the Functional Check again. Go to table S.
4	**APPLETALK COMMUNICATION** Connect the LaserWriter to a Macintosh via AppleTalk. Load the LaserWriter Test disk into the Macintosh and send its file to the printer. Is the LaserWriter test print successful?	NO	Go to table P.
5	**MANUAL FEED** Select Manual Feed at the Macintosh and resend the test file to the LaserWriter. Is the LaserWriter Manual Feed test print successful?	NO YES	Go to table R.1. The LaserWriter is fully functional. Perform the Service Technician Maintenance Procedure located in the Preventive Maintenance Section.

(2) LaserWriter Functional Check: (Explanation)

NOTE: "Print engine" refers to everything on the printer except the LaserWriter I/O PCB.

Step	Explanation

1   Self explanatory.

2   a. For a user test print to occur, the print engine must be functional, and everything on the LaserWriter I/O PCB except the network interface circuitry must have functioned.

         b. Table Q contains examples of print image defects.

         c. The service test print is a functional test of the print engine. If the service test print is produced and the quality is good, that means that the print engine must be working properly. The print engine and the LaserWriter I/O PCB work together to produce the user test print. If the user test print didn't occur but the service test print did, that indicates a problem with the LaserWriter I/O PCB.

3   In order to arrive at this point in the procedure, you have determined that the printer will not produce the user test print but the print engine is functional. This points to a LaserWriter I/O PCB failure. Step 3 checks to see if the problem lies with the LaserWriter I/O PCB or its power supply. The power supply (Interface Regulator) is located in the base of the printer.

4   The LaserWriter user test print checks all functions on the printer except the network interface functions of the LaserWriter I/O PCB and the manual feed operation of the print engine. Step 4 checks the AppleTalk network communications functions of the LaserWriter I/O PCB.

5   Step 5 checks the only remaining function, that of the manual feed operation of the print engine.

(3) Print Engine Check: (Procedure)

Step	Check	Result	Action

1	**PREPARATION FOR PROCEDURE**
	Turn off the printer and remove:
	  a. LaserWriter cover and panels
	  b. LaserWriter I/O PCB
	  c. any paper jams		

2	**VISUAL INSPECTION** Open the printer and perform visual inspection of the printer.		Clean or repair as necessary.
3	**FAN POWER** Close and turn on the printer. does the fan come on?	NO	Go to table A.

4	**"POWER-ON" DISPLAY LED STATUS**
	Observe the LEDs on the display panel.
	  a. Is the Paper Out LED on?
	  b. Is the Paper Jam LED on?
	  c. Does the Ready/Wait LED
	     begin flashing?
		
		YES
		YES
		NO
			
			Go to table I.
			Go to table G.
			Go to step 7 of table A.

5	**DELIVERY ROLLERS** Turn off the printer. Observe the delivery rollers at the front of the fuser as you turn it back on. Do the rollers rotate as the main motor finds home position?	NO	Go to table B.
6	**FUSER HEATER BULB** Observe the printer cover door latch. Do you see light from the fuser heater bulb (through the latch) going on and off every 5 to 10 seconds?	NO	Go to table D.
7	**PRECONDITIONING EXPOSURE LAMPS** Take out the toner cartridge (reinstall when this step is finished). Turn the printer on and activate the door switch using a screwdriver while you observe the red lens inside the toner cartridge cavity. Do all five of the precondition- ing exposure lamps behind the red lens come on with the proper intensity immediately after you activate the door switch? (Reinstall cartridge.)	NO	Replace the assembly with a known good one and try this step again. If the problem remains, go to table K.
8	**PAPER OUT DETECTION** Remove the paper cassette from the printer. Does the Paper Out LED come on? NOTE: the Ready/Wait LED may continue to flash. (Reinstall the cassette when finished with this step.)	NO	Go to table J.

(3) Print Engine Check: (Explanation)

Step	Explanation
1	Self explanatory.
2	Self explanatory.
3	The fan is connected to line voltage very early in the power distribution system. It is more likely that this is a symptom of a power problem than an actual fan problem.
4	a. Since you checked that the paper cassette is installed and properly loaded with paper during the Pre-Power-On Check, a lighted Paper Out LED at this point is not really an indication that there is no paper.
	b. Since the printer hasn't had a chance to process any paper, a paper jam could not possibly have occurred yet, so a lighted paper jam LED at this point is not really an indication of a paper jam.
	c. If the Ready/Wait LED does not begin flashing, it is a good possibility that there may be a power problem.
5	One of the first things that the DC controller PCB does after power becomes stable is to issue a command to the motor driver circuits in the DC power supply/motor driver PCB to rotate the main motor to its home position.
6	Upon power up, the DC controller PCB immediately begins monitoring the temperature of the fuser. If the fuser is initially cold, the DC controller will send the command to turn it on right away.
7	Self explanatory.
8	Step 8 checks the ability of the paper-out sensor to detect a paper-out condition.

(3) Print Engine Check: (Procedure)

Step	Check	Result	Action
9	**"READY" DISPLAY PANEL STATUS** After the printer has been on for about three minutes, observe the Ready/Wait LED. Does the Ready/Wait LED *stop* flashing and stay on?	NO	Go to table O.
10	**SERVICE TEST PRINT** Check for the following as you momentarily jumper pins 1 and 2 on J205 of the DC controller PCB to initiate a service test print.		
	a. Does the DC controller PCB LED light during the test print?	NO	Replace the DC controller PCB. If the problem remains, go to table L.
	b. Does the laser/scanner unit LED light during the test print?	NO	Go to step 3 of table L.
	c. Does the DC power supply/motor drive LED light during the test print?	NO	Go to table B.
11	**PRINT PROCESS COMPLETION** At the completion of the print process, the paper should be delivered and the Ready/Wait LED should come on steadily. Is the print delivered?	NO	Go to step 14.
12	**FAULTY PAPER JAM DETECT** Does the Paper Jam LED light even though print was delivered?	YES	A true paper jam has not occurred but one has erroneously been detected. Go to table G.
		NO	LED is OK; go to step 13.
13	**PRINT QUALITY CHECK** Is the print quality good?	YES	Print engine is functional; go to step 3 of the LaserWriter Functional Check.
		NO	Try several more prints. If the problem persists, replace the toner cartridge. If the problem still remains, go to table Q.
14	**PRINT IS NOT DELIVERED** Does the paper jam LED light?	YES	Go to table R to solve the paper jam problem.
		NO	A true paper jam has occurred and has not been detected. Go to table H.

(3) Print Engine Check: (Explanation)

Step   Explanation

9   The DC controller PCB monitors the conditions of the print engine to determine when to put it into the ready state. One of these conditions is the fuser temperature. If the fuser is cold when the power is turned on, it can take up to three minutes to reach operating temperature. Once the DC controller PCB detects that fuser temperature and the other conditions are met, it will activate the ready signal which lights the Ready/Wait LED and notifies the LaserWriter I/O PCB that the print engine is ready for a print command.

         If the Ready/Wait LED never stops flashing, it indicates that one of the conditions necessary for the ready state is not occurring. Table O will help you isolate that condition

10   a. This LED is an indication that laser power is on. If a print is performed where there is relatively little print in the print image, this LED can be seen to flicker as laser power goes on and off.

         b. The Scanner LED lights when the scanner servo detects that the scanner motor is rotating at the correct frequency.

         c. The DC power supply/motor drive LED lights when the motor driver servo detects that the main motor is rotating at the correct frequency.

11   Self-explanatory. Steps 12 and 14 check whether the Paper Jam LED is functioning correctly. Step 13 checks print quality.

12   If the paper is delivered then there is no jam and of course the Paper Jam LED should not light. If it does light, table G will help you determine why a paper jam has been detected when one has not occurred.

13   By arriving at this point, you have proven that all of the functions of the print engine are operational. Go back to the LaserWriter Functional Check to check the remaining functions of the LaserWriter.

         Table Q will refer you to the proper Image Defect table.

14   Arriving at this point means that paper was not delivered during the print process. This means that there is a paper jam. Step 14 checks to see that the paper jam was properly detected. If the Paper Jam LED does not come on when it should, it indicates a problem that is probably separate from the paper jam itself, and one which should be taken care of first. Table H will help you find the cause of this problem.

         Table R will help you select the proper Paper Jam table.

TROUBLESHOOTING TABLES

NOTE: Refer to the LaserWriter Wiring Diagram in the back pocket
of this manual when using these procedures.

A - THERE IS NO POWER: (Procedure)

WARNING: There are dangerous voltages present at many of the locations
called out in the following procedure. Be sure to follow all appropriate
electrical safety precautions when performing this procedure.

(If air is blowing through the louver when the power is switched on, start at step 7.)

Step	Check	Result	Action
1	Is the printer plugged in?	NO	Plug in the printer.
2	If the printer firmly closed?	NO	Close the printer.
3	Is the required voltage supplied at the AC outlet?	NO	Nothing is wrong with the printer. Take steps to provide an adequate power supply.
4	Is circuit breaker CB1 open?	YES	Reset the circuit breaker. If the breaker trips as soon as reset, there is a short that will have to be located.
		NO	Make sure the power is off. Unplug the printer. Open the printer and disconnect J105 on the AC driver PCB. Make sure that circuit breaker CB1 is reset and has continuity. If the circuit breaker is defective, replace it.

CAUTION: For the following step be sure to set the multimeter to the correct voltage range or it may
be destroyed.

5	With J105 disconnected, plug the printer in, close it, and turn it on. Is line voltage supplied between TB (terminal block) 101-1 and TB 102-1? Both terminal blocks are located just above NF1 (the noise filter in the power interlock assembly). TB 101 is towards the inner part of the printer and TB 102 is towards the on/off switch.	NO	Check noise filter NF1, main switch SW1 and the power cord and plug. Replace as necessary.

A - THERE IS NO POWER (Explanation)

Step	Explanation

1   Self explanatory.

2   If the printer is not closed, interlocks MS1 and MS2 in the power interlock assembly will block the AC line voltage almost at its entrance into the printer.

3   Try plugging a lamp into the outlet to see if the line current is on. If you suspect that the line voltage may not be at the proper level, check it with a voltmeter.

4   The circuit breaker will trip if it detects too much line current being drawn by the printer. This protects the printer's sensitive electronics. If the circuit breaker trips, it is possible that a part of the printer is shorting the current to ground. The best way to troubleshoot this kind of problem is to disconnect all channels into the printer that the line current can possibly take, and reconnect them one at a time. When you reconnect the channel leading to the module that is shorting the line current, the circuit breaker will trip. The next step is to disconnect all the modules along that channel, and reconnect them one at a time. When the faulty module is connected, the circuit breaker will trip again.

If CB1 keeps tripping after being reset, use the LaserWriter Wiring Diagram to identify the channels the AC line current takes when it leaves CB1. Then follow the procedure described above to locate the short.

5   Step 4 checked for a short circuit. Getting to step 5 indicates that a short was not the problem. Step 5 checks to see if line current is getting at least as far as noise filter NF1. If it isn't, the problem could be with any of the components the line current must flow through before it can get to NF1. Disconnecting J105 prevents a possible problem from beyond NF1 from affecting this check.

A - THERE IS NO POWER (Procedure)

NOTE: When locating pins to check signals, do not count blank pin positions. (See "Pin Numbering on the LaserWriter" on page 4.5 of this section.

Step	Check	Result	Action
6	Switch the power off and unplug the printer. Reconnect J105 on the AC driver PCB. Plug the printer in and turn it on. Is AC voltage supplied between J105-1 and J105-2 when the door switch is activated with a screwdriver?	NO	Replace MS1 and/or MS2 (the door switch interlocks in the power interlock assembly).
7	Is AC voltage supplied between J103-1 and J103-2 when the door switch is activated with a screwdriver?	NO	Replace the AC driver PCB.
8	Are the DC voltages listed below supplied between the J502 pins on the DC Power Supply/Motor Drive PCB? 1) J502-4 and J502-8(GND) 24-35VDC 2) J502-9 and J502-8(GND) 24VDC 3) J502-7 and J502-6(GND) 5VDC 4) J502-5 and J502-6(GND) -5VDC 5) J502-2 and J502-3(GND) 20-30VDC	YES	Go to step 21.
9	Switch the printer off and disconnect P501 (the plug connected to J501 on the DC Power Supply/Motor Drive PCB. Turn on the printer. Are the AC voltages listed below supplied between the pins on P501? (CAUTION: Set the multimeter to the correct voltage range or it will be destroyed.) 1) P501-1 and P501-2 29-37VAC 2) P501-3 and P501-4 10-14VAC 3) P501-4 and P501-5 10-14VAC 4) P501-6 and P501-7 18-24VAC	NO	Transformer PT1 is probably faulty. Remove the printer from its pedestal and replace transformer PT1. If the problem remains, recheck TB 102.
10	Switch the printer off. Disconnect J502 on the DC Power Supply/Motor Drive PCB and reconnect P501. Turn the printer on. Are the DC voltages shown below supplied at J502 on the DC Power Supply/Motor Drive PCB? 1) J502-4 and J502-8(GND) 24-35VDC 2) J502-9 and J502-8(GND) 24VDC 3) J502-7 and J502-6(GND) 5VDC 4) J502-5 and J502-6(GND) -5VDC 5) J502-2 and J502-3(GND) 20-30VDC	NO	Replace the DC Power Supply/Motor Drive PCB.

A - THERE IS NO POWER (Explanation)

Step	Explanation
6	If there is no short and there is line current at TB101 and 102, then interlocks MS1 and MS2, when activated, should allow line current to J105 pins 1 and 2.
7	Line current enters the AC controller PCB (the lower board of the AC driver PCB assembly) at J105 pins 1 and 2 and from there is split into three different channels. One of the channels is through J103 pins 1 and 2 to the DC power supply in the DC power supply/motor drive PCB. If there is line voltage at J105 but not at J103, then there could be a broken trace on the AC controller PCB.
8	Step 7 confirmed that line current was available at J103 pins 1 and 2 leaving the AC controller PCB. From there, the current goes through transformer PT1, where it is stepped down to three AC voltages: 12 volts, 33 volts, and 21 volts. These three AC voltages are sent to the DC power supply, where they are rectified and regulated into the various DC voltages needed by different modules in the printer. These DC voltages are sent via J502 over to the DC controller PCB, which distributes them to their proper destinations. Step 8 ensures that the DC voltages are being produced by the DC power supply/motor drive PCB. **Remember not to count the blank pin positions on J502 or J208.**
9	The line current was good at the AC controller PCB, so if the DC voltages are not being produced by the DC power supply, the problem can be with either the DC power supply/motor drive PCB (the line current shorted through the DC controller PCB or one of the modules connected to it), or the transformer PT1 in the base of the printer. This step checks to see if power is coming from the transformer. If it isn't, the problem is probably with a pinched/broken cable or the transformer.
10	This step first eliminates the DC controller PCB (and its connected modules) as a possibility by disconnecting it from the DC power supply. The step then checks again for the DC voltages. Step 9 proved whether or not the transformer was supplying the AC voltages needed by the DC power supply to produce the DC voltages. If the DC voltages are still not being produced when the DC controller is disconnected, then the DC power supply must not be functioning.

A - THERE IS NO POWER (Procedure)

Step	Check	Result	Action

Caution: Disconnect all power from the printer for steps 11 through 20. These steps are resistance checks. If power is applied to the printer during their performance, it could damage the ohmmeter.

Step	Check	Result	Action
11	TURN THE PRINTER OFF. Make sure that J502 is connected to the DC Supply/Motor Drive PCB. Disconnect all connectors on the DC Controller PCB except J208. Are any of the J502 pins listed below shorted to ground? (Measure resistance on connector pins on the Power Supply/Motor Drive board.) 1) J502-4 (+30v) and J502-8 (GND) 2) J502-9 (+24v) and J502-8 (GND) 3) J502-7 (+5v) and J502-6 (GND) 4) J502-5 (-5v) and J502-6 (GND) 5) J502-2 (+24v) and J502-3 (GND)	YES	Check the wiring between J502 and J208 for a short. If the wiring is OK, replace the DC controller PCB.
12	Reconnect all connectors on the DC Controller PCB. Are any of the J502 pins on the DC Power Supply/ Motor Drive PCB shorted now? 1) J502-4 (+30v) and J502-8 (GND) 2) J502-9 (+24v) and J502-8 (GND) 3) J502-7 (+5v) and J502-6 (GND) 4) J502-5 (-5v) and J502-6 (GND) 5) J502-2 (+24v) and J502-3 (GND)	NO	Go to step 21.
13	Were J502-4 (+30v) J502-8 shorted?	NO	Go to next step.
		YES	Check the wiring between J207 and TB5 on the preconditioning assembly for a short. If the wiring is good, replace the preconditioning exposure assembly.
14	Were J502-9 and J502-8 shorted?	NO	Go to step 17.

A - THERE IS NO POWER (Explanation)

Step	Explanation

11   Step 10 checked that the DC power supply was producing the necessary DC voltages, and so eliminated that module as a possibility. Step 11 checks to see whether any of the DC voltages are being shorted to ground on the DC controller PCB alone (the rest of the modules are disconnected from the DC controller and so are prevented from affecting this check). NOTE: Steps 11 through 20 are all resistance checks and require that no power be applied to the printer during their performance.

12   Step 11 checked that the DC controller PCB was not shorting any DC power line to ground. Step 12 checks to see if any of the modules connected to the DC controller PCB are causing the problem.

13   This step checks to see if the +30 volt channel is being shorted. Since the only module using +30 volts is the preconditioning assembly, then that would be a likely source of such a problem.

14   This step checks to see if the +24 volt (R) channel is being shorted.

A - THERE IS NO POWER (Procedure)

Step	Check	Result	Action
15	Disconnect all +24v connectors (J215, J212, J210, J216, J213, J211, J208, J204 and J206). Reconnect them in the sequence shown below. After each connector is replaced, check for shorts between the pins shown below. Are any shorts found? J215-3 and J215-1 (GND) J215-5 and J215-1 (GND) J210-1 and J210-5 (GND) J210-3 and J210-5 (GND) J210-7 and J210-5 (GND) J216-3 and J216-1 (GND) J211-6 and J211-1 (GND) J206-1 and J206-2 (GND) J204-1 and J208-3 (GND)	YES	Replace the load attached to the shorted connector.
16	Reconnect J212. Are J212-2 and J212-3 shorted?	YES	Disconnect J104 on the fuser safety PCB (upper board of the AC Driver PCB). Check the wiring from pins 2 and 3 of J104 to pins 2 and 3 of J212 on the DC controller PCB for a short. If the wiring is good, replace the AC driver PCB.
17	Are J502-7 and J502-6 shorted?	NO	Go to step 19.
18	Disconnect J201 and J204 on the DC Controller PCB. Are J201-1 and J208-8 shorted, or are J204-4 and J204-5 shorted?	YES	If the circuit between J201-1 and J208-8 is shorted, check the wiring between J201 and TB18 on the display PCB for a short. If OK, replace the display PCB. If the circuit between J204-4 and J204-5 is shorted, check the wiring between J204 and TB3 and TB4 on the laser unit for a short. If the wiring is good, replace the laser unit.
19	Are J502-2 and J502-3 shorted?	NO	Go to step 21.
20	Disconnect J204 on the DC Controller PCB. Are J204-1 and J208-8 or J204-1 and J204-4 of the connector on the cable shorted?	YES	Check the wiring between J204 and TB3 and TB4 for a short. If the wiring is good, replace the laser unit.

A - THERE IS NO POWER (Explanation)

Step   **Explanation**

15   Getting to step 15 indicates a short in the +24 volt (R) power channel. If you look at the LaserWriter wiring diagram you can see that there are many modules that use +24 volts (R).

16   The fuser safety PCB (the upper board of the AC Driver PCB assembly) is another module that uses +24 volts. This step checks to see if it is causing a short.

17   This step checks to see if the +5 volt channel is being shorted.

18   Getting to step 18 indicates a short in the +5 volt power channel.

19   This step checks to see if the +24 volt (UA) channel is being shorted.

20   Getting to step 20 indicates a short in the +24 volt (UA) power channel.

A - THERE IS NO POWER (Procedure)

Step	Check	Result	Action
21	If all of the connectors on the DC Power Supply/Motor Drive PCB and DC Controller PCB are not plugged in, plug them in. Check that the circuit breaker has been reset and the printer is closed. Switch the printer on. Are the DC voltages shown in the table below supplied between the pins on the DC controller PCB? 1) J208-4 and J208-8(GND) 24-35VDC 2) J208-9 and J208-8(GND) 24VDC 3) J208-7 and J208-6(GND) 5VDC 4) J208-5 and J208-6(GND) -5VDC 5) J208-2 and J208-8(GND) 20-30VDC	NO	Check wiring between J502 on DC Power Supply/ Motor Drive PCB and J208 on the DC Controller PCB for poor contact or wiring damage.
		YES	Replace the DC controller PCB.

A - THERE IS NO POWER (Explanation)

Step   **Explanation**

21   The power distribution system appears to be OK, but this step reconnects everything and then applies
     power for one last check under load. If a problem is found, it is probably an electronic failure on the
     DC controller PCB.

B - THE MAIN MOTOR DOES NOT ROTATE (Procedure)

Step	Check	Result	Action
1	Open the printer, remove the toner cartridge, defeat the cover open interlock (MS1 and MS2) with a screwdriver, and turn on the printer. Does the main motor begin to rotate when the printer is turned on?	NO	Check that all gears mesh correctly. Check the connection between J503 on the DC power supply/motor drive PCB and the main motor. Check cabling between the DC power supply/motor drive PCB and the DC controller (J502 - J208). If the cabling is OK, replace the DC controller PCB.
2	Disconnect J503 from the DC power supply/motor drive PCB and check the voltage between pins 5 and 6 while you perform a test print. Is there +24 volts between pins 5 and 6 of J503 while the printer is performing a test print?	NO	Go to step 3.
		YES	Replace the main motor.
3	Remove the DC power supply/motor drive PCB. Check fuse FU504. Is FU504 blown?	NO	Replace the DC power supply/motor drive PCB.
		YES	Replace FU504 and reinstall the DC power supply/motor drive PCB. If the fuse blows again, replace the main motor. If the problem still remains, go to step 14 of table A.

B - THE MAIN MOTOR DOES NOT ROTATE (Explanation)

Step	Explanation

1   Main motor movement is under the control of the DC controller PCB, which passes control signals to the DC power supply/motor drive PCB, which in turn activates the motor.

    The DC power supply/motor drive PCB contains the circuits that control the speed of the main motor. Upon power up, the DC controller PCB sends a control signal to the DC power supply/motor drive circuits to rotate the main motor to its home position.

    The main drum drive gear turns the big brass toner cartridge drive gear, which then turns the idler gear. The idler gear turns the gears that power the fuser assembly.

2   The power-on rotation (described in the explanation of step 1) is done as a result of a command from the DC controller PCB. If it fails, the possibilities are the DC controller PCB, the DC power supply/motor drive PCB, and the main motor. Step 1 eliminates the DC controller PCB as a possibility confirming that the necessary control signals are being sent to the motor drive circuits. The motor driver circuits should respond to the control signal by applying approximately +24 volts to the main motor. This step checks to see if the motor driver circuits are reacting in this way. If they are, then the motor must be defective. If they aren't, then the motor driver circuits are at fault.

3   As the motor turns, it sends tacho-generator pulses back to the motor drive circuits. The motor drive circuits relay these pulses to the DC controller PCB. The DC controller counts the number of pulses to determine if the proper amount of move has occurred. If the DC controller gets no pulses or the wrong number for a move, it will assume that a paper jam has occurred and light the Paper Jam LED in the display panel. If the problem hasn't been found by this step and the fuse on the DC power supply/motor drive module is not blown, then it's possible that the motor drive circuits may not be relaying the tacho-generator pulses back to the DC controller. By replacing the DC power supply/motor driver module you will eliminate this as a possibility.

    If the FU504 fuse in the motor driver circuitry blows consistently, the main motor is drawing too much current. See the explanation for step 2.

C - HIGH VOLTAGE POWER SUPPLY DOES NOT PROVIDE POWER (Procedure)

Step	Check	Result	Action
1	Initiate a service test print while you check for +24 volts between pins 1 (GND) and 6 of J601. Is the voltage there during a test print?	NO	Go to step 14 of table A.
2	Do the voltages between the J211 pins on the DC controller PCB vary as follows when making a test print?	NO	Replace the DC controller PCB. If the problem remains, replace the high voltage power supply.
	a) J211-8 and J211-1(GND) from about +18VDC to about +1VD immediately after making a test print?	YES	Visually inspect J1 (shown as J601 on the LaserWriter Wiring Diagram), J3, J4, and J5 on the high voltage power supply for good contact. Repair any problems. If the high voltage power supply still does not function, replace the high voltage power supply.
	b) J211-2 and J211-1(GND) and between J211-4 and J211-1(GND) from about +20VDC to about 0 VDC a few seconds after making a test print?		
	c) J211-5 and J211-1(GND) from about +17VDC to about 0 VDC a few seconds after making a test print?		

C - HIGH VOLTAGE POWER SUPPLY DOES NOT PROVIDE POWER
(Explanation)

Step   **Explanation**

1   Step 1 checks for the +24 volts required for the high voltage power supply to operate. There are many possible causes of a failure such as this. Table A will help you sort through them.

2   The high voltage power supply develops the voltages for the primary and transfer coronas and the developing cylinder in the toner cartridge.

    a) This step checks J211 pin 8, which conveys the primary corona enable signal.

    b) This step checks J211 pin 2, which conveys the transfer corona enable signal, and also checks J211 pin 4, which conveys one of the density adjust/enable signals. These signals enable the adjustment made at the print density dial to affect the potential on the developing cylinder. This determines how much negative charge is put on the toner, affecting how much toner is attracted to the relatively positive laser scanned image on the drum. The more toner attracted, the darker the image, and vice versa.

    c) This step checks J211 pin 5, which conveys the other density adjust enable signal (see explanation for 1.b).

D - THE FUSER ROLLER HEATER DOES NOT OPERATE (Procedure)

WARNING: For several of the steps in the following procedure, it will be necessary to depress cover interlocks MS1 and MS2 so that the signals being checked for will be produced. When doing this, be careful to avoid electrical shock by not touching any of the components in the power interlock assembly which carry line current.

Step	Check	Result	Action
1	Turn the printer off. Unplug J101 on the AC driver PCB. Measure the resistance between J101-1 and J101-2 of the connector on the cable. Is it between 1-5 ohms? (Reconnect J101 after measurement.)	NO	Check whether the circuit has continuity at both ends of thermoprotector TP1. If it does not, replace the thermoprotector. If it does, replace the fuser roller heater bulb H1 and the 47-ohm resistor assembly at J107 on the fuser heater safety PCB (upper board of the AC Driver PCB). Then go to step 3. (If the printer has been on, you may have to wait 15 minutes, until all the capacitors discharge, before continuing.)
2	Measure the resistance of the 47-ohm resistor assembly at J107 on the fuser safety PCB. Is the resistor open (blown)?	YES	Replace the resistor assembly. If it blows again, replace the AC Driver PCB.
3	Unplug J212 on the DC controller PCB. Measure the thermistor resistance between J212-5 and J212-4 of the connector. Is it in the range of 100-400 k-ohms at room temperature? (Reconnect J212 after measurement.)	NO	Check the wiring between thermistor TH1 in the user assembly and the DC controller PCB. Clean the thermistor if it is dirty. If the problem is still there, replace the thermistor. If the problem still remains, go on to the next step.
4	Does the voltage between J212-1 and J212-3 on the DC controller PCB go from between +22 and 24VDC to between +20 and 22VDC approximately one second after power is turned on and then again every time the heater in the fuser assembly is to be turned on?	NO	Check the wiring between J212 on the DC controller PCB and J104 on the AC driver PCB. If the problem still exists, replace the DC controller PCB.
5	Perform the three checks listed below. Do the voltages vary as listed below about one second after power is turned on and then again every time the heater in the fuser assembly is activated?	NO	Replace triac Q1 (located on the power interlock assy: see **Section 6, Illustrated Parts List,** for location). If the problem still exists, replace the AC driver PCB and reinstall the original triac.

a) *AC CHECK* - between J105-7 and J105-3 should go from line voltage to 0VAC

b) *DC CHECK*- between J104-3 (ground) and J105-5 should go from approximately .03 VDC to .1 VDC

c) *AC CHECK*- between J101-1 and J101-2 should go from 0VAC to line voltage

D - THE FUSER ROLLER HEATER DOES NOT OPERATE (Explanation)

Step	Explanation
1	This step checks the total resistance of the thermoprotector and the element in the heater bulb. If the heating element or anything else in that circuit opens, the resistor fuse attached to J107 on the fuser safety PCB (the upper board of the AC driver PCB assembly) will blow to protect the circuitry on the AC controller PCB (lower board).
2	If the resistance of the thermoprotector and the heater bulb element proves to be OK but the resistor fuse is blown, the resistor may simply have failed. However, if it blows again, odds are that something on the AC driver PCB caused it to blow.
3	If the thermistor is dirty or defective, or if the wiring is faulty, the temperature of the upper fuser roller will not be accurately measured, and the DC controller PCB will not activate the heater at the proper time, or perhaps not at all. At room temperature, the thermistor should have a resistance of 100-400 k-ohms. That resistance varies with the temperature of the roller: the greater the heat, the less the resistance. If the thermistor is coated with toner, the toner might prevent it from accurately measuring the roller temperature.
4	J212 pin 1 conveys the fuser heater bulb enable signal (FSRD). It is sent to the the fuser assembly by the microprocessor on the DC controller PCB when the thermistor voltage from J212 pin 4 gets too low. This happens when the operating temperature in the fuser's upper roller falls too low to properly fuse the toner onto the paper.
5	The triac acts as a switch activated by the DC controller board signal FSRD, which becomes active (low) when the temperature of the heater element falls below threshold. When the triac switch is activated, it passes voltage to the protection circuitry on the fuser heater safety PCB. If the protection circuitry senses that the heating circuit has continuity, it will then pass the line voltage to the heating circuit.

If the triac fails, the voltage will never reach the protection circuitry. |

E - CANNOT FEED PAPER MANUALLY (Procedure)

Step	Check	Result	Action
1	Has a manual feed command been sent to the printer?	NO	Send a manual feed command to the printer from the attached computer.
2	Insert paper into the manual feed entrance far enough to trip pickup sensor PS1. Turn on the printer and allow it to become ready. Does the voltage between J210-4 and J210-5(GND) on the DC controller PCB go from about +24VDC to about 0 VDC approx. 8 seconds after the main motor begins to rotate, and does it remain at 0 volts for about 1 second?	NO	Replace the DC controller PCB.
3	Does the upper manual pickup roller (shown below) descend and feed the paper about 8 seconds after the main motor begins to rotate?	YES	Check the lower roller for wear and rotation. Check that the upper roller presses against the paper firmly. If the lower roller is worn, return the printer to Apple following SRMA procedures.

Upper Manual Pickup Roller

Lower Manual Pickup Roller

Step	Check	Result	Action
4	Does the voltage between J210-6 and J210-5(GND) on the DC controller PCB go from about 0 VDC to +5VDC when paper is inserted into the manual feed entrance?	NO	Check J4 of the pickup sensor PS1 and J210 on the DC controller PCB for poor contact. If no problems are found, replace the registration shutter assembly.
5	Unplug J210 on the DC controller PCB. Is there continuity between J210-4 and J210-3 on the connector attached to the cable?	NO	Check the wiring and connectors for the manual pickup roller solenoid SL2 on the registration shutter assembly. If the problem still exists, replace the registration shutter assembly.

E - CANNOT FEED PAPER MANUALLY (Explanation)

Step   **Explanation**

1   Self explanatory.

2   J210 pin 4 carries the manual pickup solenoid SL2 enable signal generated by the DC controller PCB.
       This step checks to see if the DC controller actually generates the signal.

3   Self explanatory.

4   When the printer is ready to perform the manual feed, the sheet to be printed on should be inserted
       into the manual feed entrance of the printer far enough to trip PS1. The DC controller J210 pin 6
       carries the signal generated by the pickup sensor when the sensor detects the inserted sheet at the
       registration shutter assembly. The DC controller must detect this signal before it will start the
       manual print cycle. If it doesn't detect this signal, it will never perform a manual print.

5   This step checks the continuity of the winding on the manual pickup solenoid. (There are two
       solenoids on the registration shutter assembly. This is the one on your left as you face the open
       printer.)

F - PAPER PICKUP ROLLERS DO NOT ROTATE (Procedure)

Step	Check	Result	Action
1	Are the following wiring connections secure? a) J502 on DC power supply/motor drive PCB b) J208 on the DC controller PCB c) J215 on the DC controller PCB d) J10 and J11 on the lower main body, near the hinges (black & white cables).	NO	Make connections secure.
2	Disconnect J214 from the DC controller. Remove the paper cassette and manually actuate the cassette size microswitches MS5 (upper), MS6 (middle), and MS7 (lower), in that order, while checking the resistance between the cable connector pins listed below. Does the resistance drop from infinity to 0 ohms? 1) J214-1 to J214-2 (MS5) 2) J214-3 to J214-4 (MS6) 3) J214-5 to J214-6 (MS7)	NO YES	Check for wiring or connector problems between the DC controller PCB and the microswitches. If none, replace the appropriate microswitches. Replace the DC controller PCB.
3	Initiate a test print. Does the voltage between J215-4 and J215-1(GND) on the DC controller PCB drop from +24VDC to 0 VDC when a test print is executed from the READY state?	NO YES	Replace the DC controller PCB. If no effect, remove the printer from its pedestal and replace the cassette pickup assembly. The fault is probably in the cassette pickup assembly. Replace the appropriate part of the cassette pickup assembly.

F - PAPER PICKUP ROLLERS DO NOT ROTATE (Explanation)

Step   **Explanation**

1   Self explanatory.

2   The cassette size microswitches tell the DC controller PCB how big the paper is. This can affect several things in the print process, such as how many tacho-generator pulses the DC controller PCB expects to see before the paper is delivered. The longer the paper is, the longer it will take to print and be delivered. If the DC controller PCB gets erroneous cassette size information from the cassette size microswitches, it will be expecting the wrong number of tacho-generator pulses during a print.

3   This step checks to make sure the DC controller is generating the cassette pickup solenoid enable signal. You know that the main motor is operating from the first part of the print engine check. You also know that the pickup rollers are not actuating. If the solenoid enable signal is being generated by the DC controller PCB and the main motor is turning but the pickup rollers are not actuating, that leaves as the source of the problem only electromechanical parts that are not actuating. These parts are located in the base of the printer.

G - JAMS ARE DETECTED WHEN THERE ARE NO JAMS (Procedure)

Step	Check	Result	Action
1	Does the PAPER JAM indicator immediately light on the display unit when the printer is switched on?	YES	Check the wiring between J201 on the DC controller PCB and TB18 on the display unit. Then check J10 and J11 (inside the printer towards the hinges, with black and white cable connected). If the cabling is OK, replace the DC controller PCB.
2	Is a paper fragment or some other obstacle caught in the delivery unit?	YES	Remove the obstruction.
3	Does the voltage between J210-6 and J210-5(GND) on the DC controller PCB go from about 0 VDC to +5VDC when a piece of paper is inserted far enough into the manual feed entrance to trip pickup sensor PS1?	NO	Check J4 of the pickup sensor PS1 and J210 on the DC controller PCB for poor contact. Also check that the paper detection arm functions smoothly. If no problems are found, replace the registration shutter assembly.
4	Open the upper half of the printer and activate the door switch with a screwdriver. Insert paper into delivery sensor PS3 on upper body (below fan) to block its light transfer. Does the voltage between J216-2 and J216-1(GND) on the DC controller PCB vary from about 0 VDC to +5VDC?	NO	Check J5 of the delivery sensor PS3 and J216 on the DC Controller PCB for poor contact. Also check that the paper delivery sensor arm functions smoothly. If there are no problems, replace delivery sensor PS3.

G - JAMS ARE DETECTED WHEN THERE ARE NO JAMS (Explanation)

Step   **Explanation**

1   The DC controller PCB issues commands and monitors sensor inputs to interpret a paper jam condition. When it detects such a condition, the DC controller lights the Paper Jam LED. If jams are detected when there are none, it could be the result of a faulty sensor or DC controller PCB. This step eliminates the DC controller PCB as a possibility.

2   Self explanatory.

3   Pickup sensor PS1 senses when paper has arrived at the registration shutter assembly. After the DC controller PCB actuates the cassette pickup solenoid, it expects to see a response from pickup sensor PS1. If it doesn't see the response within a specified time, it will assume a paper jam and light the Paper Jam LED on the display panel. Of course, a defective sensor will never provide the expected response.

4   Delivery sensor PS3 senses when paper leaves the printer through the fuser assembly. When the DC controller PCB actuates the registration shutter solenoid to lift the registration shutter, it also turns on the motor to motivate the rollers and drums which guide the paper through a print process. As the motor turns it generates pulses. The DC controller PCB expects to see the input from the delivery sensor PS3 within a certain number of these pulses. If it doesn't, the DC controller PCB assumes a paper jam and lights the Paper Jam LED on the display panel. Of course, a defective sensor will never provide the expected response.

H - JAMS ARE NOT DETECTED (Procedure)

Step	Check	Result	Action
1	Does the JAM indicator on the display unit light when the circuit between J201-4 and J208-6(GND) on the DC controller PCB is shorted?	NO	Check J201 on the DC controller PCB and TB18 on the display unit for good contact, Check whether +5VDC is supplied between J201-4 and J208-6(GND) on the DC controller PCB. If +5VDC is there, replace the display unit. If it is not there, go to step 17 of table A.
		YES	Replace the DC controller PCB with a known good one.
2	Insert paper into the manual feed entrance to trip pickup sensor PS1. Does voltage between J210-6 and J210-5 (GND) on the DC controller PCB go from about 0 VDC to +5VDC when paper is inserted (pickup sensor PS1 is tripped)?	NO	Check J4 of the pickup sensor PS1 and J210 on the DC controller PCB for poor contact. Also check that the paper detection arm functions smoothly. If no problems are found, replace the registration shutter assembly.
3	Open the upper half of the printer and activate the door switch with a screw-driver. Block the light transition in delivery sensor PS3 (below fan) with paper. Does the voltage between J216-2 and J216-1 (GND) on the DC controller PCB vary from about 0 VDC to +5VDC?	NO	Check J6 of delivery sensor PS3 and J216 on the DC controller PCB for poor contact. Also check that the paper delivery sensor arm (on the top cover of the fuser assembly) functions smoothly. If there are no problems, replace the paper delivery sensor.

H - JAMS ARE NOT DETECTED (Explanation)

Step   **Explanation**

1   Look at the LaserWriter Wiring Diagram for this explanation. If LEDs 5 and 6 (Paper Jam LEDs)
    in the display unit are functional, they should turn on when the ground on J208 pin 6 is connected
    to one side and the + 5 volts to the other side. If they do not come on, they may not be functional
    or the + 5 volts may not be available.

    The DC controller PCB issues commands and monitors sensor inputs to interpret a paper jam
    condition. When it detects such a condition, the DC controller lights the Paper Jam LED. If jams
    are not being detected, it could be the result of a faulty sensor or DC-controller PCB. Step 1
    eliminates the DC controller PCB as a possibility.

2   Pickup sensor PS1 senses when paper has arrived at the registration shutter assembly. After the DC
    controller PCB actuates the cassette pickup solenoid, it expects a response from pickup sensor PS1.
    If it does not receive the response within a specified time, it should assume a paper jam and light
    the Paper Jam LED on the display panel. A sensor may be defective in such a way that it is always
    providing a signal even though the condition is not there.

3   Delivery sensor PS3 senses when paper leaves the printer through the fuser assembly. When the
    DC controller PCB actuates the registration shutter solenoid to lift the registration shutter, it also
    turns on the motor to motivate the rollers and drums which guide the paper through the print
    process. As the motor turns it generates pulses. These pulses are counted by the DC controller
    PCB, which expects to receive the input from the delivery sensor PS3 within a certain number of
    pulses. If the DC controller does not receive the expected response, it should assume a paper jam
    and light the Paper Jam LED on the display panel. A sensor may be defective in such a way that
    it is always providing a signal even though the condition is not there.

I - THE PAPER OUT INDICATOR LIGHTS WHEN THERE IS STILL PAPER
(Procedure)

Step	Check	Result	Action
1	Insert and remove the paper cassette a few times while you measure the voltage between J215-1 and J215-2 on the DC controller PCB. Does the voltage between J215-2 and J215-1 (GND) on the DC controller vary from about +5VDC to 0 VDC when the paper cassette is inserted?	NO	Check that the paper detection sensor arm moves freely. Check the wiring from J10 in the lower main body, near the rear hinges (black & white cables) to J215 on the DC controller PCB. If the problem is still there, remove the printer from its pedestal and replace the paper out sensor.
		YES	Replace the DC controller PCB.
2	Disconnect J214 from the DC controller. Remove the paper cassette, and then, manually (with a a screwdriver, pencil, or the like) actuate the cassette size microswitches MS5 (upper), MS6 (middle) and MS7 (lower), in that order. While you are doing this, check the resistance between the connector pins on J214 (connector and cable attached) listed below. Does the resistance drop from infinity to 0 ohms? 1) J214-1 to J214-2 (MS5) 2) J214-3 to J214-4 (MS6) 3) J214-5 to J214-6 (MS7)	NO	Check the wiring from J11 on the lower main body of the printer, near the rear hinges (black & white cables), to J21 on the DC controller PCB. If the problem is still there, remove the printer from its pedestal and replace the appropriate cassette size microswitch.

I - THE PAPER OUT INDICATOR LIGHTS WHEN THERE IS STILL PAPER (Explanation)

Step   **Explanation**

1   When the cassette is out of paper, the black paper detection arm should be hanging loosely. At such times, a part of the arm is blocking light conduction in the paper out sensor. In this condition, the phototransistor in the sensor will not receive light so the transistor conducts +5 volts to J215 pin 2. When you insert paper, the arm lifts and the phototransistor receives light, putting 0 volts to J215 pin 2.

     If the signal at J215 pin 2 is correct but the Paper Out LED lights when there is still paper, the DC controller PCB is not processing the signal correctly.

2   MS5, MS6, and MS7 are the cassette size microswitches. They tell the DC controller PCB what type of paper cassette is inserted (and therefore, what size paper is being used).

J- THE PAPER OUT INDICATOR DOES NOT LIGHT WHEN THERE IS
NO PAPER (Procedure)

Step	Check	Result	Action
1	Does the PAPER OUT indicator on the display unit light up when the circuit between J201-3 and J208-6 (GND) on the DC controller PCB is shorted?	NO	Check J201 on the DC controller PCB and TB18 on the display unit for good contact. If the contact is good, check whether +5VDC is supplied between J201-1 and J208-6(GND) on the DC controller PCB. If +5VDC is there, replace the display unit. If it is not there, go to step 17 of table A.
2	Insert and remove the paper cassette a few times while you measure the voltage between J215-1 and J215-2 on the DC controller PCB. Does the voltage between J215-2 and J215-1 (GND) on the DC controller vary from about +5VDC to 0VDC when the paper detection arm lifts?	NO	Check that the paper detection sensor arm moves freely. Check the wiring from J10 on the lower main body of the printer,by the hinges (black & white cables), to J215 on the DC controller PCB. If the problem is still there, replace the paper-out sensor in the pedestal.
		YES	Replace the DC controller PCB.
3	Disconnect J214 from the DC controller. Remove the paper cassette, manually (with a screw-driver, pencil, or the like) actuate the cassette size microswitches MS5 (upper), MS6 (middle) and MS7 (lower), in that order. While you are doing this, check the resistance between the connector pins on J214 (connector and cable attached) listed below. Does the resistance drop from infinity to 0 ohms? 1) J214-1 to J214-2 (MS5) 2) J214-3 to J214-4 (MS6) 3) J214-5 to J214-6 (MS7)	NO	Check the wiring from J11 on the lower main body of the printer, by the hinges (black & white cables), to J215 on the DC controller PCB. If the problem is still there, remove the printer from its pedestal and replace the appropriate cassette size microswitch.

J - THE PAPER OUT LED DOES NOT LIGHT WHEN THERE IS NO PAPER (Explanation)

Step	Explanation
1	Look at the LaserWriter Wiring Diagram for this explanation. If LEDs 3 and 4 (Paper Out LEDs) in the display unit are functional, they should turn on when the ground on J208 pin 6 is connected to one side of them and the +5 volts to the other side. If they do not come on, it may be they are not functional or the + 5 volts is not available.
2	When the cassette is out of paper, the black paper detection arm should be hanging loosely. At such times, part of the arm is blocking light conduction in the paper out sensor. In this condition, the phototransistor in the sensor does not receive light, so the transistor conducts +5 volts to J215 pin 2. When you insert paper, the arm lifts and the phototransistor receives light, putting 0 volts to J215 pin 2.
	If the signal at J215 pin 2 is correct but the Paper Out LED lights when there is still paper, the DC controller PCB is not processing the signal correctly.
3	MS5, MS6, and MS7 are the cassette size microswitches. They tell the DC controller PCB what type of paper cassette is installed (and therefore what size paper is being used).

K - THE PRECONDITIONING EXPOSURE LAMPS DO NOT LIGHT
   (Procedure)

Step	Check	Result	Action
1	Execute a test print from the ready state. Does the voltage between J207-1 (+24 to +30VDC) and J207-2 on the DC controller vary from 0 V to between +24VDC and +35VDC? (Attach common lead to J207-2.)	YES	Check J207 on the DC controller PCB for good contact.
2	Is the voltage between J207-1 and J208-6 (GND) on the DC controller PCB within the range of +24-30 VDC and is the voltage between J208-7 and J208-8(GND) on the DC controller PCB at +5 VDC?	YES	Replace the DC controller PCB.
		NO	Check J502 on the DC power supply/ motor drive PCB and J208 on the DC controller PCB for good contact. If OK, replace the DC power supply/motor drive PCB. If the problem is not solved, replace the DC controller PCB.

K - THE PRECONDITIONING EXPOSURE LAMPS DO NOT LIGHT (Explanation)

Step   **Explanation**

1   Self explanatory.

2   The DC controller PCB should turn on the preconditioning exposure lamps whenever the main motor is turned on. J207 pin 2 is the signal used to activate the lamps. If the voltage on J207 pin 2 is OK but the lamps do not light when they should, it may be the DC controller is not providing the necessary enable signal on J207 pin 2. The +30 volts needed by the preconditioning exposure lamp and the +5 volts needed by the logic on the DC controller PCB are generated by the DC power supply/motor drive PCB.

L - LASER OR SCANNER MALFUNCTION (Procedure)

Step	Check	Result	Action
1	Are the following connections secure? a) DC controller J204 to TB3&4 of the laser/scanner unit. b) DC controller J206 to J401 of the laser/scanner unit.	NO	Make the connections secure.
2	Measure the laser power output using the first part of the laser power adjustment in the Adjustments section of this manual. Is the laser power set properly?	NO	Adjust laser power to the proper level. If this can't be done, replace the laser unit. If this does not repair the problem, replace the DC controller PCB.
3	Is +24VDC supplied between J401-1 and J401-2 (GND) on the scanner driver PCB?	NO	Check J502 on the DC power supply and J208 on the DC controller board for secure contact. If contact is good, replace the DC power supply/ motor drive PCB.
4	Initiate a test print. Does the voltage between J206-4 and J206-2 (GND) vary from about +7VDC to about 0 VDC?	NO	Replace the DC controller PCB.
		YES	Replace the scanner unit. If this does not correct the problem, go to step 5.
5	Initiate a test print. Does the voltage between J401-3 and J401-2 (GND) on the scanner driver PCB vary from about +3VDC to about 0 VDC?	YES	Replace the DC controller PCB. If the problem is not solved, put the old PCB back in the printer and replace the scanner unit.
		NO	Replace the scanner unit.

L - LASER OR SCANNER MALFUNCTION (Explanation)

Step   **Explanation**

1   Self explanatory.

2   Self explanatory.

3   The + 24 volts is used to power the scanner unit. It is generated by the DC power supply/motor drive unit.

4   J206 pin 2 carries the SCNON (scanner on) command from the DC controller PCB to the scanner unit. It should be generated by the DC controller PCB whenever the main motor is turned on.

5   The SCNON (scanner on) command from the DC controller PCB should cause the scanner servo loop to activate. After the scanner motor has achieved the correct velocity, the scanner unit generates the SCNRDY (scanner ready) command from J401 pin 3 to J206 pin 3 of the DC controller PCB.

M - LASER OR FUSER HEATER MALFUNCTION (Procedure)

Step	Check	Result	Action
1	Switch the printer on and wait one minute. Open the printer and lift the cover of the fuser assembly. Has the temperature of the upper roller increased?	NO	Go to "THE FUSER ROLLER HEATER DOES NOT OPERATE."
2	Is the voltage between J204-1 and J204-4 (GND) in the range of +20 to 30VDC and is the voltage between J204-5 and J204-4 (GND) in the laser unit +5VDC?	NO	Check that the voltage between J208-2 and J208-3 (GND) is +20-30VDC, and +5VDC between J208-7 and J208-6 (GND). If not, check the wiring between J502 on the DC power supply/motor drive PCB and J208 for poor contact. If contact is good, replace the DC power supply/ motor drive PCB.
3	Switch the printer off. Disconnect J204 on the DC controller PCB. Measure the resistance between J204-1 and J204-2 of the connector on the cable. Is it 40-55 ohms?	NO	Replace the laser unit.
4	Measure the resistance between J204-3 and J204-4 of the connector on the cable. Is it 5-15 k-ohms when the laser is at room temperature?	YES	Replace the DC controller PCB.
		NO	Replace the laser unit.

N - THE READY/WAIT INDICATOR DOES NOT STOP FLASHING (Procedure)

Step	Check	Result	Action
1	Does the rear (I/O) connector plate's test light blink continuously or stay on?	YES	Replace the LaserWriter I/O board.
		NO	Replace the DC controller PCB.

M - LASER OR SCANNER HEATER MALFUNCTION (Explanation)

Step   **Explanation**

1   One of the first things the printer should do upon power up is heat up the fuser assembly. You can usually check to make sure that the fuser heater bulb is going on and off by watching through the cover latch, but if there is a high level of ambient light in the room, it may be necessary to open the door and check the temperature of the fuser assembly.

2   This step checks to see that the two voltages (+24 volts and +5 volts) needed by the laser unit are being produced by the DC power supply/motor drive PCB.

3   The DC controller PCB is constantly monitoring the temperature in the laser chip. It accomplishes this with the use of a thermistor on the laser chip. The voltage from the thermistor tells the DC controller PCB the temperature of the laser chip. To enable the laser chip to heat up, the DC controller activates J204 pin 2, allowing current to flow through a heating element on the chip. Step 3 checks the resistance of the laser heater element in the laser unit.

4   This step checks the resistance of the thermistor in the laser unit. See the explanation for step 3.

N - THE READY/WAIT INDICATOR DOES NOT STOP FLASHING (Explanation)

Step   **Explanation**

1   The LaserWriter I/O PCB communicates with the print engine through the DC controller PCB. If there is a problem on the LaserWriter I/O PCB, it is possible that the I/O PCB and the DC controller PCB could be caught in a loop. In this case, the printer will never come ready, so the Ready/Wait indicator on the display panel will never stop flashing. If the green Test LED on the mounting connector comes on steadily or blinks continually, that indicates that the problem relates to the I/O Board.

O - THE READY/WAIT INDICATOR DOES NOT LIGHT (Procedure)

Step	Check	Result	Action
1	Is a toner cartridge installed in the printer?	NO	Install a toner cartridge.
2	Turn the printer off and then on again. Is the problem solved?	YES	Finished.
3	Are the wiring connections OK between J502 on DC power supply/motor drive PCB and J208?	NO	Make connections secure.
4	Is +5VDC supplied between J201-1 and J208-6 (GND) on the DC controller PCB?	NO	Go to "THERE IS NO POWER."
5	Does the READY/WAIT indicator light steadily when the circuit between J201-2 and J208-6 (GND) on the DC controller PCB is shorted?	YES	Replace the DC controller PCB.
		NO	Check J201 on the DC controller PCB and TB18 on the display PCB for good contact. If contact is good, check whether +5VDC is supplied between TB18 and J208-6 (GND) on the DC controller PCB. If so, replace the display PCB. If not, go to "THERE IS NO POWER."
6	Go to table M (Laser or Fuser Heater Malfunction). If that doesn't help, go to table B (The Main Motor Does Not Rotate).		

O - THE READY/WAIT INDICATOR DOES NOT LIGHT (Explanation)

Step	Explanation
1	If the toner cartridge is not installed, the DC controller PCB will never activate the ready condition and light the Ready/Wait LED.
2	Occasionally, a momentary flicker will cause a beam detect signal malfunction. Turning the power off and then on again re-initializes the circuit and solves the problem. If this problem occurs to frequently, go "LASER OR SCANNER MALFUNCTION".
3	Self explanatory.
4	Step 4 checks to make sure that there is power for the logic on the DC controller PCB.
5	Step 5 checks to see if the Ready/Wait LED will work properly if it is given a correct enable signal. The DC controller PCB requires eight conditions to exist in the printer before it will put the printer into the ready condition and light the green Ready/Wait LED. These conditions are:

      (1) Proper laser chip temperature
      (2) Proper fuser temperature
      (3) Toner cartridge installed
      (4) Paper loaded
      (5) No jams
      (6) Pickup sensor PS1 does not sense paper
      (7) Printer not in Pause mode (can only be caused by an external device)
      (8) Main motor producing tachogenerator pulses

If the printer is not entering the Ready state, it can be caused by a real condition as listed above, or by a faulty detection of one of the conditions above. The faulty detection of one of these conditions may be caused by a bad sensor or by malfunctioning logic on the DC controller PCB. Step 5 eliminates the DC controller PCB as a possibility. If the printer still will not enter the Ready condition, the problem is probably in a sensor.

| 6 | Table M checks the possibility that the temperature of the laser or fuser may be causing the printer not to go into the Ready condition. |

Table B checks the possibility that the main motor tachogenerator pulses (generated whenever the main motor rotates) are not getting to the DC controller PCB.

P - PRINTING DOES NOT START WHEN A FILE IS SENT TO THE PRINTER (Procedure)

Step	Check	Result	Action
1	Is the protocol selector switch on back of the printer set correctly?	NO	Set the switch to correct position.
2	Is appropriate network software and printer software installed on the application disk?	NO	Install the correct software.
3	Is the Macintosh defective? (Run MacTest.).	YES	Repair the defective Macintosh.
4	Is there a network problem? (Run test disk supplied with laser printer).	YES	Refer to AppleTalk troubleshooting material.
5	Does the green test light on the rear (I/O) plate blink continuously or stay on when printer power is turned on?	YES	Turn the printer off for one minute then on. Then if the problem remains, replace the LaserWriter I/O PCB.

P- PRINTING DOES NOT START WHEN A FILE IS SENT TO THE PRINTER (Explanation)

Arriving at this troubleshooting table means that you have determined that the print engine is functional and the LaserWriter I/O PCB's processing and communications functions are capable of producing the user test print. The failure must have occurred when a print was attempted by a node on the network.

Step   **Explanation**

1   If the protocol selector switch is not set to AppleTalk, the printer won't be able to communicate with the other nodes on the AppleTalk Personal Network.

2   Self explanatory.

3   Self explanatory.

4   Self explanatory.

5   The nodes on the AppleTalk network communicate with the print engine through the LaserWriter I/O PCB. It is possible for the processor on the I/O PCB to be caught in a software loop. If the green test LED on the mounting connector plate comes on steadily or blinks continually, that indicates that the problem relates to the I/O board.

TABLE Q: IMAGE DEFECTS

Compare your printer's images to the ones shown on these two pages.
Determine which image it most nearly resembles.

Light Image

All printed areas are light
Go to Table Q1

Dark Image

All printed areas and possibly
the background area are dark
Go to Table Q2

Blank Print

Look closely to make
sure that this is not an
exceptionally light image
Go to Table Q3.

Black Image

A black print may have a
white bar on the right.
Go to Table Q4

Stained Separation Strip

Go to Table Q5

Scrambled Image
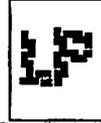
The print image
looks as if it has been
cut and rearranged.
Go to Table Q6

**Stains On
Back of Paper**
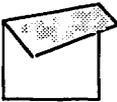
Go to Table Q7

Dark Vertical Lines

Go to Table Q8

**Sharp Horizontal
Black Lines**

Go to Table Q9

**Vertical Fogged
Stripes**

Go to Table Q10

**Horizontal
Fogged Stripes**

Go to Table Q11

**White Horizontal Lines/
Other Shapes
On A Black Image**

Go to Table Q12

Thin Vertical White Lines/Stripes

Go to Table Q13

Faulty Registration

Go to Table Q14

Poor Fusing

Go to Table Q15

Distortion

Go to Table Q16

Waviness

Go to Table Q17

Uneven Print Density

Go to Table Q18

Gray Cloud/Big Blur Totally Unrecognizable

Go to Table Q19

Smearing 80-90 mm from Left Edge of Page

Go to Table Q20

Q.1 - LIGHT IMAGE - WHOLE PRINT (Procedure)

Step	Check	Result	Action
1	Is the print density adjustment dial set with its dot at the top?	NO	Set the dial so that its dot is at the top.
2	Is the toner cartridge indicator red?	YES	Replace the toner cartridge.
3	Do prints improve when new paper is used?	YES	Replace the paper with approved paper (16-21 lb. standard photocopier paper).
4	Is the transfer corona wire broken?	YES	Replace the transfer corona wire.
5	Is connector J211 on the DC controller board securely connected?	YES	Replace the DC controller board.
6	Does the voltage between J209-1 and J209-2 (GND) on the DC controller vary from +5VDC to 0V when microswitch MS3 (the middle one) is pressed? Does the voltage between J209-3 and J209-4 (GND) on the DC Controller vary from +5VDC to 0V when microswitch MS4 (the lower one) is pressed? Do microswitches actuate normally when a toner cartridge is inserted?	NO	Replace the faulty microswitch. Reposition the microswitch holder if the microswitches do not actuate normally when a toner cartridge is inserted.
7	Is the print still light?	YES	Replace the high voltage power supply.
8	Measure the laser power output, using the first part of the Laser Power adjustment procedure, to determine if adjustment is necessary. Was the laser out of adjustment and *not able* to be adjusted?	YES	Replace the following modules. Retry the adjustment after each replacement to determine if the next replacement is necessary. • DC controller PCB • laser unit
		NO	Replace the varistor PCB.

Q.1 - LIGHT IMAGE - WHOLE PRINT (Explanation)

Step   Explanation

1   The print density adjustment dial is connected to a variable resistor on the varistor PCB. This
     adjustment varies the voltage potential on the developing cylinder, thereby adjusting how much of
     the toner from the toner bin will be attracted to the surface of the photosensitive drum. The more
     toner attracted, the darker the print image.

2   If the cartridge indicator is red the cartridge is empty.

3   Self-explanatory.

4   The transfer corona puts the charge on the paper which attracts the toner from the drum onto the
     paper. Refer to the LaserWriter Circuit Diagram for the following explanation. The transfer corona
     is supplied with power at its power terminal (visible when you open the printer). This power comes
     from the high voltage power supply. The high voltage power supply gets its power from the DC
     controller PCB in the form of +24 volts DC. The DC controller gets the +24 volts from the DC
     power supply. The DC power supply gets its power from transformer PT1 in the base of the
     printer. Transformer PT1 is fed power from the power interlock assembly (through the circuit
     breaker CB1, the ON/OFF switch, the cover open interlocks MS1 and 2, etc.).

5   This connector is used to communicate control signals and the +24 volt power source from the
     controller PCB to the high voltage power supply to activate the coronas and the developing
     cylinders. This should happen when the DC controller PCB activates the main motor. See the
     explanation for step 4.

6   Microswitches MS3 and MS4 are used to indicate the sensitivity of the photosensitive drum to the
     DC controller PCB. The DC controller uses these inputs to adjust the laser intensity.

7   The high voltage power supply provides the voltages for the primary and transfer coronas and the
     developing cylinder. See the explanation for step 4.

8   If the laser is weak, it might not fully neutralize the areas on the surface of the photosensitive drum
     which correspond to the print.

     If the varistor PCB failed in such a way as to cause less of a charge on the developing cylinder, then
     less toner would be attracted to the drum and the print image would be light. See the explanation
     for step 1.

Q.2 - DARK IMAGE - WHOLE PRINT (Procedure)

Step	Check	Result	Action
1	Is the print density adjustment dial set with its dot at the top?	NO	Set the dial so that its dot is at the top.
2	With a toner cartridge in place, is there continuity between J21-1 on the varistor PCB and the metal frame of the upper main body?	NO	Check whether the grounding spring is in place in the middle of the big brass drum drive gear (on the upper body).
3	Does the voltage between J209-1 and J209-2 (GND) on the DC controller vary from +5VDC to 0V when microswitch MS3 (the middle one) is pressed? Does the voltage between J209-3 and J209-4 (GND) on the DC controller vary from +5VDC to 0V when microswitch MS4 (the lower one) is pressed? Do microswitches actuate normally when a toner cartridge is inserted?	NO	Replace the faulty microswitch. Reposition the microswitch holder if the microswitches do not actuate normally when a toner cartridge is inserted.
4	Measure the laser power output, using the first part of the Laser Power adjustment procedure, to determine if adjustment is necessary. Adjust if necessary. Was the laser out of adjustment and *not able* to be adjusted?	YES	Replace the following modules. Retry a print after each replacement to determine if the next replacement is necessary. * DC controller PCB * laser unit
		NO	Replace the varistor PCB.

Q.2 - DARK IMAGE - WHOLE PRINT (Explanation)

Step   Explanation

1   The print density adjustment dial is connected to a variable resistor on the varistor PCB. This
     adjustment varies the voltage potential on the developing cylinder and so adjusts how much of the
     toner from the toner bin will be attracted to the surface of the photosensitive drum. The more toner
     attracted, the darker the print image will be.

2   The spring provides a ground for the primary corona and the photosensitive drum in the toner
     cartridge.

3   Microswitches MS3 and MS4 are used to indicate the sensitivity of the photosensitive drum to the
     DC controller PCB. The DC controller uses these inputs to adjust the laser intensity.

4   If the varistor PCB failed in such a way as to cause more of a charge on the developing cylinder,
     then more toner would be attracted to the drum and the print image would be dark. See the
     explanation for step 1.

Q.3 - BLANK PRINT (Procedure)

Step	Check	Result	Action
1	Is the toner cartridge indicator red?	YES	Replace the toner cartridge.
2	Has the sealing tape been removed?	NO	Remove it.
3	Do the toner cartridge protective shield and the light-blocking shutters open when a toner cartridge is inserted? Does the laser-beam-blocking shutter open?	NO	Locate the cause of the trouble and repair. If the cause is in the toner cartridge, replace the cartridge.
4	Does the green test light on the rear (I/O) connector plate blink continu-ously or stay on when the printer power is turned on?	YES	Replace the LaserWriter I/O board.
5	Is connector J211 on the DC controller board securely connected?	YES	Replace the DC controller board.
6	Measure the laser power output, using the first part of the Laser Power adjustment procedure, to determine if adjustment is necessary. Was the laser power output greater than zero?	NO	Replace the following modules. Perform a laser adjustment after each replacement to determine if the next replacement is necessary. * DC controller PCB * laser unit
7	If the laser was out of adjustment: was it possible to adjust it?	NO	Replace the following modules. Generate a test print after each replacement to determine if the next replacement is necessary. * DC controller PCB * laser unit
8	Is the print still blank?	YES	Replace the high voltage power supply; if this has no effect, replace the varistor PCB.

Q.3 - BLANK PRINT (Explanation)

Step   **Explanation**

1   If the indicator is red, the cartridge is out of toner.

2   The toner will not be released in the toner cartridge until the sealing tape has been removed.

3   The shield and shutters allow the laser beam access to the photosensitive drum in the toner cartridge.

4   The green test LED should light briefly when the LaserWriter is first turned on. After a moment, the LED should go out and stay out.

5   J211 on the DC controller PCB provides control signals and power to the high voltage power supply, which in turn activates and provides power to the coronas and the developing cylinder. The DC controller PCB should activate these signals at the same time it activates the main motor to rotate.

6   Self explanatory.

7   If the laser power cannot be adjusted, the laser unit may be faulty, or the DC controller PCB may not be sending the proper signals to the laser unit.

8   See the explanation for step 4.

Q.4 - BLACK IMAGE (Procedure)

Step	Check	Result	Action
1	Is the primary corona wire inside the toner cartridge broken?	YES	Replace the toner cartridge.
2	Is connector J211 on the DC controller board securely connected?	YES	Replace the DC controller board.
3	Is the print still black?	YES	Replace the high voltage power supply.
4	Does the green test light on the rear (I/O) connector plate blink continuously or stay on when the printer power is turned on?	YES	Replace the LaserWriter I/O board.
		NO	Replace the laser unit.

Q.5 - STAINED SEPARATION STRIP (Procedure)

Step	Check	Result	Action
1	Is the separation belt, separation roller, or pinch roller (near the separation belt) dirty?	YES	Clean any that are dirty.
		NO	Replace the toner cartridge.

Q.6 - SCRAMBLED USER TEST PRINT IMAGE - "GARBAGE" (Procedure)

Step	Check	Result	Action
1	Turn printer off and then on again. Does green test light on rear (I/O) connector plate blink continuously or stay on and/or is self-test printout scrambled?	YES	Replace LaserWriter I/O board.

Q.4 - BLACK IMAGE (Explanation)

Step   **Explanation**

1   The primary corona lays down the base negative charge on the surface of the photosensitive drum. The negatively charged toner particles are attracted to the areas of the drum that have been neutralized by the laser because those areas are more positive. If the primary corona were to fail to lay down the base charge, the entire surface of the drum would be more positive and the toner would be attracted to the entire surface of the drum, resulting in a black print.

2   J211 on the DC controller PCB provides control signals and power to the high voltage power supply, which in turn activates and provides power to the coronas. The DC controller PCB should activate these signals at the same time it activates the main motor to rotate.

3   See explanation for Step 2.

4   The green test LED should light briefly when the LaserWriter is first turned on. After a moment, the LED should go out and stay out.

Q.5 - STAINED SEPARATION STRIP (Explanation)

Step   **Explanation**

1   The separation belt peels the left side of the paper away from the drum in the toner cartridge. If the separation belt, separation roller, or pinch roller is dirty, the area of the paper contacted by the dirty component would be stained. The stain would probably appear as an irregular vertical line.

      If none of these components is dirty, the problem is probably in the toner cartridge.

Q.6 - SCRAMBLED USER TEST PRINT IMAGE - "GARBAGE" (Explanation)

Step   **Explanation**

1   If the LaserWriter I/O PCB is operating correctly, the green test LED should light briefly when the LaserWriter is first turned on. After a moment, the LED should go out and stay out.

Q.7 - STAINS ON BACK OF PAPER (Procedure)

Step	Check	Result	Action
1	Is the fuser roller cleaner felt dirty?	YES	Replace the fuser roller cleaner felt.
2	Check for the following:		
	a. Is there any toner on the underside of the toner cartridge?	YES	Clean with a damp cloth, then with a dry cloth.
	b. Is there toner on the transfer guides or are the guides dirty?	YES	Clean with a damp cloth, then with a dry cloth.
	c. Is there any toner on the transfer corona assembly feeder guides?	YES	Clean with a damp cloth, then with a dry cloth.
	d. Is there any toner on the separation belt, separation roller, or pinch roller?	YES	Clean with a damp cloth, then with a dry cloth.
	e. Is the manual paper feed guide dirty or not grounded?	YES	Clean with a damp cloth, then with a dry cloth. Ground it if it is not correctly grounded.
3	Does the leading-edge blank area on printed pages measure about 5mm?	NO	Replace the DC controller PCB.
4	Are the transfer guides correctly grounded via 15MΩ resistance when the printer upper unit is closed?	NO	Ground them correctly.
5	Is the fuser assembly correctly grounded?	NO	Ground it correctly.

Q.8 - DARK VERTICAL LINES - PAPER FEED DIRECTION (Procedure)

Step	Check	Result	Action
1	Is the fuser roller cleaner felt dirty?	YES	Replace the fuser roller cleaner felt.
2	Turn the printer off in the middle of printing and open the upper half of the printer. Open the protective shield on the toner cartridge. Can you see a vertical line on the drum? (Make this check as quickly as possible and in dim light to prevent light from damaging the drum.)	YES	Clean the surface of the photosensitive drum as described in the Service Technician Maintenance Procedure of the Preventive Maintenance section in this manual. Then try about fifteen prints. If the problem persists, replace the toner cartridge.

Q.7 - STAINS ON BACK OF PAPER (Explanation)

Step   **Explanation**

1   If the fuser roller cleaner felt becomes exceptionally dirty, it will no longer clean the upper fuser
         pressure roller, which may then transfer its contaminants to the lower pressure roller. This may
         then cause stains on the back of any paper passed through the fuser.

2   Self explanatory.

3   The DC controller PCB determines when in the print sequence the laser begins scanning the print
         image onto the drum. If the controller PCB is out of sync with the paper's position relative to the
         drum, the laser scanning might begin too late, causing the toner image on the drum to be positioned
         lower on the paper. If the image is positioned too low, the lower part of the toner image on the
         drum will not be transferred to the paper, but will instead have to be scraped off by the sweeper strip
         and cleaner blade. The excess toner could then fall down onto the separation area and possibly adhere
         to the back of the paper on any copies made thereafter.

4   If the transfer guide is not properly grounded, it may develop a positive static charge which could
         attract toner.

5   See explanation for step 4.

Q.8 - DARK VERTICAL LINES - PAPER FEED DIRECTION (Explanation)

Step   **Explanation**

1   If the fuser roller cleaner felt becomes exceptionally dirty, it will no longer clean the upper fuser
         pressure roller, which may then transfer its contaminants to the lower pressure roller. Either roller
         may then transfer streaks or lines to the paper.

2   The photosensitive drum in the toner cartridge will rotate several times during the print of one piece
         of paper. For the drum to be causing a line the length of paper, the dirt or defect must stretch around
         the entire circumference of the drum. If the dirt or defect does not completely circle the drum, the
         resulting line will not be continuous for the length of the paper.

Q.9 - SHARP HORIZONTAL BLACK LINES - CROSS FEED DIRECTION (Procedure)

Step	Check	Result	Action
1	Measure the laser power output, using the first part of the Laser Power adjustment procedure, to determine if adjustment is necessary. Was the laser out of adjustment and *not able* to be adjusted?	YES	Replace the following modules. Check the laser power output after each replacement to determine if the next replacement is necessary. * DC controller PCB * laser unit
2	Initiate a test print by jumpering pins 1 and 2 on J205 on the DC controller board. Does the scanner motor start and LED401 on the scanner driver PCB light continuously during the print process?	YES	Proceed to step 6.
3	Are J401 on the scanner driver PCB and J206 on the DC controller board securely connected?	NO	Connect J401 or J206.
4	Is +24VDC supplied between J401-1 and J401-2(GND) on the scanner driver PCB?	NO	Check J502 on the DC power supply and J208 on the DC controller board for secure contact. If contact is good, replace the DC power supply/motor drive PCB.
5	Does the voltage between J206-4 and J206-2(GND) vary from about +7VDC to about 0 VDC when a test print is initiated?	NO	Replace the DC controller PCB.
		YES	Replace the scanner unit. If this does not correct the problem, go step 7.
6	Initiate a test print. Does the voltage between J401-3 and J401-2(GND) on the scanner driver PCB vary from about 0 VDC to +3 VDC and then 3 minutes later back to 0 VDC?	YES	Replace the DC controller PCB. If the problem is not solved, put the old PCB back in the printer and replace the scanner unit.
		NO	Replace the following. Check for the problem after each replacement to see if the next replacement is necessary. * DC controller PCB * scanner unit * laser unit * high voltage power supply * varistor PCB

Q.9 - SHARP HORIZONTAL BLACK LINES - (CROSS FEED DIRECTION (Explanation)

This kind of problem is usually caused by the laser/scanner unit in the image formation system. There are two functions to the laser/scanner unit. They are:

1) Producing the laser beam to be reflected by the optics assembly onto the surface of the photo-sensitive drum in the toner cartridge;

2) Rotating the hexagonal mirror at exactly the correct speed to scan (reflect) the laser beam across the drum in sync with the main motor as it turns the drum.

Step   Explanation

1   Step 1 confirms that there is a laser beam being produced and that it is the right intensity.

2   Step 2 confirms that the hexagonal mirror is being rotated at the correct speed to maintain sync with the main motor as it turns the drum in the toner cartridge. Steps 3 and 4 check for things that might interfere with the proper operation of the laser/scanner motor.

3   J206 of the DC controller PCB communicates control (ON/OFF) and power (+24 volts) to the scanner unit.

4   The +24 volt power for the laser/scanner unit comes from J401 of the DC controller PCB. The DC controller gets its power from J502 of the DC power supply. If the DC power supply is not producing the voltage, then it should be replaced. If the DC power supply is producing the voltage but the laser/scanner unit is not receiving it, then that means that the DC controller PCB is probably the problem.

5   J206 pin 4 from the DC controller PCB carries the signal that turns on the laser/scanner motor. The DC controller PCB should turn on this signal at the same time that it activates the signal to rotate the main motor.

6   When the scanner motor achieves the correct velocity, the scanner servo circuitry should notify the DC controller with the signal on pin 3 of J401. If the DC controller cannot properly sense this signal, then it is probably faulty.

Q.10 - **VERTICAL FOGGED STRIPES - PAPER FEED DIRECTION**
(Procedure)

Step	Check	Result	Action
1	Clean the primary corona wire. Does the print image improve?	YES	Finished.
2	Replace the toner cartridge. Does the print image improve?	YES	Finished.
3	Feeder guide warped?	YES	Tighten the feeder guide screws fully and then loosen each screw 1/8 to 1/4 turn. If warpage remains, replace feeder guide.
4	Stripe appears 80-90 mm from left side of page?	YES	Go to Table Q 20.

Q.11 - **HORIZONTAL FOGGED STRIPES - CROSS FEED DIRECTION**
(Procedure)

Step	Check	Result	Action
1	Check the distance of the stripes from the leading edge. Are they about 188mm or 66mm from the leading edge of the prints? (The circumference of the drum is 188.5mm, that of the developing cylinder, 66mm.)	YES	Replace the toner cartridge.

Q.12- **WHITE HORIZONTAL LINES OR OTHER SHAPES ON A BLACK**
PRINT (Procedure)

Step	Check	Result	Action
1	Is approved paper being used?	NO	Replace with approved paper (16-21 lb. standard photocopier paper). Explain to user that use of non-approved paper may cause poor quality prints.
2	Is the paper damp?	YES	Replace the paper. Instruct the user to store paper in its package in a dry place and not to open the packages before they are ready to be used.

Q.10 - VERTICAL FOGGED STRIPES - PAPER FEED DIRECTION (Explanation)

Step   **Explanation**

1   The primary corona lays a negative base charge down on the surface of the photosensitive drum in the toner cartridge. Wherever the laser beam strikes the drum, the negative charge is removed. The negatively charged toner is attracted to the relatively positive areas hit by the laser, forming a visible image of the print on the drum. The paper is charged more positively than the areas hit by the laser, and is then put into contact with the drum. The toner is attracted away from the drum by the more positively charged paper, transferring the print image from the drum to the paper.

         If the primary corona fails, there will be no difference in charge potential after the laser has struck the drum. This will result in no print image (or a very cloudy image if the performance of the corona is degraded).

2   Self-explanatory

4   If the problem appears 80-90 mm from the left edge of the paper, it may be caused by an improperly seated thermistor. See table Q20.

Q.11 - HORIZONTAL FOGGED STRIPES - CROSS FEED DIRECTION (Explanation)

Step   **Explanation**

1   The photosensitive drum and the developing cylinder must rotate several times for each length of paper that is printed. If there is a flaw on either of these components, the print problem will be repeated whenever the flawed area rolls into contact with the paper. Because the circumference of the drum is 188.5mm, a fogged stripe caused by a flaw on the drum may be seen at multiples of that distance. The circumference of the developing cylinder is 66mm, so a flaw there would cause a fogged stripe at multiples of that measurement.

Q.12 - WHITE HORIZONTAL LINES OR OTHER SHAPES ON A BLACK PRINT (Explanation)

Step   **Explanation**

1   If the proper thickness of paper is not used, the mechanical components of the paper transport system may have difficulty moving the paper at a consistent speed through the paper feed path. The inconsistent speed may result in white lines or other shapes, caused by the paper slipping or skipping in its contact with the drum in the toner cartridge.

2   Damp paper increases in thickness, causing the problem described in the explanation for step 1.

Q.13 - THIN VERTICAL LINES OR STRIPES - PAPER FEED DIRECTION (Procedure)

Step	Check	Result	Action
1	Are white stripes being produced?	YES	If the toner cartridge indicator is green, rock the cartridge to spread the toner evenly. If the indicator is red, replace the toner cartridge.
2	Is the fuser roller cleaner felt dirty?	YES	Replace the fuser roller cleaner felt.
3	Do prints improve after the transfer corona wire is cleaned?	YES	Finished.
		NO	Replace the toner cartridge. If that does not work, replace the original cartridge and go to next step.
4	Remove the toner cartridge and manually open the laser beam blocking shutter in the printer (above the cartridge). Check the area for obstacles or blockages. Are there any?	YES	Remove the obstacles or clean the area with a fine brush.
5	Remove the laser/scanner unit. Examine the dustproofing glass on the bottom of the laser/scanner unit.Is it cracked or dirty?	YES	If the glass is cracked, replace the scanner unit. If dirty, clean the dustproofing glass with lint-free cloth. Dust should not be the left on glass.
		NO	Replace the scanner unit.

Q.13 - THIN VERTICAL LINES OR STRIPES - PAPER FEED DIRECTION (Explanation)

Step   **Explanation**

1   Self explanatory.

2   The fuser roller cleaner felt is impregnated with a silicon oil. As the upper pressure roller in the fuser assembly turns, the silicon is applied to the roller. The silicon keeps the toner (in powder form as it enters the fuser) from sticking to the pressure roller. When the felt's supply of silicon is depleted, the toner may stick to the pressure roller, causing vertical lines or stripes.

3   The transfer corona charges the paper more positively than the areas hit by the laser. The paper is then put into contact with the drum. The toner is attracted away from the drum by the more positively charged paper, transferring the print image from the drum to the paper.

        If dirt builds up on the transfer corona, the area of paper passing over the buildup may receive a less positive charge. This will result in no toner transfer to that area for the length of the paper, resulting in thin vertical lines or stripes.

4   Self explanatory.

5   The stationary laser beam is reflected from the hexagonal mirror as it rotates, creating horizontal scans across the printed page. The scans from the hexagonal mirror are reflected by the beam-to-drum mirror in the laser/scanner unit, out of the laser/scanner unit through the dustproofing glass (in the laser escape aperture) down through the beam access door in the upper body of the printer, through light blocking shutter number 2 in the toner cartridge, and onto the surface of the drum in the toner cartridge.

        If there is a piece of dust or a crack in the dustproofing glass or beam-to-drum mirror, the laser beam will be blocked at that point in its scans across the drum, resulting in white vertical lines or stripes on the print image.

Q.14 - FAULTY REGISTRATION (Procedure)

(NOTE: For small horizontal registration problems, see the Image Skew Adjustment in the Adjustments section of this manual.)

Step	Check	Result	Action
1	Is the paper cassette loaded with too much paper (more than 10mm high)?	YES	Remove the excess paper.
2	Has either shutter loading spring (located at ends of the feed roller shaft on the registration shutter assembly) come loose?	YES	Reinstall the shutter loading springs.
3	Is the leading edge of the paper showing excessive curl?	YES	Straighten paper edges or replace paper.
4	Is approved paper being used?	NO	Replace with approved paper (16-21 Lb. standard photocopier paper).
5	Are the feed rollers dirty? (cassette pickup assembly)	YES	Clean with a damp cloth, then with a dry cloth. *Hint:* You can turn the rollers as you are cleaning them by opening the printer and rotating the gears in the bottom of the printer .
6	Disconnect J214 from the DC controller. Actuate the cassette size microswitches MS5 (upper), MS6 (middle), and MS7 (lower) manually in that order while checking the resistance between the connector pin listed below. Does the resistance drop from infinity to 0 ohms? 1) J214-1 to J214-2 (MS5) 2) J214-3 to J214-4 (MS6) 3) J214-5 to J214-6 (MS7)	NO	Check for wiring or connector problems between the DC controller PCB and the microswitches. If none, remove the printer from its pedestal and replace any microswitch that didn't drop to 0 ohms on activation.
7	Is the problem still there?	YES	Replace the DC controller board.

Q.14 - FAULTY REGISTRATION (Explanation)

Step   Explanation

1   The springs in the paper cassette must have the required amount of space in which to compress
     when the paper pickup rollers in the lower half of the printer rotate and contact the paper.

     If there is too much paper in the cassette, the springs cannot compress and the pickup rollers may
     pick up more than one sheet of paper or exhibit other problems as a result of improper registration.

2   Self explanatory.

3   Self explanatory.

4   If the proper thickness of paper is not used, the mechanical components of the paper transport system
     may have difficulty moving the paper through the paper feed path. This can result in paper jams
     or skewed prints caused by improper registration of the paper at the registration shutter assembly.

5   Self explanatory.

6   The number of turns taken by the pickup rollers, feed rollers, main motor, etc., is determined by the
     length of the paper cassette. The length of the cassette is sensed by MS5, MS6, and MS7. If any
     of these microswitches do not work, the rollers will turn more or less than they should, resulting in
     improper registration.

7   The DC controller PCB determines when in the print process the pickup rollers actuate, checks the
     pickup sensor, and controls nearly every other aspect of the paper's progress through the print
     process. Replacing the DC controller PCB with a known good one eliminates a number of
     potential problems.

Q.15 - POOR FIXING - IMAGE SMEARS EASILY (Procedure)

Step	Check	Result	Action
1	Is approved paper being used?	NO	Replace paper with approved paper (16-21 lb.standard photocopier paper).
2	Are the upper and lower fuser rollers worn?	YES	Replace as necessary.
3	Refer to the Nip Width procedure at the end of this section. Use the procedure to determine if the nip width on the fuser assembly is correct. Is the nip width correct?	NO	Replace the fuser assembly.

Q.16 - DISTORTION (Procedure)

Step	Check	Result	Action
1	Perform a test print by jumpering pins 1 and 2 on J205 of the DC controller PCB. Does LED 501 on the DC power supply/motor drive PCB stay on steadily with out flashing or going out during the print process?	NO	Perform each of the following actions, generating a test print after each step to see if the problem is solved: 1) Check all parts of the drive mechanism. 2) Replace the DC power supply/motor drive PCB. 3) Reinstall the original DC power supply/motor drive PCB in the printer and replace the main motor.

Q.17 - WAVINESS (Procedure)

Step	Check	Result	Action
1	Perform a test print by jumpering pins 1 and 2 on J205 of the DC controller PCB. Does LED 401 on the scanner driver PCB light continuously?	NO	Replace the scanner unit. If the problem is not solved, reinstall the original scanner unit and replace the DC controller PCB.

Q.15 - POOR FIXING - IMAGE SMEARS EASILY (Explanation)

Step   **Explanation**

1   It is very important that the upper and lower pressure rollers in the fuser exert the proper amount of pressure on the paper. Paper other than that approved for the Apple LaserWriter may not be of the correct thickness. The wrong thickness of paper will cause an improper amount of pressure from the pressure rollers.

2   Worn rollers can cause too little pressure on the paper as it rolls through the fuser. See the explanation for step 1.

3   If the pressure rollers in the fuser assembly are too far apart or poorly adjusted, there will not be enough heat or pressure to fuse the toner into the paper. The nip width procedure checks for proper and uniform pressure between the upper and lower fuser rollers. See the explanation for step 1.

Q.16 - DISTORTION (Explanation)

Step   **Explanation**

1   The laser scanning action and the main motor revolutions must be in exact sync or the image will be vertically compacted or lengthened. If the main motor is turning too fast, the image will be lengthened. If it is turning too slowly, the image will be compacted. LED 501 on the DC power supply/motor drive PCB lights when the main motor is turning at the proper speed.

Q.17 - WAVINESS (Explanation)

Step   **Explanation**

1   The hexagonal mirror and the laser ON/OFF action must be in exact sync or the image may be wavy and distorted. During the service test print, the laser ON/OFF signal is controlled by the DC controller PCB, and the speed of the hexagonal mirror by servo loop circuitry on the laser/scanner unit. LED 401 lights when the hexagonal mirror is rotating at the correct speed.

Q.18 - UNEVEN PRINT DENSITY (Procedure)

Step	Check	Result	Action
1	Rock the toner cartridge to distribute the toner; then try several test prints. Does the problem go away?	YES	Finished.
2	Is the transfer guide bent?	YES	Replace the transfer guide.

Q.19 - GRAY IMAGE - NO PART OF THE IMAGE IS RECOGNIZABLE (Procedure)

Step	Check	Result	Action
1	Does the problem go away when you replace the toner cartridge?	YES	Finished.
2	Clean the transfer corona. Does the problem go away?	YES	Finished.
		NO	Go to table C (High Voltage Power Supply Does Not Provide Power).

Q.20 - SMEARING 80-90 mm FROM LEFT EDGE OF PAGE (Procedure)

Step	Check	Result	Action
1	Feeder guide warped?	YES	Tighten the feeder guide screws fully and then loosen each screw 1/8-1/4 turn. If warpage remains, replace feeder guide, carefully following directions for tightening and loosening screws.
2	Locate the thermoprotector in the fuser assembly. Is the thermoprotector properly seated?	NO	Clean the thermoprotector with MEK (methyl ethyl ketone) and seat it properly (see Section 2, Take-Apart), or install a new thermoprotector.

Q.18 - UNEVEN PRINT DENSITY (Explanation)

Step   **Explanation**

1   If the toner becomes clumped in the toner bin, it will not be able to move freely around the
     developing cylinder. The developing cylinder puts the charge onto the toner so that it can be
     attracted to the surface of the photosensitive drum. Clumping of the toner can cause insufficient
     toner to be attracted to the surface of the photosensitive drum, affecting the density of the print.
     When the toner cartridge is rocked, the toner in the toner bin is shaken up, restoring its free access
     to the developing cylinder.

2   If the transfer guide is bent, it can affect the movement of the paper as it is brought into contact
     with the toner image on the drum. If there is slippage during this contact, uneven print density can
     occur. A bent transfer guide can cause such slippage.

     A bent transfer guide can also cause an uneven distance between the paper and the transfer corona,
     causing a varying charge and uneven print density.

Q.19 - GRAY IMAGE - NO PART OF THE PRINT IMAGE IS RECOGNIZABLE
(Explanation)

Step   **Explanation**

1   This problem is usually caused by a faulty primary corona, developing cylinder, or transfer corona.
     Since the toner cartridge contains the first two possibilities, replacing it helps narrow down the
     problem.

2   The high voltage power supply provides the electrical charges required for the operation of the
     primary corona, developing cylinder, and transfer corona. If the problem was not found in this table,
     it may be found in table C, which is concerned with troubleshooting the high voltage power supply.

Q.20 - SMEARING 80-90 mm FROM LEFT EDGE OF PAGE (Explanation)

Step   **Explanation**

1   Feeder guide warpage seems to be the most common cause of this problem. If this is the cause of the
     problem, the smearing may also occur at other positions. See also table Q10.

2   If the thermoprotector is not correctly seated, toner will build up on its surface and cause smearing on
     prints. The location of the smear in this case is the same as the location of the thermoprotector.

R - PAPER JAMS (Procedure)

Paper in the printer passes through four main areas (see the diagram below):

(1) manual feed area
(2) cassette feed area
(3) separation/feed area and
(4) fuser/delivery area.

Frequent jams in any area indicates that the area should be checked and repaired or cleaned and lubricated.
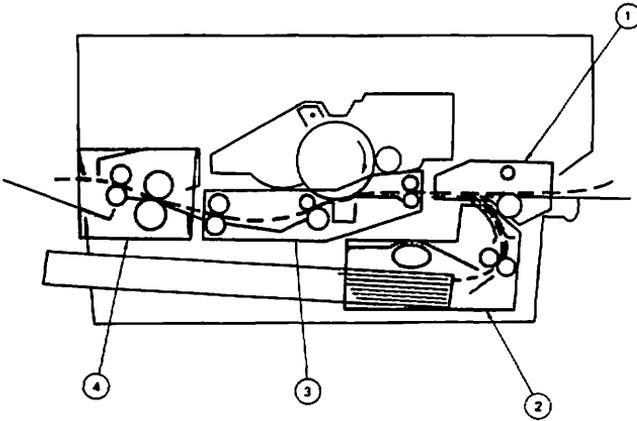
R - PAPER JAM TABLE (Procedure)

NOTE: If a step doesn't solve the problem, turn off the printer, remove the paper jam, and go on to the next step.

Step	Check	Result	Action
1	Turn off the printer and replace the DC controller PCB with a known good one. Then turn on the printer and retry the test print.		
	Does the problem recur?	NO	Finished. The DC controller PCB was the problem.
2	Jumper pins 1 and 2 of J205 to initiate a test print. After a jam occurs, open the printer to observe the location of the paper. Refer to the diagram on the opposite page for location reference.		
	Did the paper make it up from the cassette feed area to the printer's upper body?	NO	Go to step 3 of this procedure.
	Are there any sheets of paper stuck together in the paper path?	YES	Go to table R.5.
	Is the paper jam in the fuser/delivery area?	YES	Go to table R.4.
	Is the paper jam in the separation/feeder area?	YES	Go to table R.3.
3	Lower the door beneath the manual feed tray to shed light into the paper cassette area. Then look into the cassette paper pickup area as you initiate a test print. NOTE: It is normal for the Paper Jam LED to come on for this step.		
	Do the pickup rollers rotate completely at the beginning of the test print?	NO	Go to table F.
	Did a jam occur down in the cassette paper guide/feed roller area even though the pickup rollers rotated?	YES	Go to table R.2.

R.1 - MANUAL FEED UNIT (Procedure)

Step	Check	Result	Action
1	Is approved print paper being used?	NO	Use approved paper (16-21 lb. standard photocopier paper).
2	Is the paper wrinkled or curled?	YES	Replace the paper and make sure that the paper is stored correctly.
3	Does the paper detection arm on the registration shutter move smoothly?	NO	Adjust the arm motion until it is smooth.
4	Are the paper guides deformed?	YES	Replace deformed guides as necessary.
5	Open the upper half of the printer and switch the power on. Actuate the door switch with a screwdriver. Short together J210 pins 2 and 5 on the DC controller PCB. Does Registration Shutter Solenoid SL1 activate?	NO	Check the wiring between J210 on the DC controller PCB and the registration shutter solenoid SL1 for continuity. Also check the connectors. If no problems are found, replace the registration shutter assembly.
		YES	Go to Table E (Cannot Feed Paper Manually).

R.2 - CASSETTE PICKUP ASSEMBLY (Procedure)

Step	Check	Result	Action
1	Is the paper cassette loaded with more than 10mm of paper?	YES	Remove the excess paper.
2	Is approved print paper being used?	NO	Use approved paper (16-21 lb. standard photocopier paper).
3	Is the paper wrinkled or curled?	YES	Replace the paper and make sure that the paper is stored correctly.
4	Is the paper cassette installed properly in the printer?	NO	Install the paper cassette properly.
5	Is the cassette spring lifting force OK?	NO	Check the movement of the cassette plate. If OK, replace the paper cassette.
6	Is the right or left cassette hold-down tab deformed?	YES	Repair or replace the paper cassette.
7	Does the door beneath the manual feed tray (lower paper feed guide) close firmly?	NO	Replace the paper cassette.
8	Open the door beneath the manual feed tray (lower paper feed guide) and examine the feed rollers. Are any of the feed rollers dirty?	YES	Clean with a damp cloth, then with a dry cloth. *Hint:* you can turn the rollers by rotating a gear in the lower half of the printer.
9	Are any pickup rollers dirty, deformed, or worn?	YES	Clean the rollers with alcohol. If rollers are worn, replace as necessary.

R.3 - SEPARATION/FEEDER UNIT (Procedure)

Step	Check	Result	Action
1	Is the separation belt damaged or twisted?	YES	Replace the separation belt.
2	Is the separation belt inside out?	YES	Reinstall correctly. The notched side of the belt should be facing away from the I/O connector plate.
3	Is any roller dirty or worn?	YES	Clean dirty rollers as necessary. Replace separation/feeder unit if rollers are badly worn. *Hint:* You can turn the rollers by rotating a gear in the lower half of the printer.
4	Do pinch rollers press firmly against separation and feeder rollers?	NO	Replace the separation/feeder unit.
5	Are the feeder rollers dirty or worn?	YES	Clean with alcohol if dirty. If worn, replace separation/feeder unit.
6	Are the transfer guides deformed in any way?	YES	Replace the transfer guides.
7	Is the guide wire on the transfer corona assembly broken?	YES	Restring the guide wire.
8	Are the two strips of mylar tape located on the transfer corona wire termination covers loose or missing?	YES	Replace the corona assembly wire termination covers as necessary.
9	Replace the registration shutter assembly.		

R.4 - FUSER/DELIVERY AREA (Procedure)

Step	Check	Result	Action
1	Is the fuser roller cleaner felt dirty?	YES	Replace the fuser roller cleaner felt.
2	Are the entrance guides dirty?	YES	Clean the guides.
3	Are the separation claws worn?	YES	Replace claws as necessary.
4	Are the lower delivery guides dirty?	YES	Clean the guides.
5	Are the upper delivery guides dirty?	YES	Clean the guides.
6	Does the paper delivery sensor arm PS3 move freely?	NO	Repair to restore free motion.

R.5 - INCOMPLETE FEED-SHEETS STUCK TOGETHER (Procedure)

Step	Check	Result	Action
1	Is approved print paper being used?	NO	Use approved paper (16-21 lb. standard photocopier paper).
2	Is the cassette spring lifting force as specified?	NO	Check the movement of the cassette plate. If OK, replace the cassette springs.
3	Are the cassette side plates worn?	YES	Replace paper cassette.

S - LASERWRITER I/O PCB POWER PROBLEMS (Procedure)

Step	Check	Result	Action
1	Remove the printer from its pedestal and visually inspect the cabling from the power interlock assembly to transformer PT2 to the I/F regulator to P3 of the LaserWriter I/O PCB. Are there any cabling problems?	YES	Repair as necessary.
2	Remove the I/F regulator assembly. Check the fuse on the I/F regulator assembly. Is the fuse blown?	NO	Replace the I/F regulator with a known good one, reinstall the printer into its pedestal, then recheck power at P3. If there is still no power at the LaserWriter I/O PCB, replace transformer PT2. If the problem still remains, replace noise filter NF2.
		YES	Replace the fuse, reinstall the printer into its pedestal, and recheck for power at P3. Then if there is still no power at the Laser Writer I/O PCB, replace the I/F regulator with a known good one. If there is still no power at the LaserWriter I/O PCB, replace transformer PT2. If the problem still remains replace noise filter NF2.

S - LASERWRITER I/O PCB POWER PROBLEMS (Explanation)

NOTE: Refer to the LaserWriter Wiring Diagram in the back pocket of this manual for the following explanation.

Step	Explanation
1	Power for the LaserWriter I/O PCB originates at TB 101 (terminal block) in the power interlock assembly. Both terminal blocks (101 and 102) are located just above NF1 (the noise filter in the power interlock assembly). TB 101 is towards the inner part of the printer and TB 102 is towards the on/off switch. From TB 101, power for the LaserWriter I/O PCB goes down into the pedestal to noise filter NF2 and then to transformer PT2. From PT2, the power goes to the I/F regulator. From the I/F regulator the power goes up to P3, which connects power to J3 of the LaserWriter I/O PCB.
2	See the explanation for step 1.

APPENDIX

NIP WIDTH MEASUREMENT

The nip width measurement should be performed when irregular fusing is a problem. The measurement shows whether the fuser assembly's rollers are exerting uniform pressure on the prints. If they are not, the lower roller should be replaced. If that fails to fix the problem, the pressure springs should be replaced.
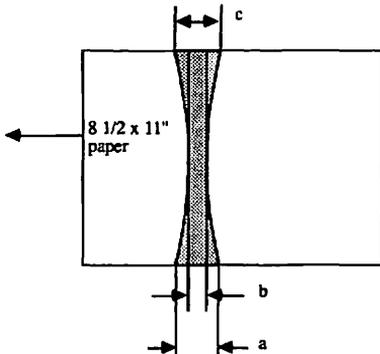
To measure:

NOTE: Take measurements when the rollers are hot; wait 15 minutes after turning power ON before making a measurement.

1. Start a service test print by momentarily shorting together pins 1 and 2 on J205 on the DC controller board.

2. Switch the power OFF when the leading edge of the print appears at the paper delivery port.

3. Pull the leading edge forward slightly and wait 10 seconds; then pull the print completely from the fuser assembly.

The result of this procedure is a glossy strip on the paper where the rollers rested. The strip should be 2 to 3 mm wide at its center (see figure below, measurement b) and should spread out no more than .5 mm at either edge (see figure below, measurements a and c).

4. Measure the width of the glossy section where the rollers were pressing on the paper (see the figure below). If it meets specifications, rollers are acceptable. If it fails, replace the lower roller and measure nip width again. If nip width is still outside specification, replace the pressure spring assemblies on either side of the fuser assembly.

Width	Measure when upper and lower rollers are hot.
b	2-3 mm.
|a-b|	Under 0.5 mm
|a-b|	Under 0.5 mm
|b-c|	Under 0.5 mm
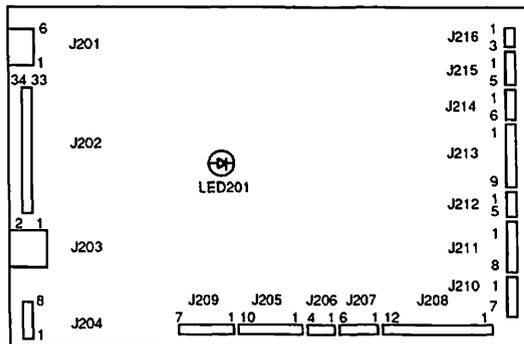
**CONNECTOR LOCATIONS ON THE
DC CONTROLLER PCB**
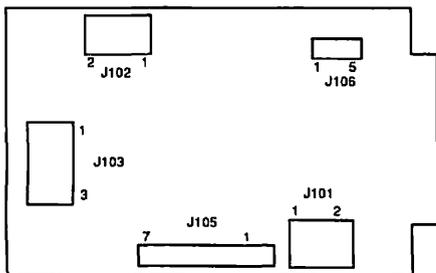
LOWER BOARD
(AC Controller PCB)
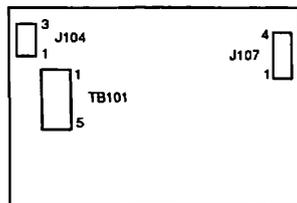
UPPER BOARD
(Fuser Heater Safety PCB)

CONNECTOR LOCATIONS ON THE AC DRIVER PCB

Apple LaserWriter Printer
Technical Procedures

Section 5 - Preventive Maintenance

Contents:

5.A - General Information................................5.1

5.B - Service Technician Maintenance Procedure.........5.3

5.C - End User Maintenance Procedures..................5.15

5.D - Appendix to Section 5.............................A.1

Service Technician Maintenance Procedure Checklist
LaserWriter Maintenance Record Form (Example)
LaserWriter Maintenance Record Form (Master)

5.A - GENERAL INFORMATION

This section is composed of the LaserWriter maintenance procedure for the service technician, a set of maintenance procedures for the end user, and an Appendix to Section 5.

(1) **Service Technician Maintenance procedure** - This procedure should be performed in its entirety every time service is required on the LaserWriter.

After the first time through, it may be more convenient to use the **Service Technician Maintenance Procedure Checklist** found in the **Appendix to Section 5**.

The Service Technician Maintenance procedure makes reference to the user maintenance procedures in the second part of this section and to the procedures in the Take-Apart section.

(2) **End User Maintenance procedures** - This part of the LaserWriter Maintenance section is composed of procedures primarily intended for the end user.

(3) **Appendix to Section 5** - This part of the section contains the **Service Technician Maintenance Checklist Form** and the **LaserWriter Maintenance Record Form**.

The **Service Technician Maintenance Checklist** form is a shorthand version of the **Service Technician Maintenance** procedure. It is intended to serve as a reminder for the technician who is already familiar with the procedure.

The **LaserWriter Maintenance Record** form is intended to help the technician keep a service call record for each printer. This can be very important, especially in the case of a recurring problem.

Make copies of the Checklist and Maintenance Record forms. Take a copy of the Checklist on every service call. Leave a Maintenance Record form with every LaserWriter that you install or service.

When you service a printer, check the Maintenance Record form to see if a similar problem has occurred before, then make sure that you update the form after completing the service.

5.B SERVICE TECHNICIAN MAINTENANCE PROCEDURE

NOTES: (1) **The Service Technician Maintenance procedure
           (Steps 5.B.1 through 5.B.5)** should be performed
           in its entirety every time service is required on
           the LaserWriter.

       (2) For information on LaserWriter operation, refer
           to the **Theory of Operation** section in this
           manual. For information on the removal or
           replacement of LaserWriter assemblies and modules
           refer to the **Take-Apart** section in this manual.

5.B.1 - PREPARE YOUR WORK AREA

1. Collect the following items:
    4 by 4 dropcloth (for toner spillage)
    penlight
    magnetized stubby #2 Phillips screwdriver
    soft lint free cloth (for cleaning)
    cotton tipped swabs
    Isopropyl alcohol

2. You should always be sure to hold the toner cartridge
    over the drop cloth to catch any toner that might
    spill. In addition, all tools or removed
    assemblies/modules should be placed on the drop cloth
    to keep them and the customer's area clean.

5.B.2 - CHECK THE PRINT COUNT

   The print count can be checked in two ways:

   (1) When the printer is powered on it will produce a
       test print. On the bottom of the test print will be
       the number of prints that have occurred since the
       LaserWriter I/O board was installed on the printer.

   (2) Inside the top half of the printer is the page
       counter (a fuse-like component that is part of the
       preconditioning exposure assembly) which shows how
       many prints have been made on the printer since the
       counter was installed.

   **If you are positive that the LaserWriter I/O board in
   the printer has never been removed,** then you can use the
   number on the bottom of the printout to judge how many
   prints have occurred. If this is the case then go to
   Step 7.

If you suspect that the LaserWriter I/O board has been removed since installation, then you must gain access to the page counter to obtain an accurate print count. Steps 1 through 6 will help you to remove the ozone filter so that you can see the page counter.

1. Open the printer and remove the toner cartridge (if necessary use the instructions in the User Maintenance procedures part of this section).

2. Look inside through the open toner cartridge door at the center part of the top half of the printer.

3. Locate a single phillips screw holding a dark piece of plastic to the printer's top frame. This dark piece of plastic is the ozone filter.

4. Remove the ozone filter with the magnetized stubby #2 phillips screwdriver (magnetized to help prevent the screw from falling inside the printer).

5. Use the pen-light to help you locate the page counter. Peer into the open printer from the paper output side as if you were looking into the mouth of a lion. Look through the opening in which the ozone filter was installed for a device that looks like a small thermometer.

6. Determine the print count. Each mark on the counter represents approximately 10,000 prints.

7. If the print count is:

    0 to 50,000 - Go to Step 5.B.3.

    50,000   - Replace the Separation Belt then
                    go to Step 5.B.3.

    100,000   - Inspect the items below and
                    replace as necessary.

    (1) Fuser Assy   (5) Separation Roller
    (2) Pre-Exposure Unit   (6) Separation Guide
    (3) Transfer Corona Assy   (7) Fusing Feed Roller
    (4) Separation Belt

5.B.3 - SERVICE THE TONER CARTRIDGE

The toner cartridge (see Figure 5-1) contains many moving parts as well as toner. If the toner cartridge is not already removed, then open the printer and remove the cartridge (if instructions are necessary refer to the **End User Maintenance procedures** in this section).

Caution: Hold the toner cartridge horizontally to distribute toner. Don't hold the cartridge on end; the toner will spill out.
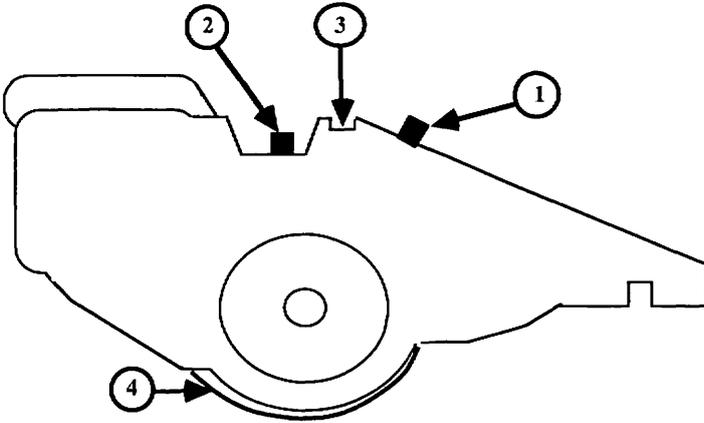
FIGURE 5-1: FAR SIDE OF CARTRIDGE

A. The Light Blocking Shutters

The **light blocking shutters** should open as the cartridge is inserted.

Light blocking shutter number one (Figure 5-1, #1) provides an opening so that the light from the pre-conditioning exposure lamp (in the main body of the printer) can enter the cartridge and shine on the photosensitive drum to neutralize any residual charges.

Light blocking shutter number two (Figure 5-1, #2) provides an opening for the laser to enter the cartridge and ionize the surface of the photosensitive drum in the form of the image to be printed. The shutters should close when the cartridge is removed to prevent the ambient light in the room from damaging the drum.

To Service the Light Blocking Shutters:
Open and close the light blocking shutters a few times
in a low light area to make sure that they are not
jammed or broken.

B.   The Primary Corona

The **primary corona** (Figure 5-1, #3) applies a uniform layer
of negative charge over the photosensitive drum surface to
prepare it for the laser beam.

To Service the Primary Corona:
Clean the Primary Corona Wire with a soft cloth
dampened in alcohol (if instructions are necessary,
then refer to the **Cleaning the Primary Corona Wire**
procedure in the **End User Procedures** part of this
section).

C.   The Photosensitive Drum's Protective Shield

The **protective shield** (Figure 5-1, #4) covering the
photosensitive drum should open as the cartridge is
inserted.   The opening allows the toner powder clinging to
the surface of the drum after the image development process
to leave the drum and be transferred to the paper.   When the
cartridge is removed, the shield closes to prevent ambient
light from damaging the drum.   If the shield has toner
sticking to it, then the print image may be dirty.

1.   Turn over the toner cartridge.   Open and close the
     protective shield a few times in a low light area to
     make sure that it is not jammed or broken.

2.   Clean the shield with a soft cloth dampened in alcohol.

3.   Check that the foam on the shutter edge is not peeling.
     If the foam is peeling, glue it back on (glue for
     porous type materials e.g. white glue, works best).

D.   The Photosensitive Drum

The surface of the **photosensitive drum** (the blue drum
exposed when the shield is open) is ionized by the laser to
form a latent (invisible) image of the print. As the drum
rolls past the developing cylinder, this image is exposed to
a cloud of toner. The toner will be attracted to the
ionized image on the drum forming a visible image of the
print.

The paper is ionized to the opposite charge as that of the
drum. When the toner image on the drum rolls past the
ionized paper, the toner particles forming the print image
on the drum are magnetically attracted to the paper causing
the image to transfer to the paper. If the surface of the
photosensitive drum becomes loaded up with residual toner
its ability to accept ionized charges from the laser may be
affected. In addition, residual toner can prevent a clean
transfer of the toner image to the paper.

1.   Hold the protective shield open in a **low light area** and
     examine the surface of the photosensitive drum while
     you turn the drum with the large toothed gear on the
     left of the cartridge. Look for things like
     fingerprints, toner buildup, etc.

NOTE: The following step will cause toner spillage from the
cartridge. Perform the indicated cleaning procedure only
when necessary (as described below).

2.   If you find an area that needs to be cleaned, collect a
     small amount of toner on the drop cloth by holding the
     toner cartridge on end and turning the drum. Hold the
     shield open and use a soft cloth impregnated with toner
     powder to clean the soiled area using long strokes with
     medium to light pressure.

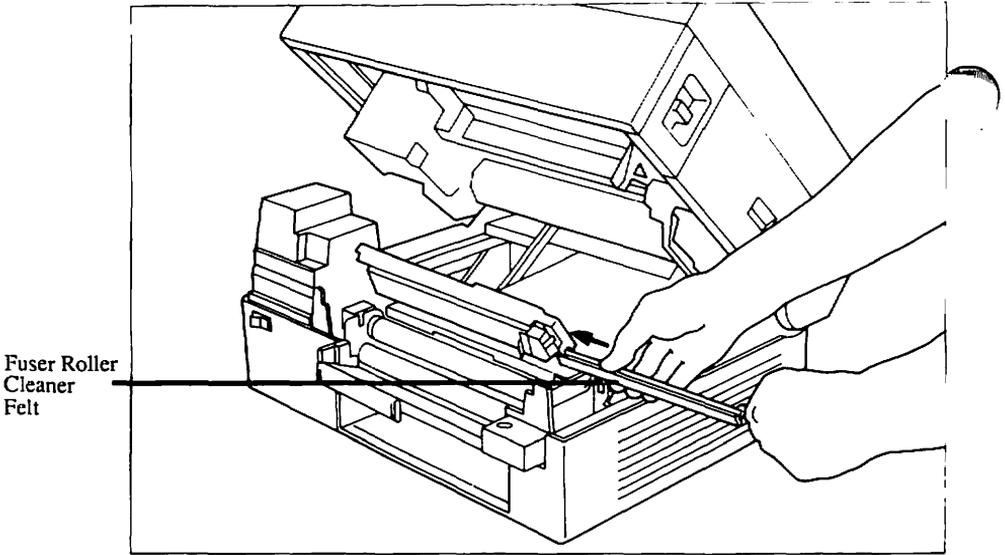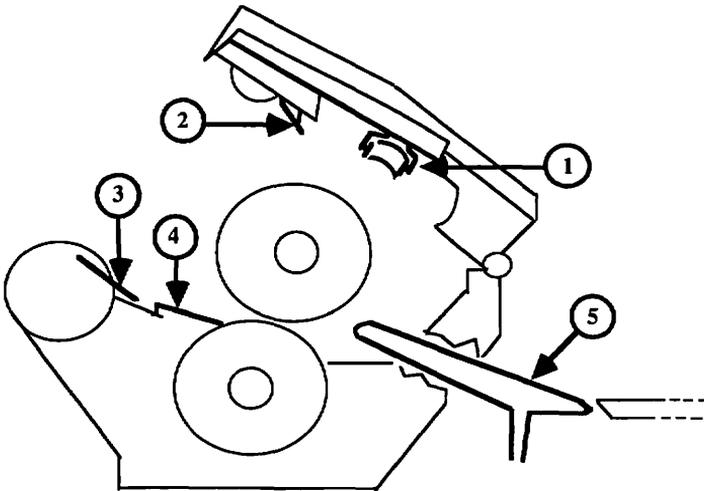Fuser Roller
Cleaner
Felt

FIGURE 5-2

FIGURE 5-3: SIDE VIEW OF OPEN
FUSER ASSEMBLY

5.B.4 SERVICE THE FUSER ASSEMBLY

The fuser assembly (the green felt covered mechanism on the paper output side of the printer's bottom half) is used to melt the plastic toner powder print image onto the paper. For this reason the fuser assembly gets very hot.

> **CAUTION:** Make sure that the LaserWriter has been off at least five minutes before servicing the fuser assembly to allow it to cool. Once the service is completed, allow a few minutes for the alcohol to dry before turning on the LaserWriter.

A.   The Fuser Roller Cleaner Felt

The **fuser roller cleaner felt** (Figure 5-2 and 5-3, #1) is impregnated with a special fluid to collect contaminants from the upper fuser pressure roller. If exceptionally dirty the felt should be replaced not cleaned.

> **To Service the Fuser Roller Cleaner Felt:**
> Raise the top of the fuser assembly and slide the fuser roller cleaner felt out (Figure 5-2). Check the felt and if necessary replace it with a new one.

B.   The Separation Claws

The **Separation Claws** (Figure 5-3, #2) skim the paper from the fuser pressure roller after the plastic toner has been fused onto the paper. It is important that their tips remain smooth and sharp.

> **To Service the Separation Claws:**
> Clean the Separation Claws with your fingernail being careful not to damage the leading edge (Figure 5-3, #2).

C.   The Delivery Guide, Separation Guide, and Paper Guide

The **delivery and separation guides** (Figure 5-3; #3, #4, and #5) keep the paper from getting jammed in the delivery roller as it is output from the fuser assembly. Over a period of time these guides can collect dirt from the paper.

The **paper guide** is the small grey plastic tray which guides
the paper between the upper and lower fuser pressure
rollers.

> **To Service the Delivery, Separation, and Paper Guides:**
> Clean the delivery guide, separation guide, and paper
> guide with a soft cloth dampened in alcohol (Figure 5-
> 3; #3, #4, and #5).

5.B.5 SERVICE THE PAPER PATH

Figure 5-4 below shows the paper path components that
require periodic cleaning. Clean them with a soft cloth
dampened in alcohol.

FIGURE 5-4: PAPER PATH

Approximate number of
prints

1,700 Prints — | G | G |

2,000 prints (order a new — | G | Y |
toner cartridge)

2,800 prints — | G | Y |

3,000 prints (replace the — | R |
toner cartridge)

Laser Writer Toner
Cartridge indicator
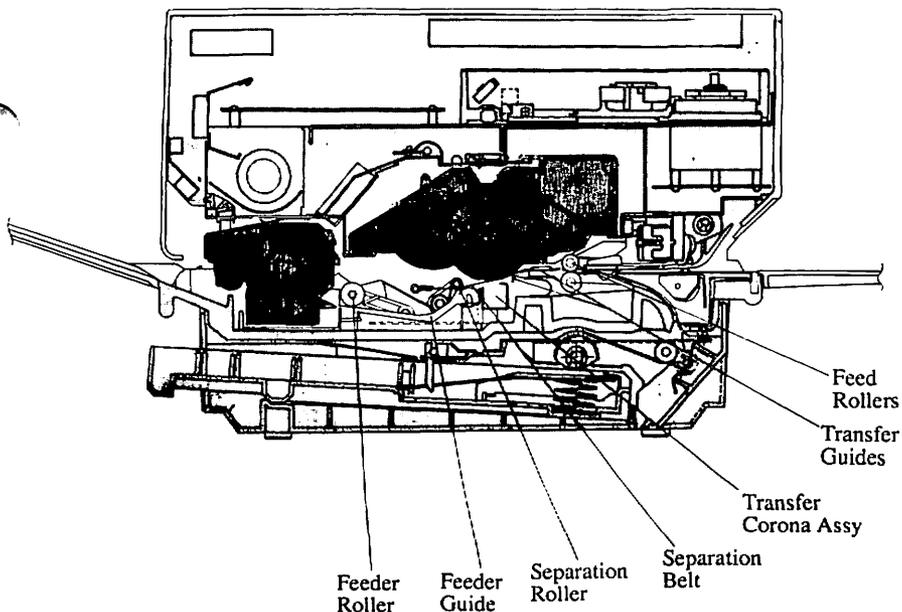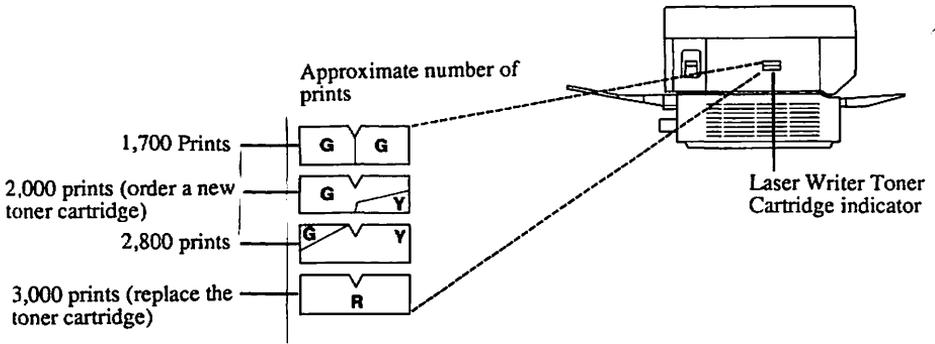
FIGURE 5-5: CARTRIDGE INDICATOR

Indicator lights

On/Off switch

Upper unit release lever

Laser Writer Toner
Cartridge door

Laser Writer Toner Cartridge
indicator
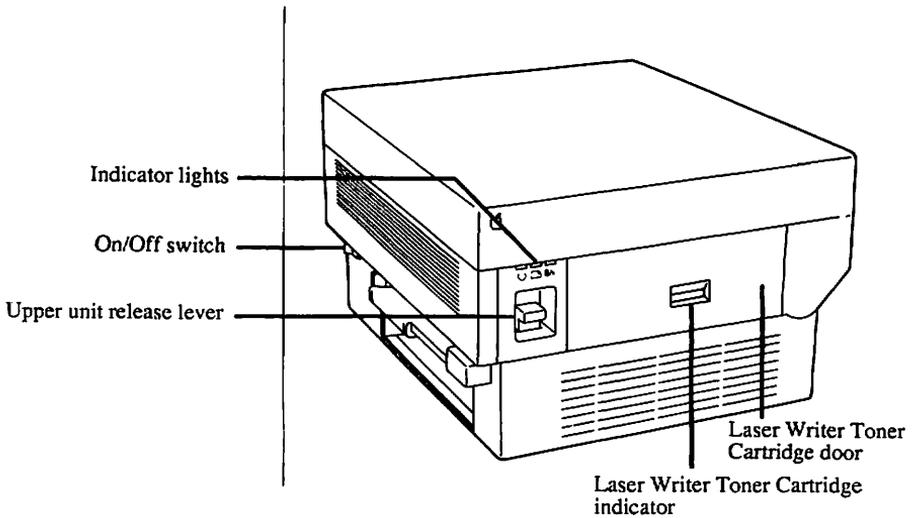
FIGURE 5-6

5.C END USER MAINTENANCE PROCEDURES

5.C.1 TO CHECK THE TONER CARTRIDGE

To Service:
To determine whether the toner cartridge needs to be
replaced, look at the color of the indicator (see
Figure 5-5), visible through the window on the right.
As the drum rotates, the color of the indicator changes
to indicate the useable service life of the cartridge.
The cartridge indicator becomes yellow when the
cartridge is about half used up, and finally turns to
red when the cartridge is ready to be replaced.

Each cartridge contains enough toner to make approximately
3,000 letter size prints. If many originals with high toner
image ratios (e.g. dense graphics) are printed, toner is
used up more quickly, and white stripes may appear on prints
before the printing capacity indicator turns red.

5.C.2 TO REMOVE THE TONER CARTRIDGE

Caution: Don't hold the cartridge on end; the toner will
spill out (Figure 5-7).

1. Lift the release and raise the upper half of the printer
    (Figure 5-6).

2. Open the door on the release side of the printer and
    pull out the used Toner Cartridge.

NOTE: The right door can be opened only after the upper main
body has been raised.

Don't hold the cartridge on end
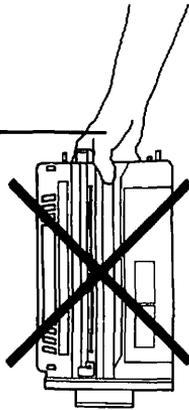
FIGURE 5-7
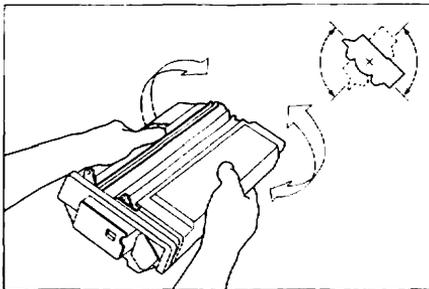
Laser Writer Toner Cartridge

FIGURE 5-8

5.C.3 DISTRIBUTE THE TONER IN A TONER CARTRIDGE

To Service:
Hold the new toner cartridge horizontal and rock it 45 degrees slowly back and forth about five times (with the drum as the center of rotation; Figure 5-8). Do this if white stripes appear on the finished paper.

Caution: Hold the toner cartridge horizontally to distribute toner. Don't hold the cartridge on end; the toner will spill out (Figure 5-7).

Slide the cartridge into the printer
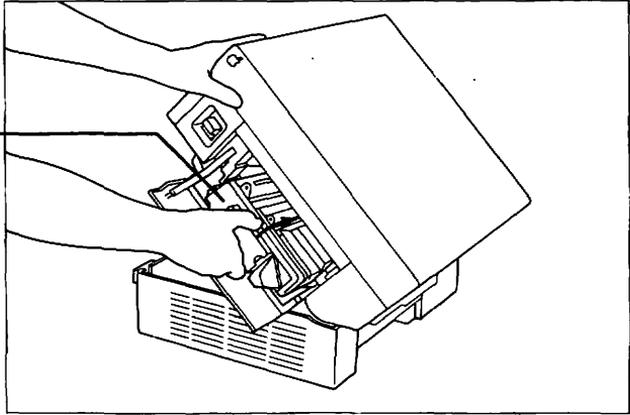
FIGURE 5-9

Flex the black tab until it breaks loose

Pull out the tab and the attached tape
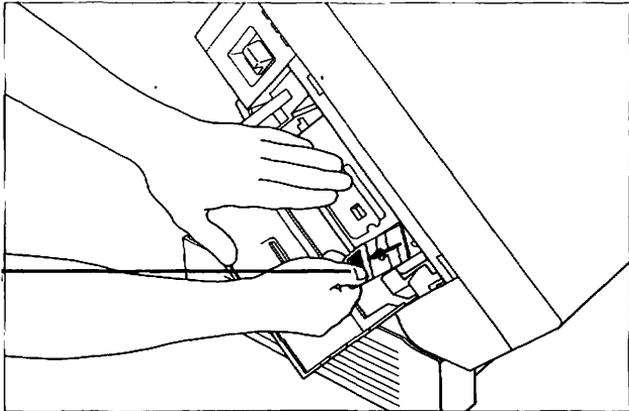
FIGURE 5-10

5.C.4 INSTALL A TONER CARTRIDGE IN THE PRINTER

Caution: Don't hold the cartridge on end; the toner will spill out.

1. Fully insert the new toner cartridge into the printer (Figure 5-9).

2. Flex the black tab on the toner cartridge until it breaks loose (Be careful not to break the attached sealing tape; Figure 5-10). Hold the cartridge steady and pull the tab out completely to remove the attached sealing tapes.

3. Raise the top of the fuser assembly and replace the fuser roller cleaner felt with a new one (Figure 5-11). Lower the top of the fuser assembly.

4. Close the upper half of the printer. Turn the printer on and perform 10 prints. If white lines show, remove the cartridge and try the **Distribute the Toner in a Toner Cartridge** procedure in this section. If white lines still show, try a new toner cartridge.

Remove the
old and insert
the new
cleaner pad
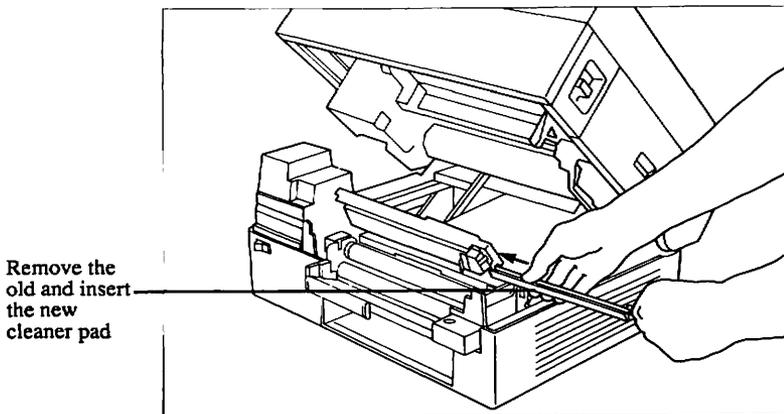
FIGURE 5-11

The separation belt is near
the back of the printer
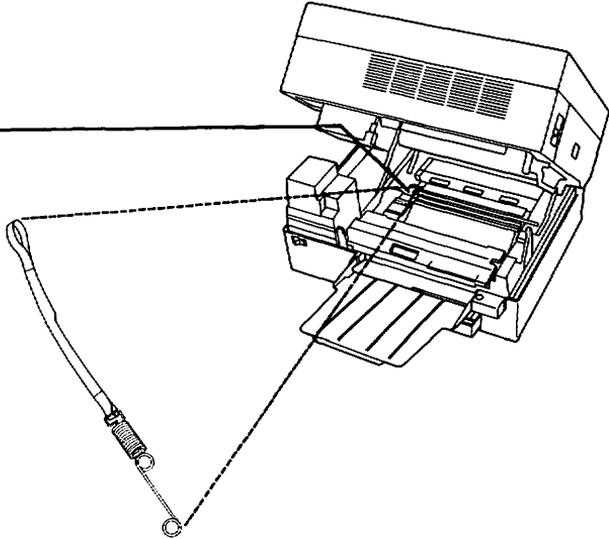
FIGURE 5-12: SEPARATION BELT LOCATION

A properly installed
separation belt
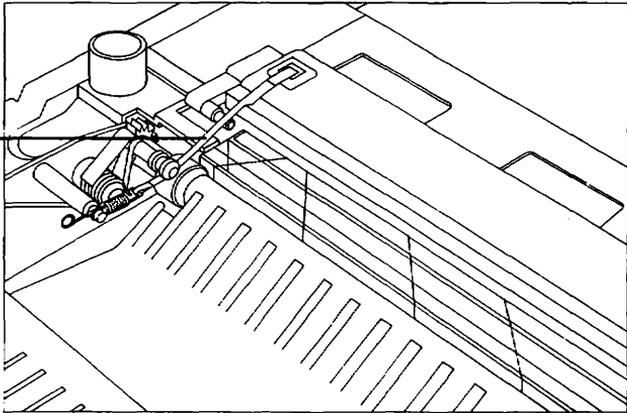
FIGURE 5-13

5.C.5 REPLACE THE SEPARATION BELT

If the separation belt breaks, use the following procedure to replace it.

NOTE: There is a replacement belt provided with each machine.

1. Push the release lever up and open the upper half of the printer (Figure 5-6).

2. Locate the separation belt (Figure 5-12).
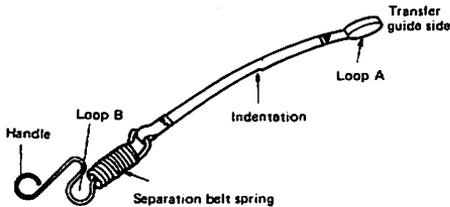
FIGURE 5-14
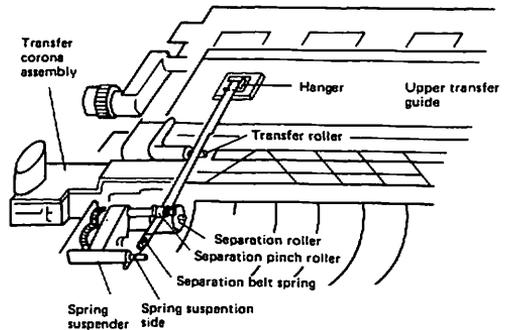
FIGURE 5-15

3. Open loop A on the separation belt with a screwdriver (Figure 5-14).

4. Hang loop A from the tab on the upper transfer guide (Figure 5-15). The indentation on the separation belt belongs on the right side.

5. Pass the separation belt over the transfer roller, and under the separation pinch roller (Figure 5-15).

6. Hook loop B on the separation belt to the underside of the spring suspension side of the spring suspender.

7. Check the following items after installing the separation belt.

___ Is the belt twisted or cut?
___ Is the indentation on the right side?
___ Is loop A securely hung from the upper transfer guide?
___ Does the belt pass over the transfer roller?
___ Does the belt pass between the separation roller and the separation pinch roller?
___ Is the separation belt spring hooked securely to the underside of the spring suspension side of the spring suspender?

8. Close the upper main body.

Green wire cleaner

Right side of green cover

The green cover
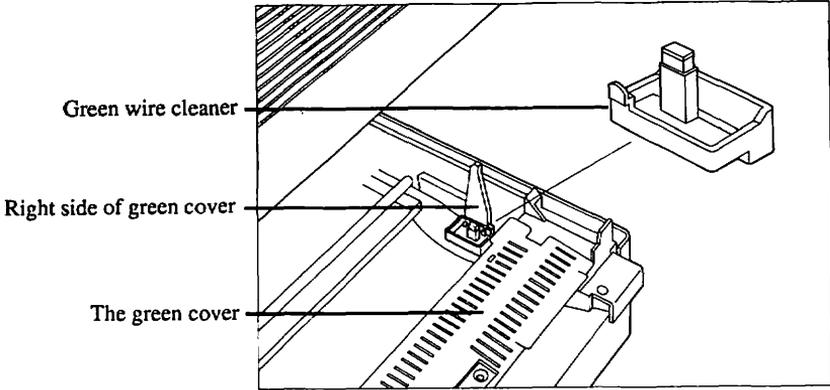
FIGURE 5-16: PRIMARY CORONA WIRE CLEANER
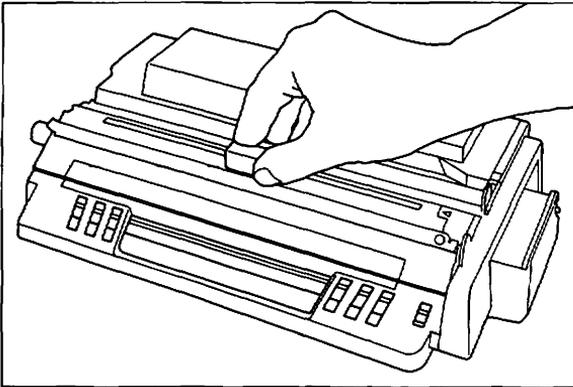
FIGURE 5-17: PRIMARY CORONA CLEANER SLOT

5.C.6 CLEANING THE PRIMARY CORONA WIRE

1. Open the printer and pull out the toner cartridge (if
   necessary use the instructions in this section). Locate
   the wire cleaner inside the lower half of the printer.
   (Figure 5-16).

2. Insert the wire cleaner into the long slot of the toner
   cartridge (between the two shutters) and move it back
   and forth in the slot (Figure 5-17). The cleaner
   displaces the thin protective plastic sheet.
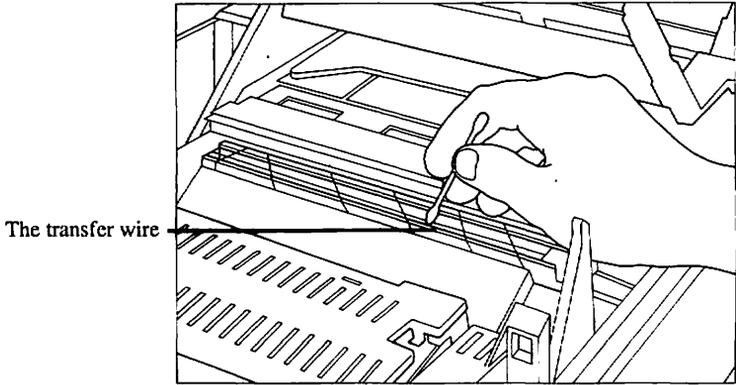
The transfer wire

FIGURE 18: TRANSFER CORONA WIRE
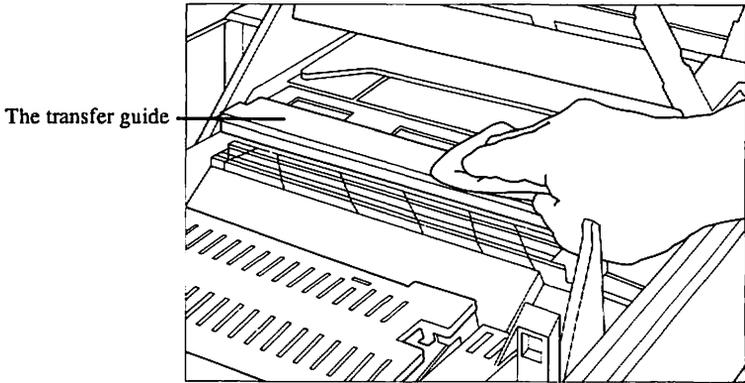
The transfer guide

FIGURE 19: TRANSFER GUIDE

5.C.7 CLEANING THE TRANSFER CORONA WIRE

To Service:
Open the printer and pull out the toner cartridge (if necessary use the instructions in this section). Gently draw the cotton swab (provided with the cartridge) up and down the corona wire (Figure 5-18).

NOTE: The Transfer wire is hard to see. It's a very thin wire located under the almost transparent crossed wires you see in the middle area inside the printer. Be gentle cleaning the wire; it's rather fragile.

5.C.8 CLEANING THE TRANSFER GUIDE

To Service:
Dampen a cloth with alcohol. (Don't soak it - it should be moist, not wet.) Clean the transfer guide with the cloth (Figure 5-19).

NOTE: The transfer guide is the brass-colored metal plate located behind the transfer wire.

Appendix to Section 5

Contents:

  Service Technician Maintenance Procedure Checklist
  LaserWriter Maintenance Record Form (Example)
  LaserWriter Maintenance Record Form (Master)

GENERAL INFORMTION

The Appendix to Section 5 contains the **Service Technician Maintenance Checklist Form** and the **LaserWriter Maintenance Record Form**.

The **Service Technician Maintenance Checklist** form is a shorthand version of the **Service Technician Maintenance** procedure. It is intended to serve as a reminder for the technician who is already familiar with the procedure.

The **LaserWriter Maintenance Record** form is intended to help the technician keep a service call record for each printer. This can be very important, especially in the case of a recurring problem.

Make copies of the Checklist and Maintenance Record forms. Take a copy of the Checklist on every service call. Leave a Maintenance Record form with every LaserWriter that you install or service.

When you service a printer, check the Maintenance Record form to see if a similar problem has occurred before, then make sure that you update the form after completing the service.

SERVICE TECHNICIAN MAINTENANCE PROCEDURE
CHECKLIST

EQUIPMENT NEEDED

4 by 4 dropcloth (for toner spillage)	soft lint free cloth (for cleaning)
penlight	cotton tipped swabs
magnetized stubby #2 Phillips screwdriver	Isopropyl alcohol

1. Prepare your work area for LaserWriter maintenance - details on page 5.5:
   ☐ Obtain the equipment listed above
   ☐ Spread the drop cloth over the work area beside the LaserWriter

2. Check the page count for the following numbers - details on page 5.5
   ☐ Under 50,000 - Go to Step 3
   ☐ Over 50,000 - Replace the Separation Belt
   ☐ Over 100,000 - Inspect the following items and replace if necessary
        Fusing Assembly
        Pre-Exposure Unit
        Transfer Corona Assembly
        Separation /Feeder Unit
        Feed Roller
        Paper Feed Roller
        Paper Pickup Roller

3. Service the Toner Cartridge - details on page 5.7
   ☐ Inspect the Light Blocking Shutter
   ☐ Clean the Primary Corona Wire
   ☐ Clean the Photosensitive Drum's Protective Shield
   ☐ Inspect the surface of the Photosensitive Drum; clean if necessary

4. Service the Fusing Assembly - details on page 5.11
   ☐ Inspect the Fusing Roller Cleaner Felt; replace if necessary
   ☐ Clean the Separation Claws
   ☐ Clean the Delivery Guide, Separation Guide, and Paper Guide

5. Service the Paper Path - details on page 5.12
        Clean the following items:
   ☐ Toner Feed Rollers
   ☐ Transfer Guides
   ☐ Transfer Corona Assembly
   ☐ Separation Belt
   ☐ Separation Roller
   ☐ Separation Guide
   ☐ Fusing Feed Roller

LASERWRITER MAINTENANCE RECORD FORM

ACCOUNT Smith Widget Co.   **SER #** 3935   **INSTALL DATE** 2-26-85

REASON FOR CALL CODES
CQ   COPY QUALITY
PH   PAPER HANDLING
UG   UPGRADE
OTH   OTHER
PM   PREVENTIVE MAINTENANCE

PROBLEM CODES
ID   IMAGE DEFECTS
EP   ELECTROMECHANICAL
PJ   PAPER JAMS

ACTION CODES
A   ADJUST
C   CLEAN
L   LUBRICATE
R   REPLACE / REPAIR
C   CHECK / PERFORM
PM   PREVENTIVE MAINTENANCE

	FILL OUT		ENTER CODES (SEE BOXES)			DESCRIBE	
DATE	PRINT COUNT	SERVICE TECH	REASON FOR CALL	PROBLEM	ACTION	ASSEMBLY / MODULE	REMARKS
10-15-85	15,000	Jones	CQ	ID	PM	—	Just Dirty
9-30-86	30,000	Jones	CQ	ID	PM	—	" "
5-2-87	50,000	Jones	PM	—	PM	Separation Belt	Routine 50,000 print maintenance
8-7-87	70,000	Jones	PH	PJ	PM	—	Trouble reported by customer not found so just did PMs.
10-12-87	75,000	Thomas	PH	PJ	R / PM	Separation Feeder Unit	Trouble reported by customer on 8-2-87 found this time.

EXAMPLE

LASERWRITER MAINTENANCE RECORD FORM

| ACCOUNT | SER # | INSTALL DATE |

REASON FOR CALL CODES
CQ   COPY QUALITY
PH   PAPER HANDLING
UG   UPGRADE
OTH OTHER
PM   PREVENTIVE MAINTENANCE

PROBLEM CODES
ID   IMAGE DEFECTS
EP   ELECTROMECHANICAL
PJ   PAPER JAMS

ACTION CODES
A   ADJUST
C   CLEAN
L   LUBRICATE
R   REPLACE / REPAIR
C   CHECK / PERFORM
PM   PREVENTIVE MAINTENANCE

FILL OUT			ENTER CODES (SEE BOXES)			DESCRIBE	
DATE	PRINT COUNT	SERVICE TECH	REASON FOR CALL	PROBLEM	ACTION	ASSEMBLY / MODULE	REMARKS

LaserWriter Technical Procedures

Section 6

Illustrated Parts List

The figures and lists below include all piece parts that can
be purchased from Apple for the LaserWriter, along with their
part numbers. These are the only parts available from Apple.
Refer to your Apple Service Programs binder for prices.

Contents:

General Information

The figures and lists that follow include all parts that can be ordered from Apple for the LaserWriter, along with their part numbers. These are the only parts available from Apple.

Included for your information is the Hewlett Packard (HP) part number for some of the piece parts used in LaserWriter. If there is no reference HP part number, that part number is only available from Apple.

Certain piece parts shown on the following pages are available only as parts of kits. On the parts list accompanying each figure, the generic hardware description refers to the part itself, but the part number refers to the kit that contains the part. When placing an order for such packaged parts, please note the descriptions below.

Apple P/N	Description
076-8133	Screw Assy, Misc, LaserWriter
076-8135	Screw Assy, Misc, LaserWriter
076-8136	Pin Set, Guide/Roll, LaserWriter
076-8137	Spring Set, Laserwriter
076-8138	Gear Set, LaserWriter
076-8139	Screw Set, LaserWriter
076-8167	Gear/Roller Set, Fuser
076-8168	Spring/Terminal Set, Fuser

VARISTOR PCB (14)
SEE FIGURE 11

DC POWER SUPPLY /
(1) MOTOR DRIVE PCB
(13) SEE FIGURE 20
(220 V)

DC CONTROLLER PCB (12)

LASER / SCANNER UNIT
SEE FIGURE 13

FUSER ASSY
SEE FIGURES 16 & 17 (10)
(11)
(220 V)

EXTERNAL COVERS
SEE FIGURE 19

PAPER CASSETTE
SEE FIGURE 8

CASSETTE
PICKUP ASSY
SEE FIGURE 10

(6)
(7)
(8)
(9)

FEEDER GUIDE ASSY
SEE FIGURE 2

PRECONDITIONING
EXPOSURE ASSY
SEE FIGURE 3

TONER CARTRIDGE

TRANSFER
GUIDE ASSY (3)
SEE FIGURE 15

REGISTRATION
(2) SHUTTER ASSY
SEE FIGURE 18

SEPARATION /
FEEDER ASSY (5)

FEEDER GUIDE ASSY
SEE FIGURE 2

TRANSFER
(4) CORONA ASSY
SEE FIGURE 9

LaserWriter Parts List   rev. Sep 85   page 6.4

Item	Apple p/n	HP p/n			Description
1	661-0273	–	–	–	PCB, PS/Mtr Drive 110 VAC
2	699-0323	–	–	–	Registration Shutter Assy
3	970-1149	–	–	–	Transfer Guide Assy
4	970-1021	RG1-0191-020CN			Corona Assy, Transfer
5	970-1019	RG1-0194-000CN			Roller Assy, Separation/Feed
6	699-0296	–	–	–	Cassette, Letter
7	699-0297	–	–	–	Cassette, Legal
8	699-0298	–	–	–	Cassette, A4
9	699-0299	–	–	–	Cassette, B5
10	699-0306	RG1-0197-000CN			Fuser Assembly, 115V
11	699-0318	RG1-0198-000			Fuser Assembly, 220V
12	661-0267	–	–	–	PCB, DC Controller
13	661-0274	–	–	–	PCB, PS/Mtr Drive 220VAC
14	970-1035	RG1-0287-000CN			PCB, Varistor

UPPER MAIN BODY
SEE FIGURES 11 & 12

(1) DISPLAY PANEL

PEDESTAL ASSY
SEE FIGURE 23

LOWER MAIN BODY
SEE FIGURES 6 & 7

(2)

(3) LASERWRITER I/O BOARD
SEE FIGURES 24 & 25

(4) HIGH VOLTAGE
POWER SUPPLY ASSY
SEE FIGURE 4

(5)

MAIN MOTOR ASSY
SEE FIGURE 21

(9)

J202

MANUAL FEED ASSY
SEE FIGURE 1 (8)

MOUNTING
CONNECTOR PLATE
SEE FIGURE 14

(6) A C DRIVER
PC B
SEE FIGURE 5

(10) (220 V)
SEE FIGURE 22

(7) PWR INTERLOCK
SEE FIGURE 5

(11) (220V)
SEE FIGURE 22
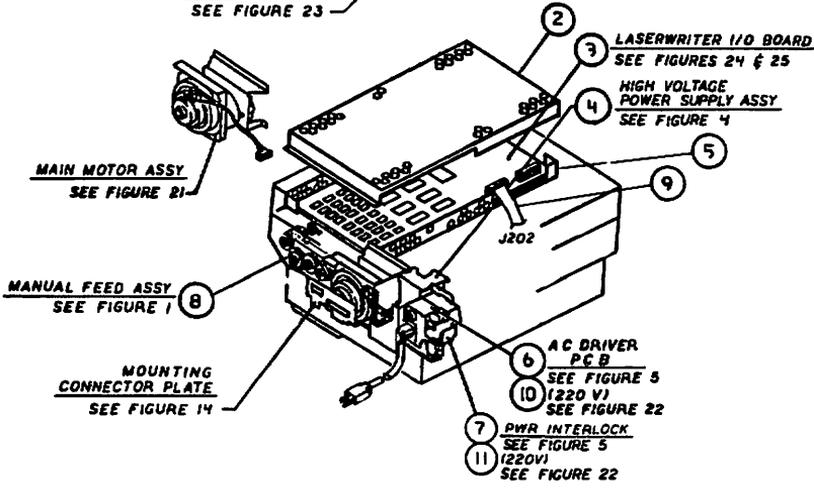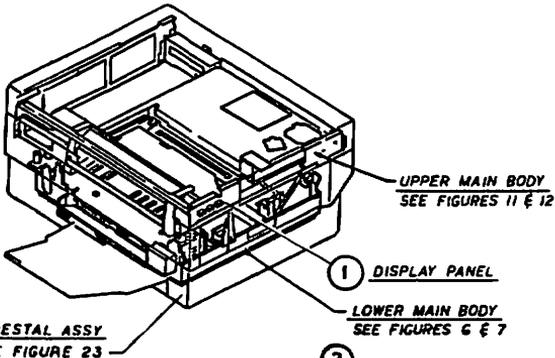
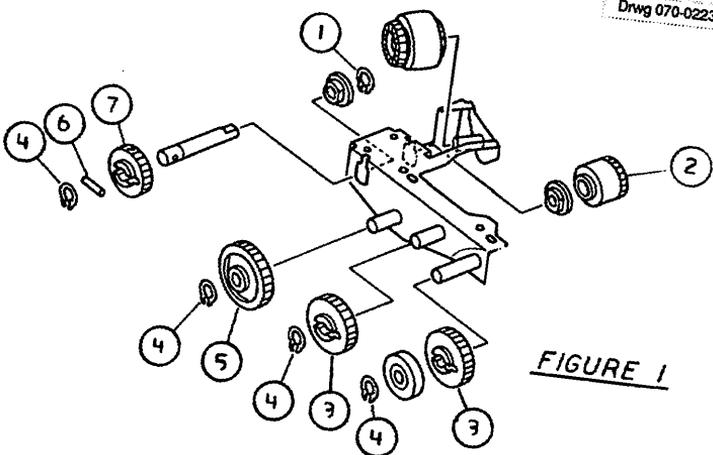| Item	Apple p/n	HP p/n			Description
1	970-1109	-	-	-	Panel Assy, Display
2	970-1182	-	-	-	Frame, Shield, Top
3	661-0270	-	-	-	PCB, LaserWriter I/O
4	661-0266	-	-	-	Pwr Supply, HV, Assy
5	970-1183	-	-	-	Frame, Shield, Bottom
6	661-0268	-	-	-	PCB, Driver, 110 VAC
7	699-0324	-	-	-	Power Interlock Assy, 110V
8	699-0322	-	-	-	Manual Feed Assy
9	970-1192	-	-	-	Cable, Internal, Video I/F
10	661-0269	RG1-0205-000			PCB, Driver, 220 VAC
11	699-0325	-	-	-	Power Interlock Assy, 220V

FIGURE 1
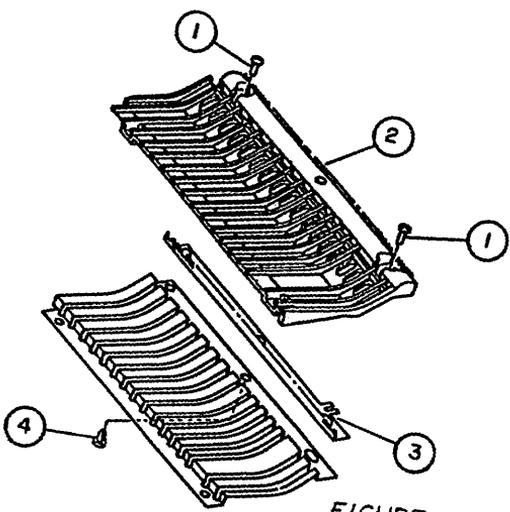
FIGURE 2

LASERWRITER - MANUAL FEED ASSEMBLY, P/N 699-0322 (Figure 1)

Item	Apple p/n	HP p/n	Description
1	076-8135	XD2-1100-502CN	Ring, E, 5.0 mm, Stainless Stl
2	076-8138	FS1-0707-000CN	Gear, 16T, Manual Feed Assy
3	076-8138	FS1-0708-000CN	Gear, 20T, Manual Fd/Transfer
4	076-8135	XD2-2100-602CN	Ring, Grip, 6.0 mm, Stainless Stl
5	076-8138	FS1-0709-000CN	Gear, 24T, Manual Feed Assy
6	076-8136	XD3-2200-122CN	Pin, Roll 1.2 x 2.0mm Stainless Stl
7	076-8138	FS1-0734-000CN	Gear, 17T, Manual Feed Assy

FEEDER GUIDE ASSEMBLY (Figure 2)

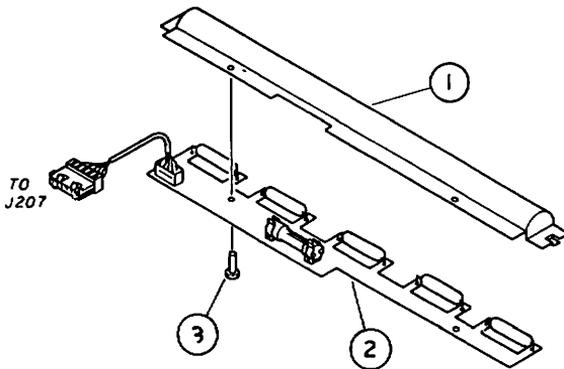| Item	Apple p/n	HP p/n	Description
1	076-8133	XB1-2400-809CN	Screw, 4 x .7 x 8 mm, Truss Head
2	970-1092	RF1-0164-000CN	Guide, Feeder
3	970-1018	FA2-5928-000CN	Plate, Static Eliminator
4	970-1066	XZ9-0137-000CN	Clip, Nylon, Feed Guide

TO
J207

①

③

②

FIGURE 3

VR2   J10

②

J22

TO
J211

①
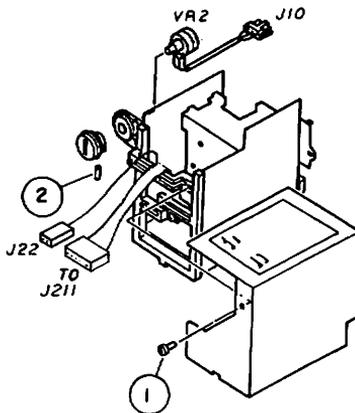
FIGURE 4

LASERWRITER – PRECONDITIONING EXPOSURE ASSEMBLY (Figure 3)

Item	Apple p/n	HP p/n	Description
1	970-1146	RA1-0753-000CN	Shield, Reflector, Preconditioning
2	970-1020	RG1-0101-000CN	PCB, Exposure, Preconditioner
3	076-8133	XB1-2300-609CN	Screw, 3 x .5 x 6 mm, Pan Head

LASERWRITER – HIGH VOLTAGE POWER SUPPLY, P/N 661-0266 (Figure 4)

Item	Apple p/n	HP p/n	Description
1	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 6 mm, Pan Head
2	076-8139	XB6-2400-508CN	Screw, Set 4x5
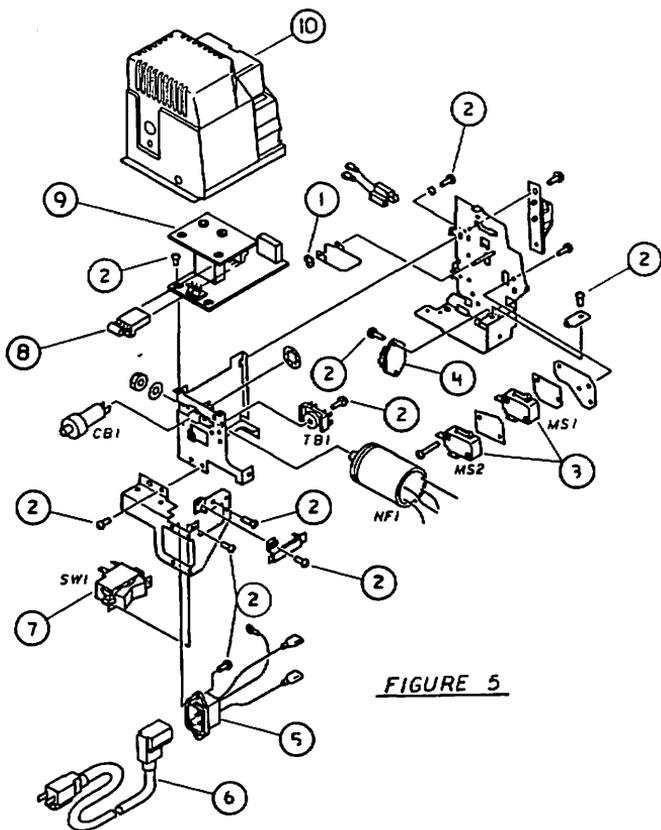
FIGURE 5

LASERWRITER - POWER INTERLOCK ASSEMBLY (110V)*, P/N 699-0324
        (Figure 5)

Item	Apple p/n	HP p/n	Description
1	076-8135	XD2-2100-402CN	Ring, Grip, 4.0mm, Stainless Stl
2	076-8133	XB1-2300-809CN	Screw, 3 x 5 x 8 mm, Pan Head
3	705-0109	WC4-0091-000CN	Switch, Micro, 115 VAC, 15A
4	970-1031	WA5-0045-000CN	TRIAC, AC16DIFR (115V)
5	970-1187	- - -	Connector, Power Supply
6	590-0283	- - -	Power Cord, 115 VAC, Rt Angle
7	705-0110	RH7-6001-000CN	Switch, Rocker, 250VAC, 20A
8	076-8149	- - -	Res Assy, 47 ohm, 5 PK
9	661-0268	- - -	PCB, Driver, 110 VAC
10	970-1143	- - -	Cover, Pwr Intlk Assy

* See Figure 22 for 220V version.
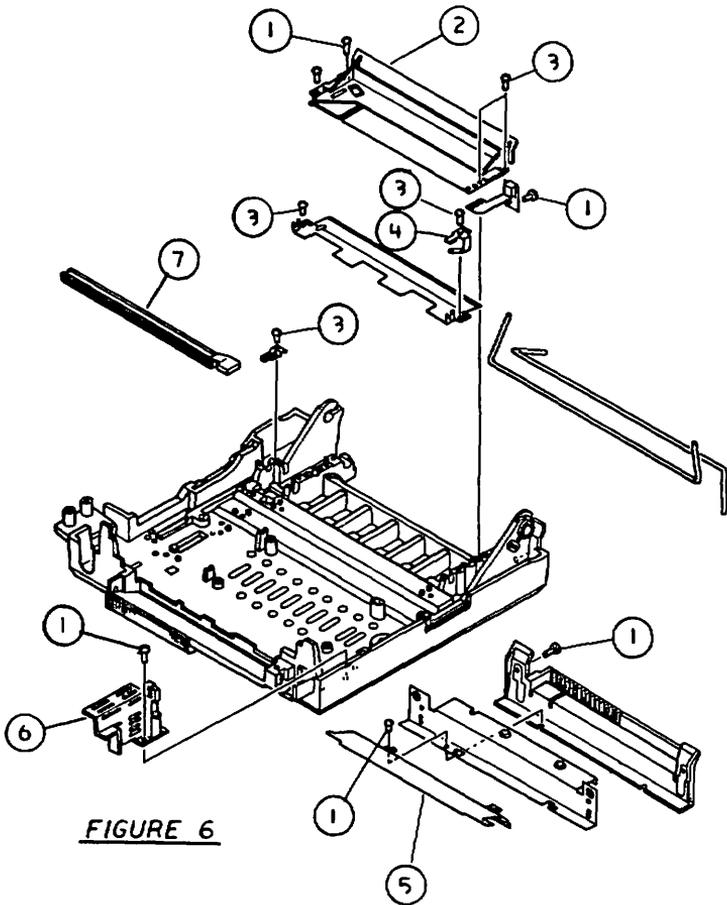
FIGURE 6

LASERWRITER - LOWER MAIN BODY (Figure 6)

Item	Apple p/n	HP p/n	Description
1	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 6 mm, Pan Head
2	076-8139	XB3-2401-209CN	Screw, Tapping, Truss Hd, M4x12
3	076-8137	RA1-0837-000CN	Spring, Roller Retaining
4	970-1127	FA2-5725-030CN	Plate, Paper Guide, Lower
5	970-1272	RF1-0211-000CN	Plate, Manual, Paper Feed
6	970-1267	FA2-5682-000CN	Latch, Front
7	970-1004	FG1-2377-020CN	Felt, Cleaning
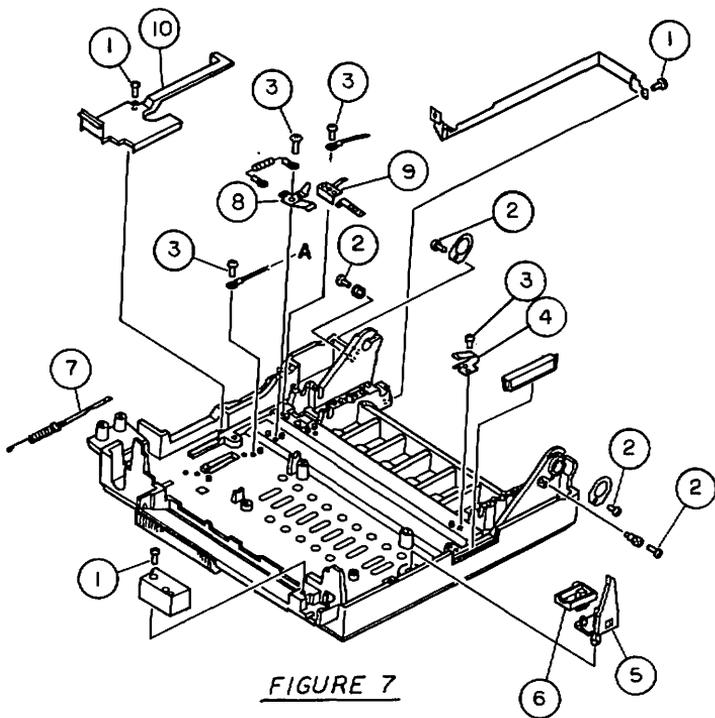
FIGURE 7

LASERWRITER - LOWER MAIN BODY   (Figure 7)

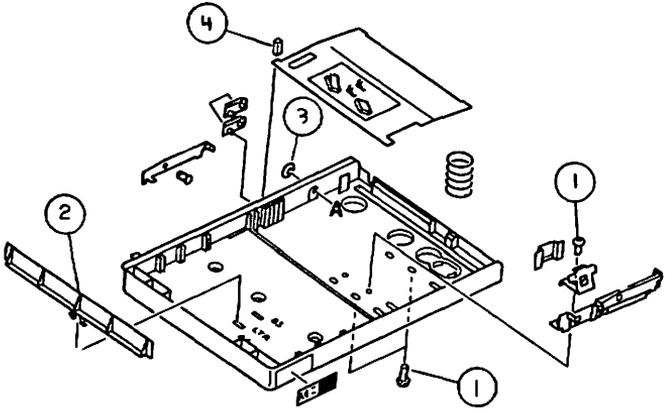| Item	Apple p/n	HP p/n	Description
1	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 8 mm, Pan Head
2	076-8139	XB3-2401-009CN	Screw, Tapping, Truss Head, M4x10
3	076-8139	XB3-2401-209CN	Screw, Tapping, Truss Hd, M4x12
4	076-8137	FA2-5728-000CN	Spring, Transfer Guide, Lifting
5	970-1041	FA2-5683-000CN	Actuator, Cartridge Shield
6	970-1064	FF1-3591-000CN	Cleaner, Felt, Corona Wire
7	970-1005	RF1-0224-000CN	Belt, Paper Separator
8	076-8137	FA2-5730-000CN	Spring, Grounding
9	076-8137	FA2-5729-000CN	Spring, Electrical Contact
10	970-1069	FA2-5719-000CN	Cover, Wire Harness

FIGURE 8

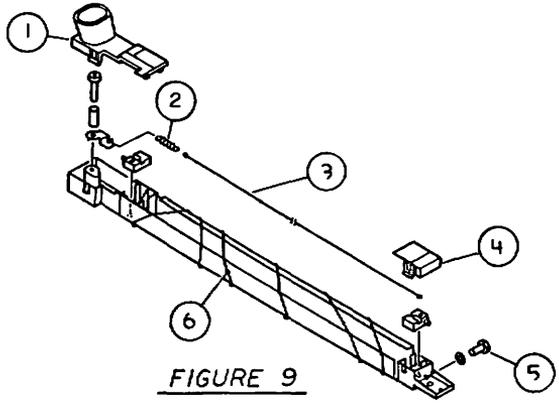*FIGURE 9*

LASERWRITER - CASSETTE (Letter, P/N 699-0296; Legal, P/N 699-0297; A4, P/N 699-0298; B5, P/N 699-0299) (Figure 8)

Item	Apple p/n	HP p/n	Description
1	076-8133	XB6-7300-609CN	Screw, 3 x .5 x 6mm, Pan Head
2	970-1128	RA1-0861-000CN	Plate, Stop Cassette
3	076-8135	XD2-1100-402CN	Ring, E, 4.0 mm, Stainless Stl
4	970-1166	FA1-9787-000CN	Stop, Rubber, Cassette

LASERWRITER - TRANSFER CORONA ASSEMBLY, P/N 970-1021 (Figure 9)

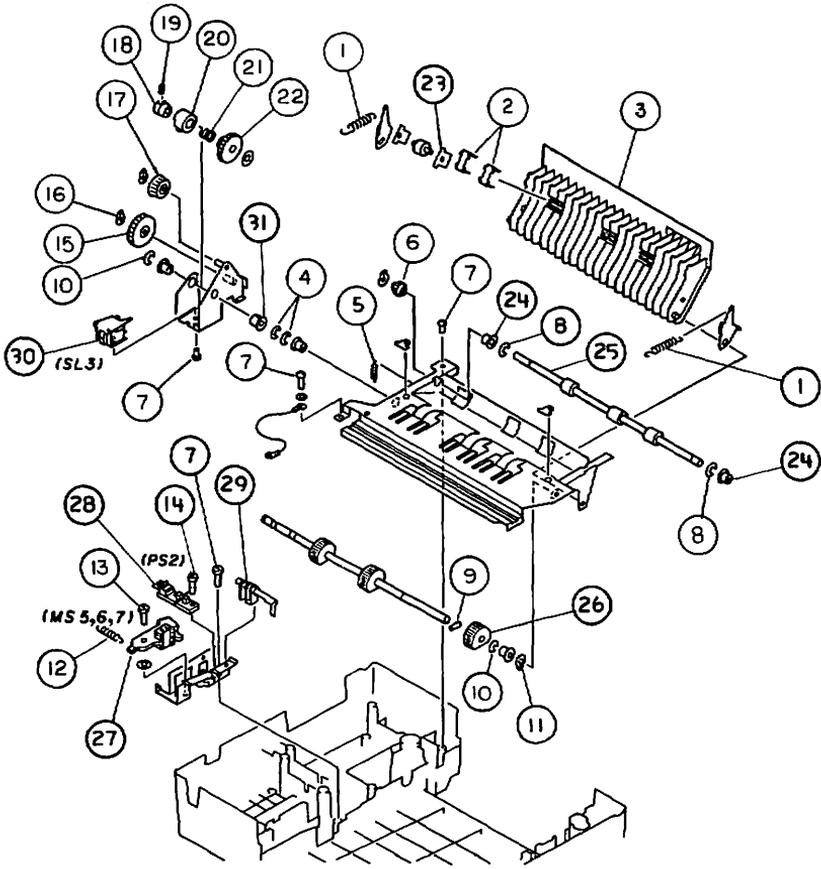| Item	Apple p/n	HP p/n	Description
1	970-1038	RF1-0137-000CN	Cover, Wire Termination, LH
2	970-1036	97-5527-000CN	Spring, Tension, Corona Wire
3	076-8126	FY1-0100-000CN	Wire, Corona, Set
4	970-1037	RF1-0136-000CN	Cover, Wire Termination, RH
5	076-8133	XB1-2300-609CN	Screw, 3 X .5 X 6 mm, Pan Head
6	970-1040	RY1-1502-000CN	Wire, Guide, Nylon Roll

FIGURE 10

LASERWRITER - CASSETTE PICKUP ASSEMBLY   (Figure 10)

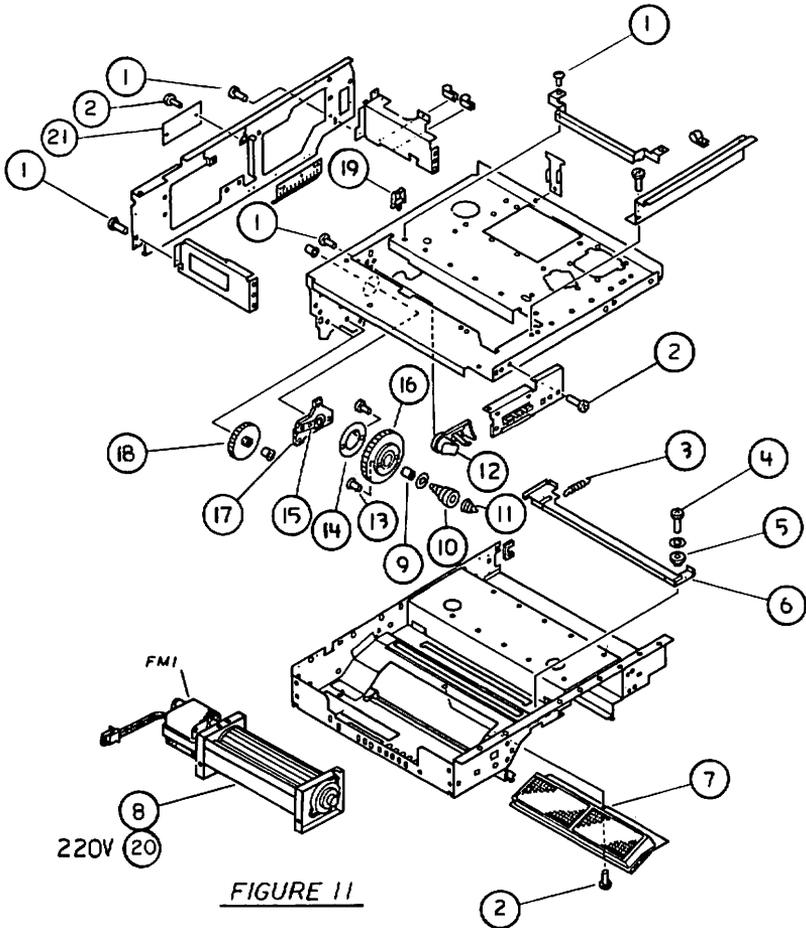| Item	Apple p/n	HP p/n	Description
1	076-8137	RS1-2011-000CN	Spring, Tension, Cassette
2	076-8137	FA2-5600-000CN	Spring, Leaf
3	970-1093	FA2-5611-010CN	Guide, Lower, Paper Feed
4	076-8135	XD2-1100-642CN	Ring, E, 6.4 mm, Stainless Stl
5	076-8137	FS1-2652-000CN	Spring, Torsion, Cassette
6	076-8138	FS1-0704-000CN	Gear, 14T, Paper Feed Idler
7	076-8133	XB6-7300-609CN	Screw, 3 x .5 x 6 mm, Pan Head
8	076-8135	XD2-1100-502CN	Ring, E, 5.0 mm, Stainless Steel
9	076-8136	XD3-2200-122CN	Pin, Roll 1.2 x 2.0mm Stainless Stl
10	076-8135	XD2-1100-642CN	Ring, E, 6.4 mm, Stainless Stl
11	076-8135	XD2-2100-802CN	Ring, Grip, 8.0 mm, Stainless Stl
12	076-8137	RS1-2007-000CN	Spring, Tension, Cassette
13	076-8139	FA2-5970-000CN	Screw, 3x.5x5mm TRUSS CRS REC STL BLK
14	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 8 mm, Pan Head
15	076-8138	FS1-0702-000CN	Gear, 37T, Paper Feed Idler
16	076-8135	XD2-2100-602CN	Ring, Grip, 6.0 mm, Stainless Stl
17	076-8138	FS1-0703-000CN	Gear, 20T, Paper Feed Idler
18	970-1073	FA2-5606-000CN	Drum, Clutch Driver
19	076-8139	XB6-2400-509CN	Screw, Set, 4x5
20	076-8135	FA2-5607-000CN	Ring, Clutch, Pickup Control
21	076-8137	FS1-2651-000CN	Spring, Torsion, Cassette
22	076-8138	FS1-0701-000CN	Gear, 30T, Drum/Clutch Dr.
23	970-1274	RA1-0667-000CN	Plate, Cassette/Roller Pickup
24	970-1055	FS1-1190-000CN	Bushing, Paper Feed Roller
25	970-1012	RA1-0977-000CN	Roller, Paper Feed
26	970-1011	RA1-0666-000CN	Roller, Paper Pickup
27	970-1104	RF1-0163-000CN	Micro Switch Assy, Cassette
28	970-1014	FH7-7024-000CN	Sensor, Paper Out Detect
29	970-1043	RA1-0673-000CN	Arm, Cassette Pickup
30	970-1032	FH7-5034-000CN	Solenoid, Cassette, 24VDC
31	970-1054	FS1-1046-000CN	Bushing, Paper Feed Idler

FM1

220V

FIGURE 11

Item	Apple p/n	HP p/n	Description
1	076-8133	XB6-7300-609CN	Screw, 3 x .5 x 6 mm, Pan Head
2	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 8 mm, Pan Head
3	076-8137	RS1-2008-000CN	Spring, Tension, Shutter
4	076-8139	FA2-5970-000CN	Screw, 3x.5x5mm TRUSS CRS REC STL BLK
5	970-1056	RA1-0717-000CN	Bushing, Shutter
6	970-1147	RA1-0716-000CN	Shutter, Laser Shielding
7	970-1001	FA2-5664-020CN	Filter, Ozone
8	720-0502	RH7-1006-000CN	Fan, 110V, 60 Hz
9	970-1108	XB7-2100-609CN	Nut, Hex, 6 mm, Blk Stl Znc
10	970-1095	RA1-0972-000CN	Holder, Drum
11	076-8137	FS1-2670-000CN	Spring, Grounding
12	970-1058	RF1-0138-000CN	Cam, Cartridge Shutter
13	076-8136	FA2-5690-000CN	Pin, Drum Drive
14	076-8137	FA2-5691-000CN	Spring, Drive Pin, Drum Locator
15	970-1170	RA1-0720-000CN	Terminal, Grounding
16	970-1089	RS1-0011-000CN	Gear, 60 Tooth
17	970-1271	RA1-0721-000CN	Disc, Insulator, Drum Drive
18	076-8138	FS1-0729-020CN	Gear, 38T, Idler, Cassette Dr
19	970-1065	WT2-0133-000CN	Clip, Cable, 3NS
20	970-1074	RH7-1007-000CN	Fan, 220V, 50 Hz
21	970-1035	RG1-0287-000CN	PCB, Varistor
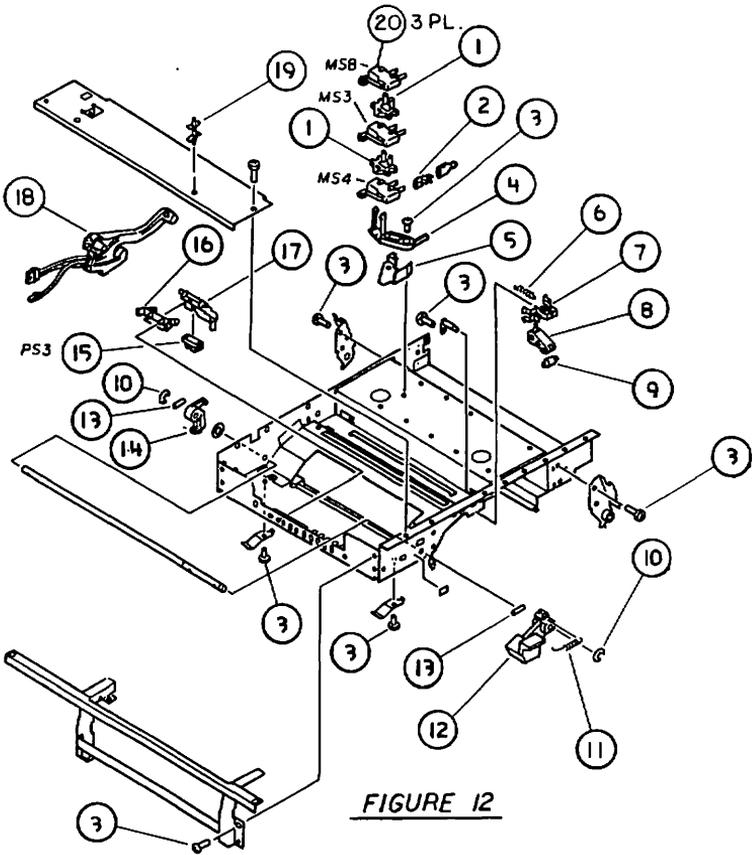
FIGURE 12

Item	Apple p/n	HP p/n	Description
1	970-1151	RA1-0739-000CN	Spacer, Microswitch
2	970-1148	X62-5370-000CN	Socket, Faston, 115V, 20-24 AWG
3	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 8mm, PN CRS REC STL ZNC
4	970-1002	RA1-0738-000CN	Bracket, Mounting, Motor Switch
5	970-1125	RA1-0718-000CN	Plate, Microswitch, Mounting
6	076-8137	FS1-2671-000CN	Spring, Tension
7	970-1105	FA2-5693-000CN	Mount, Cartridge Latch Roller
8	970-1042	FA2-5694-000CN	Arm, Cartridge Latch Roller
9	970-1135	FA2-5695-000CN	Roller, Cartridge Latch
10	076-8135	XD2-1100-502CN	Ring, E, 5.0 mm, Stainless Stl
11	076-8137	FS1-2677-000CN	Spring, Tension, Release Lever
12	970-1003	- - -	Lever, Release
13	076-8136	XD3-2200-122CN	Pin, Roll, 1.2 x 2.0mm Stainless Stl
14	970-1129	FA2-5678-000CN	Rear Latch, Upper Unit
15	970-1118	FH7-7023-000CN	Photosensor, Paper Delivery
16	970-1106	FA2-5697-000CN	Mount, Paper Dlry Sensor
17	970-1096	FA2-5696-000CN	Holder, Paper Dlry Photosensor
18	970-1067	RH2-9001-000CN	Connector, High Voltage
19	970-1165	VT2-0001-004CN	Standoff, PCB Nylon
20	705-0108	WC4-0084-000CN	Switch, Micro, Toner/Paper Cassette

J203

J204

J206

J207
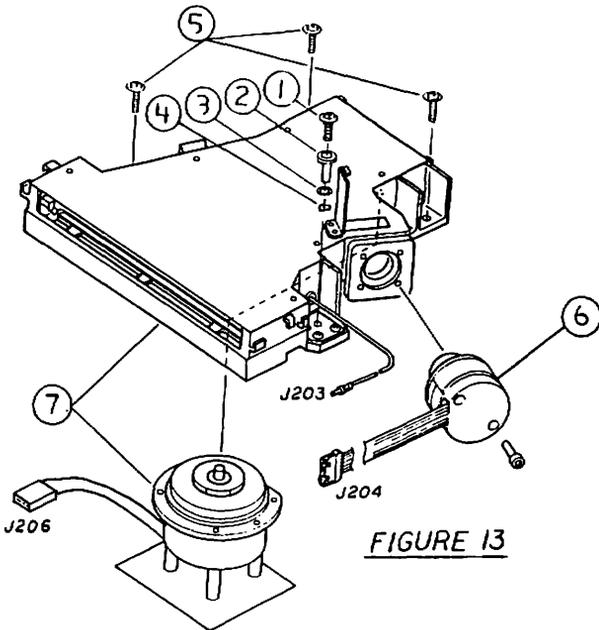
FIGURE 13

LASERWRITER - LASER/SCANNER UNIT   (Figure 13)

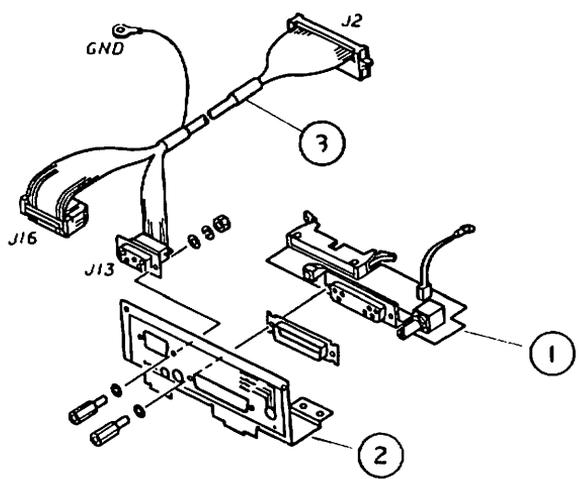| Item	Apple p/n	HP p/n	Description
1	467-5300	- - -	Scr, M 4 x .7 x 16, PN CRS Rec Stl Blk
2	955-0001	- - -	Standoff, Shldr, M 12.6 x 3.95 x 13 Stl
3	860-0243	- - -	Washer, 6.1 x 12, Brass
4	860-0460	- - -	Washer, Thrust, M 6.5 x .3 x 11, Spring Stl Blk
5	467-5301	- - -	Scr, M 4 x .7 x 12, PN CRS Rec Stl Blk
6	661-0277	RS0-0009-000CN	Laser Unit, Svc Stk
7	661-0278	- - -	Scanner Unit, 300DPI, Svc Stk

FIGURE 14

LASERWRITER - MOUNTING CONNECTOR PLATE (Figure 14)

Item	Apple p/n	HP p/n	Description
1	970-1194	- - -	Connector, I/O Assy
2	970-1184	- - -	Plate, Mounting Connector
3	970-1193	- - -	Cable, I/O
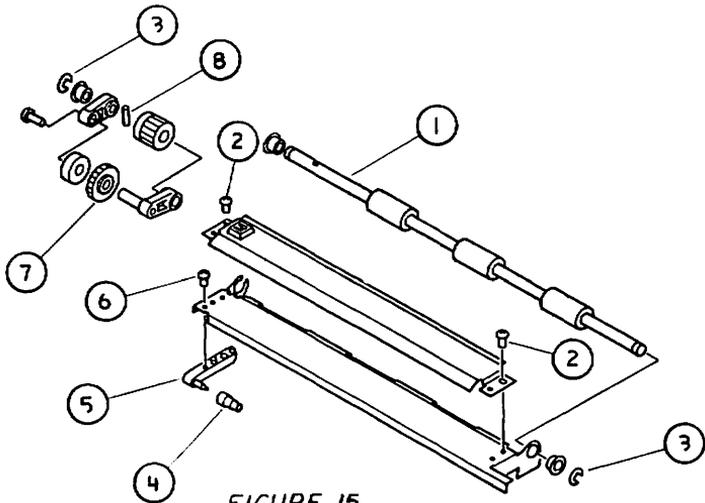
FIGURE 15

LASERWRITER - TRANSFER GUIDE ASSEMBLY, P/N 970-1149
         (Figure 15)

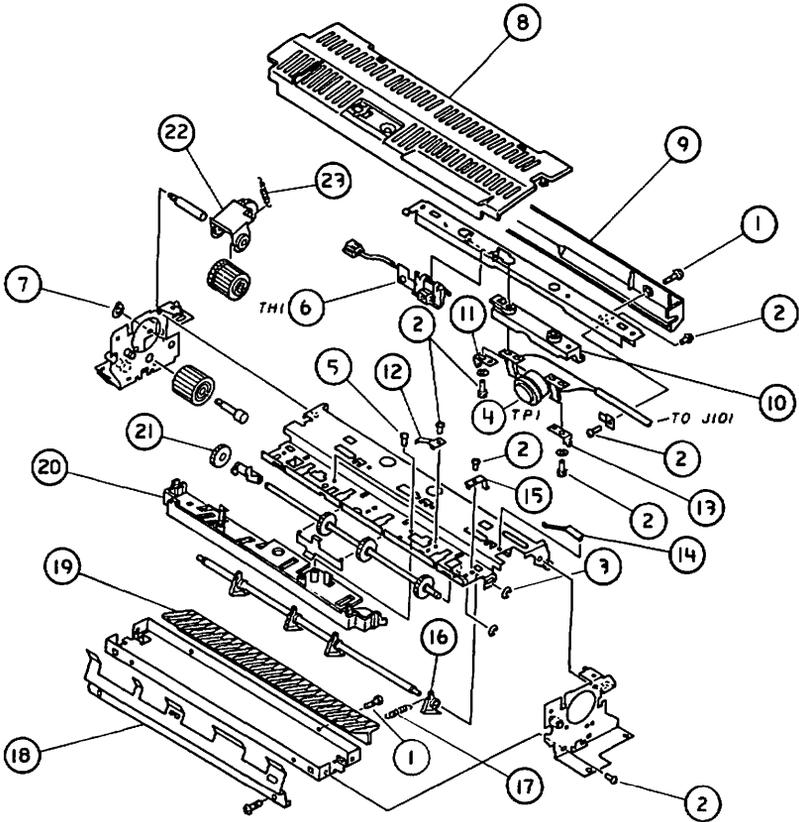| Item	Apple p/n	HP p/n	Description
1	970-1017	RA1-0968-000CN	Roller, Feed, Transfer Assy
2	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 8 mm, Pn Crs Rec Stl Znc
3	076-8135	XD2-1100-502CN	Ring, E, 5.0mm, Stainless Stl
4	970-1139	FA2-5886-000CN	Roller, Transfer Guide
5	970-1107	FA2-5885-000CN	Mount, Stud, Transfer Guide
6	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 8 mm Pn Crs Rec Stl Znc
7	076-8138	FS1-0708-000CN	Gear 20T, Manual Fd/Transfer
8	076-8136	X03-2200-122CN	Pin Roll, 1.2 x 2.0 mm, Stainless Stl

FIGURE 16

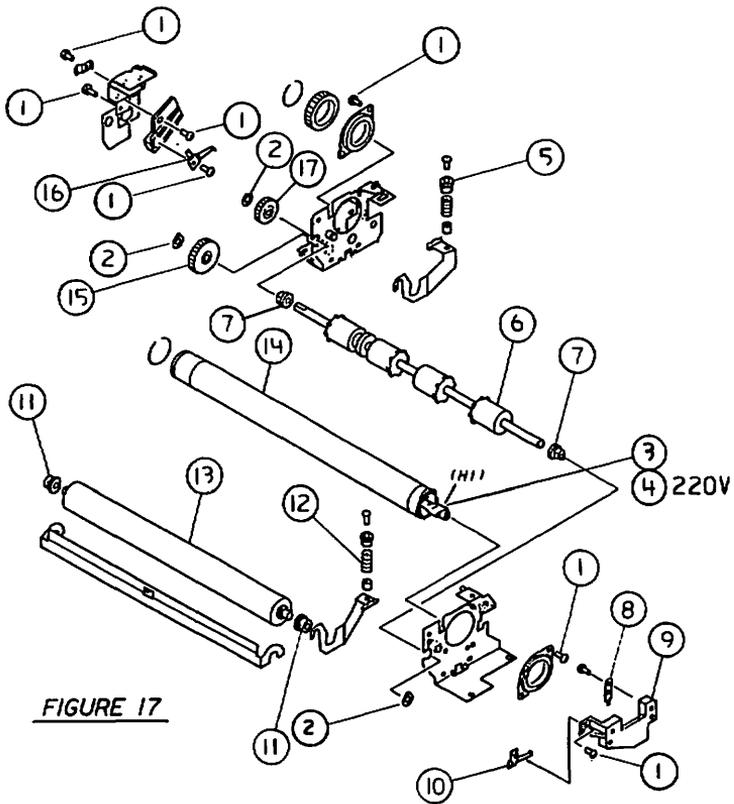| Item	Apple p/n	HP p/n	Description
1	076-8139	FA2-5970-000CN	Screw, 3 x .5 x 5 mm Truss Crs Rec Stl
2	076-8133	XB1-2300-609CN	Screw 3 x .5 x 6 mm Pn Crs Rec Stl Znc
3	076-8135	XD2-1100-402CN	Ring, E, 4.0 mm, Stainless Stl
4	720-0003	FH7-7041-000CN	Sensor, Thermal Protector, Fuser
5	076-8133	XB3-2300-809CN	Screw, 3 x .5 x 8 mm Truss Crs Rec Stl
6	107-0102	RH7-7002-000CN	Thermistor, Fuser
7	076-8135	XD2-2100-402CN	Ring, Grip, 4.0 mm, Stainless Stl
8	970-1068	FA2-6261-030CN	Cover, Upper, Fuser
9	970-1115	FA2-9823-000CN	Paper Guide, Upper Fuser
10	970-1049	FA2-9820-000CN	Bracket, Mtg, Thermo
11	076-8168	FA2-9818-000CN	Terminal, Spade, LH Thermo
12	076-8168	FA2-5959-000CN	Spring, Leaf, Fuser
13	076-8168	FA2-9819-000CN	Terminal, Spade, RH Thermo
14	076-8168	FA2-5963-000CN	Spring, Leaf, Fuser
15	076-8168	FA2-5962-000CN	Spring, Leaf, Fuser
16	970-1024	FA2-5938-000CN	Claw, Separation, Fuser
17	076-8168	FS1-2658-000CN	Spring, Separation Claw
18	970-1025	FA2-5947-020CN	Guide, Delivery, Lower Fuser
19	970-1114	RA1-0695-000CN	Paper Guide, Lower Fuser
20	970-1091	FA2-5946-000CN	Guide, Delivery, Upper Fuser
21	076-8167	FA2-5957-000CN	Roller, Exit, Fuser
22	076-8167	FF1-3532-030CN	Gear Assy, Driver, Fuser
23	076-8168	FS1-2676-000CN	Spring, Tension, Fuser

FIGURE 17

220V

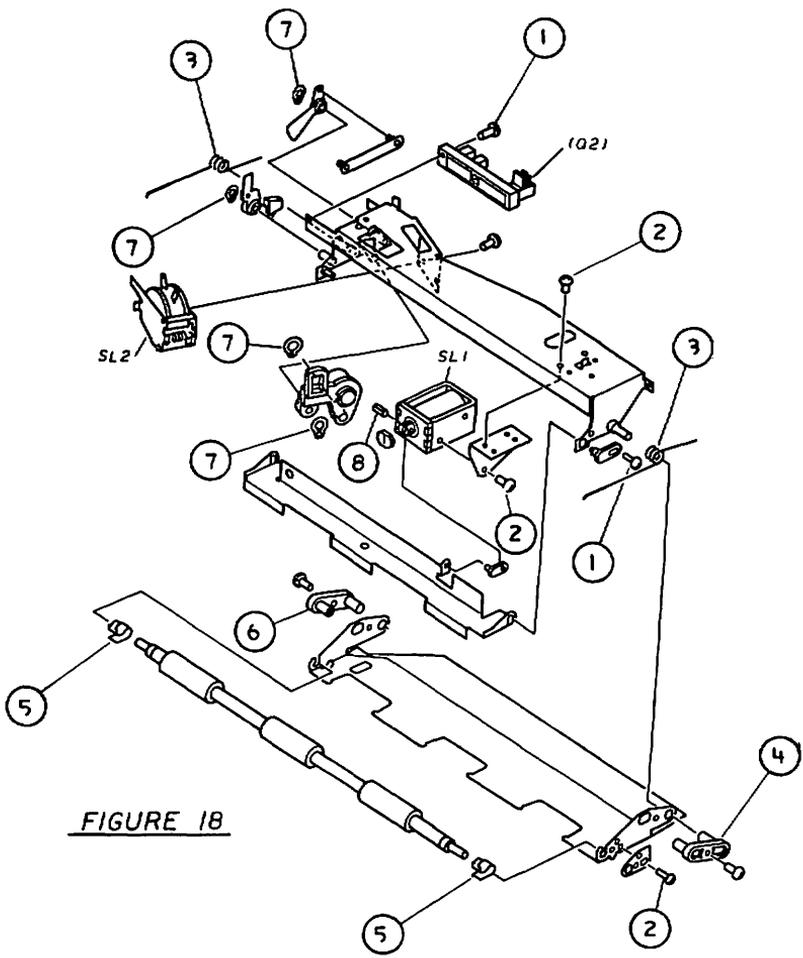| Item	Apple p/n	HP p/n	Description
1	076-8133	XB1-2300-609CN	Screw, 3 x .5 x 6 mm Pn Crs Rec Stl Znc
2	076-8135	XD2-2100-602CN	Ring Grip, 6.0 mm, Stainless Stl
3	970-1027	RH7-4007-000CN	Heater, Fuser, 115V, 500 W
4	970-1094	RH7-4009-000CN	Heater, Fuser, 220V, 570 W
5	970-1052	FA2-5955-000CN	Bushing, Fuser
6	970-1136	FA2-5939-000CN	Roller, Delivery, Rubber
7	970-1051	FS1-1205-000CN	Bushing, Delivery/Transfer
8	076-8168	FA2-5966-020CN	Terminal, Lug, Fuser Lamp
9	970-1047	FA2-5964-000CN	Bracket, Fuser, RH
10	076-8168	FA2-9824-000CN	Spring, Leaf, Fuser, RH
11	970-1050	FS1-1204-000CN	Bushing, Bronze, Fuser Roller
12	076-8168	FS1-2657-000CN	Spring, Compression, Fuser
13	970-1023	RA1-0696-000CN	Roller, Lower, Fuser
14	970-1022	RA1-0697-000CN	Roller, Upper, Fuser
15	076-8167	FS1-0716-000CN	Gear 26T, Delivery
16	076-8168	FA2-5968-000CN	Terminal, Lug, Fuser Lamp
17	076-8167	FS1-0717-000CN	Gear 19T, Idler, Fuser

FIGURE 18

LASERWRITER - REGISTRATION SHUTTER ASSEMBLY, P/N 699-0323
(Figure 18)

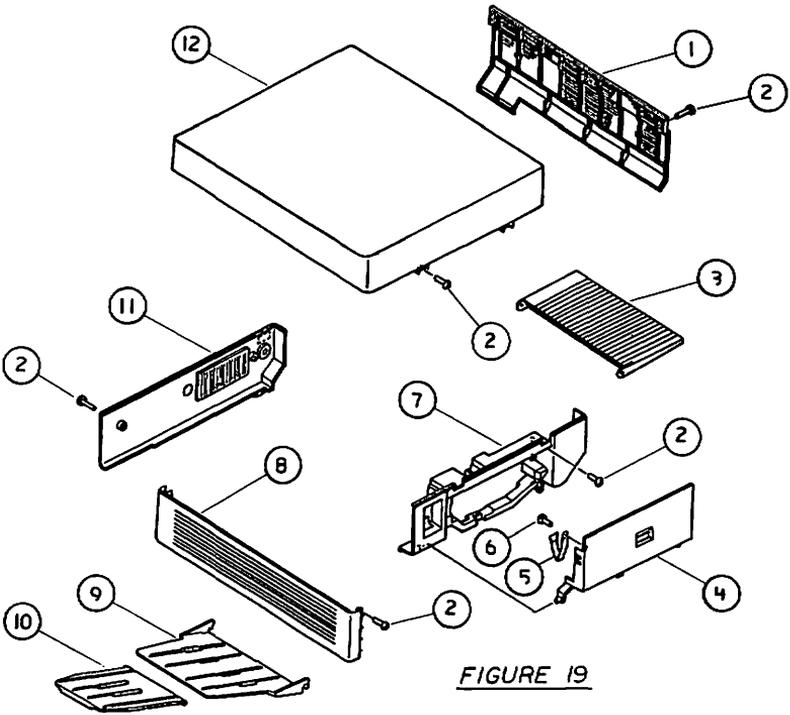| Item	Apple p/n	HP p/n	Description
1	076-8133	XB1-2300-309CN	Screw, 3 x .5 x 8 mm Pn Crs Rec Stl Znc
2	076-8139	XB1-2300-409CN	Screw, 3 x .5 x 4 mm Truss Crs Rec, Stl
3	076-8137	FS1-2659-000CN	Spring, Shutter Loading
4	076-8136	RA1-1016-000CN	Pin, Guide, Reg. Shutter
5	076-8137	FA2-5867-020CN	Spring, Registration Roller
6	076-8136	FA2-5858-020CN	Pin, Guide, Reg. Shutter
7	076-8135	XD2-2100-402CN	Ring, Grip 4.0 mm, Stainless Stl
8	076-8136	XD3-1300-802CN	Pin, Roll, 8.0 x 3.0 mm, Stainless Stl

FIGURE 19

LASERWRITER - EXTERNAL COVERS, PANELS, ETC. (Figure 19)

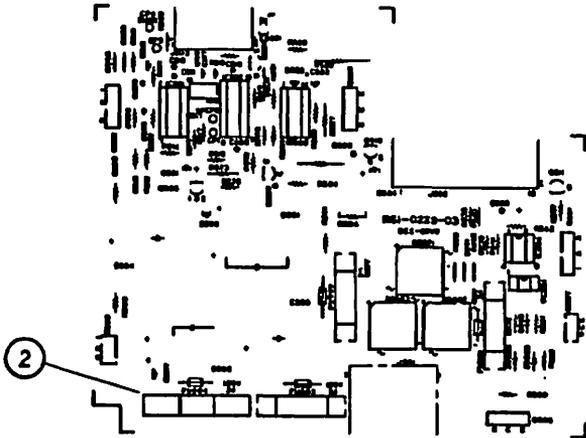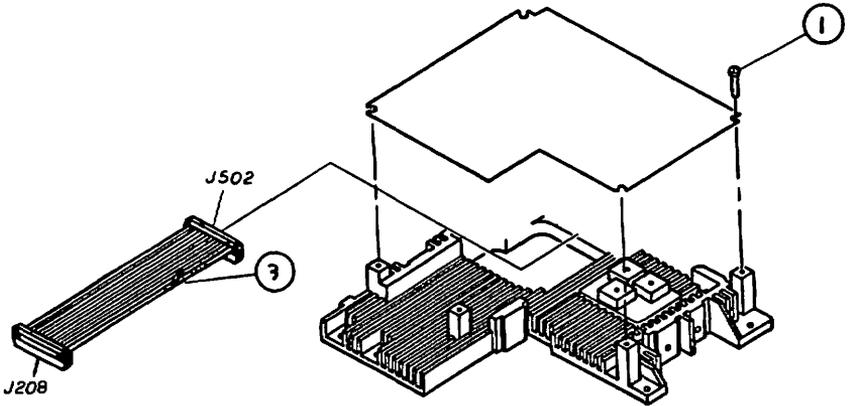| Item	Apple p/n	HP p/n	Description
1	970-1112	- - -	Panel, Right
2	076-8133	XB1-2300-609CN	Screw, 3 x .5 x 6 mm Pn Crs Rec Stl Znc
3	970-1030	- - -	Tray, Manual Paper Feed
4	970-1142	- - -	Door, Cassette
5	970-1269	FA2-6003-000CN	Strap, Cassette Door
6	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 8 mm Pn Crs Rec Stl Znc
7	970-1113	- - -	Panel, Front
8	970-1110	- - -	Panel, Left
9	970-1028	- - -	Tray, Copy
10	970-1029	- - -	Tray, Print Auxiliary
11	970-1111	- - -	Panel, Rear
12	810-0608	- - -	Cover, Top

J502

J208

FIGURE 20

LASERWRITER – DC POWER SUPPLY/MOTOR DRIVE PCB (110VAC, P/N 661-0273; 220VAC, P/N 661-0274) (Figure 20)

Item	Apple p/n	HP p/n	Description
1	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 8 mm Pn Crs Rec Stl Znc
2	740-0102	– – –	Fuse, 3 Amp, 250V, 3 AG
3	970-1190	– – –	Cable, Power, DC Controller

FIGURE 21

J503
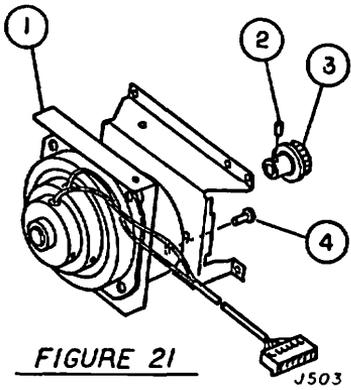
LASERWRITER - MAIN MOTOR ASSEMBLY   (Figure 21)

Item	Apple p/n	HP p/n	Description
1	970-1009	RG9-0102-000CN	Motor, Main Drive
2	076-8139	XB6-2400-508CN	Screw, Set, 4 x 5
3	970-1010	RS1-0010-000CN	Gear, 24T, Main Motor
4	076-8133	XB1-2400-809CN	Screw, 4 x .7 x 8 mm Truss Crs Rec Stl

FIGURE 22
220 V

**LASERWRITER - POWER INTERLOCK ASSEMBLY (220V)*, P/N 699-0325
(Figure 22)**

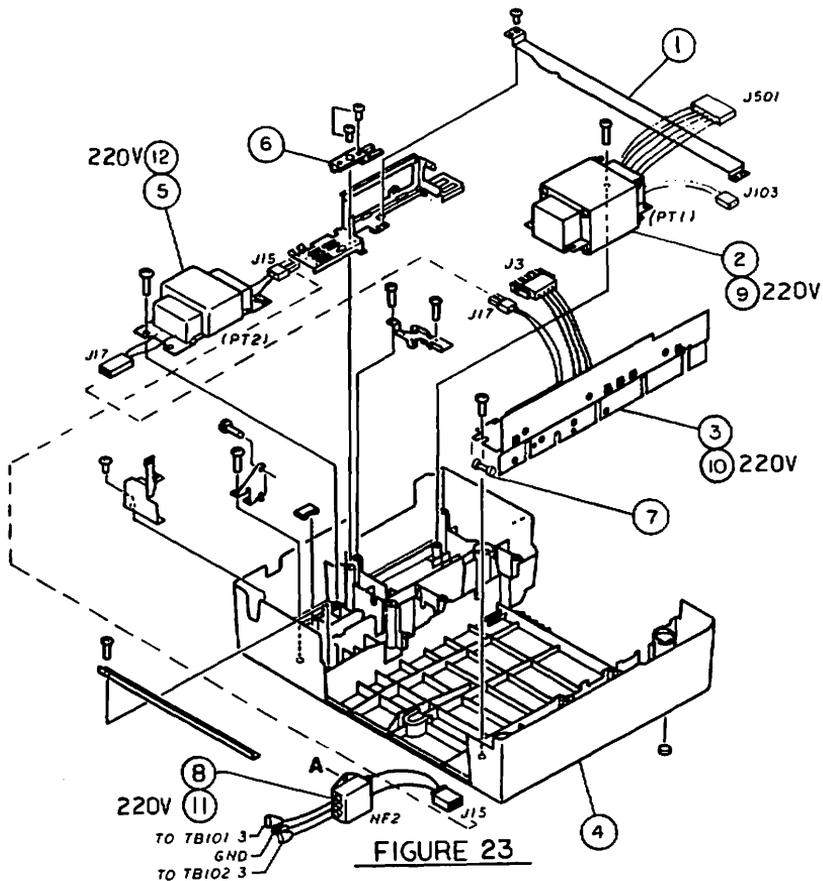| Item	Apple p/n	HP p/n	Description
1	076-8133	XB1-2300-809CN	Screw, 3 x .5 x 8mm, Pan Head
2	970-1177	- - -	Triac, AC16FIFR (220V)
3	076-8135	XD2-2100-402CN	Ring, Grip, 4.0mm, Stainless Stl
4	970-1167	- - -	Switch, Micro, 220VAC, 15A
5	970-1130	- - -	Resistor Assy, 10K ohm, 10W Ceramic
6	970-1187	- - -	Connector, Power Supply
7	705-0110	RH7-6001-000CN	Switch, Rocker, 250VAC, 20A
8	076-8149	- - -	Res Assy, 47 ohm, 5 PK
9	661-0269	RG1-0205-000	PCB, Driver, 220VAC
10	970-1143	- - -	Cover, Pwr Intlk Assy

* See Figure 5 for 110V version.

FIGURE 23

LASERWRITER - PEDESTAL ASSEMBLY (Figure 23)

Item	Apple p/n	HP p/n	Description
1	970-1141	— — —	Plate, Grounding
2	970-1273	RH3-0011-000CN	Transformer, 115VAC, 60Hz
3	661-0323	— — —	Pwr Supply, LaserWtr I/O, 110V*
4	949-0002	— — —	Cover, Bottom, LaserWriter
5	157-0050	RH3-0014-000CN	Transformer, 115VAC, 60Hz
6	970-1173	RA1-0794-000CN	Terminal, SG
7	740-0302	— — —	Fuse, 5A, 125V
8	199-0005	RF1-0190-000CN	Noise Filter, 110/115VAC, 15A
9	970-1276	— — —	Transformer, 220/240V, 50Hz
10	970-1198	— — —	PCB, Regulator I/F, 220V
11	970-1075	— — —	Noise Filter, 220VAC, 15A
12	970-1176	— — —	Transformer, 220V, 50Hz

*formerly called "Interface Regulator".
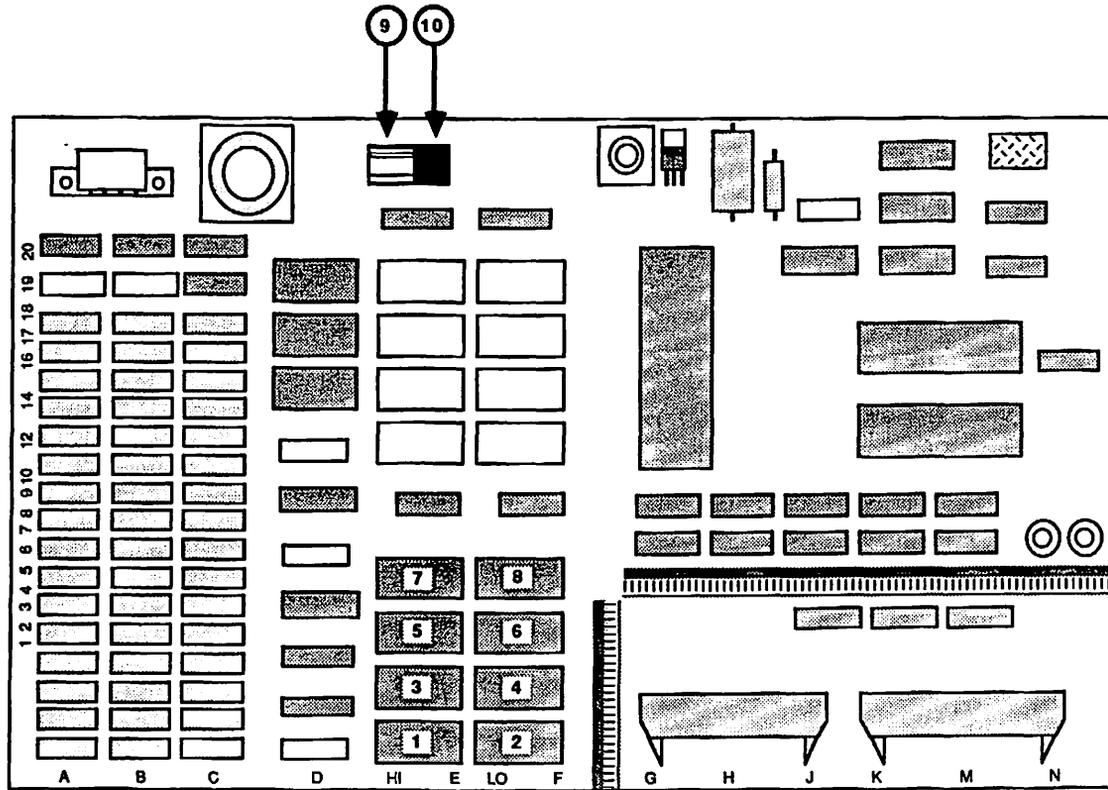
FIGURE 24

**LASERWRITER - LASERWRITER I/O BOARD WITH REV. 2 ROMS
(Figure 24)**

Item	Apple p/n	Description
1	342-0082	IC, ROM, LaserWriter Rev 2, H0
2	342-0081	IC, ROM, LaserWriter Rev 2, L0
3	342-0084	IC, ROM, LaserWriter Rev 2, H1
4	342-0083	IC, ROM, LaserWriter Rev 2, L1
5	342-0086	IC, ROM, LaserWriter Rev 2, H2
6	342-0085	IC, ROM, LaserWriter Rev 2, L2
7	342-0088	IC, ROM, LaserWriter Rev 2, H3
8	342-0087	IC, ROM, LaserWriter Rev 2, L3
9	511-1603	IC Socket, 16 pin
10	750-0102	Configuration Block, LaserWriter
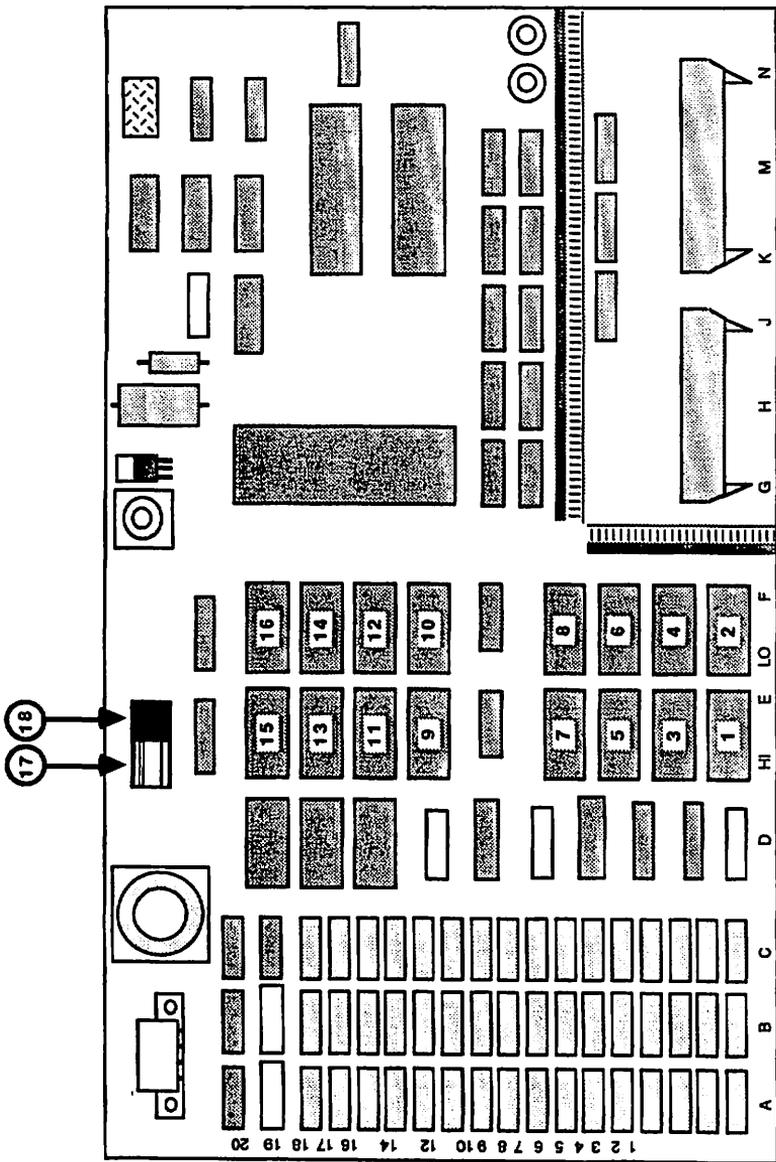
FIGURE 25

LASERWRITER - LASERWRITER PLUS I/O BOARD (Figure 25)

Item	Apple p/n	Description
1	342-0090	IC, ROM, LaserWriter Plus, H0
2	342-0089	IC, ROM, LaserWriter Plus, L0
3	342-0092	IC, ROM, LaserWriter Plus, H1
4	342-0091	IC, ROM, LaserWriter Plus, L1
5	342-0094	IC, ROM, LaserWriter Plus, H2
6	342-0093	IC, ROM, LaserWriter Plus, L2
7	342-0096	IC, ROM, LaserWriter Plus, H3
8	342-0095	IC, ROM, LaserWriter Plus, L3
9	342-0098	IC, ROM, LaserWriter Plus, H4
10	342-0097	IC, ROM, LaserWriter Plus, L4
11	342-0100	IC, ROM, LaserWriter Plus, H5
12	342-0099	IC, ROM, LaserWriter Plus, L5
13	342-0102	IC, ROM, LaserWriter Plus, H6
14	342-0101	IC, ROM, LaserWriter Plus, L6
15	342-0104	IC, ROM, LaserWriter Plus, H7
16	342-0103	IC, ROM, LaserWriter Plus, L7
17	511-1603	IC socket, 16 pin
18	750-0102	Configuration Block, LaserWriter
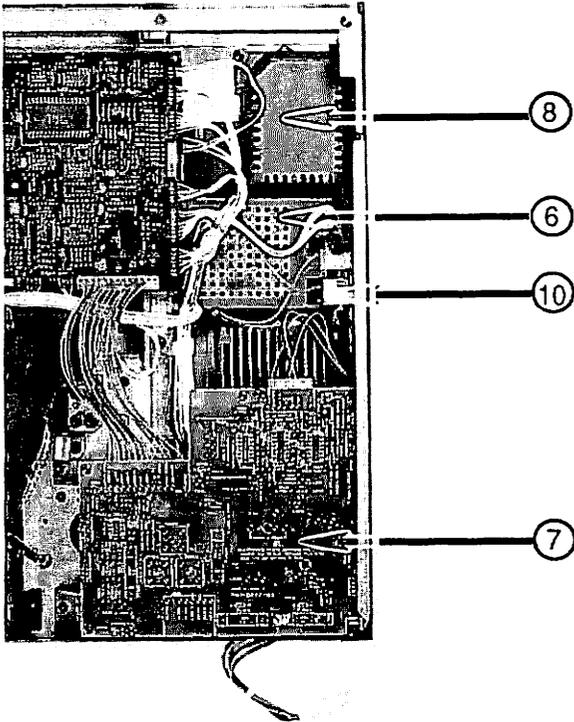
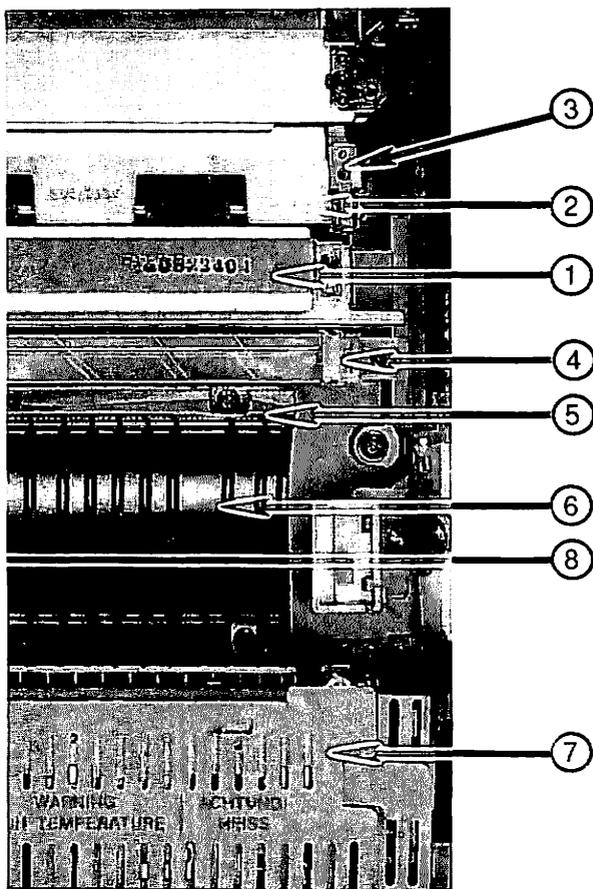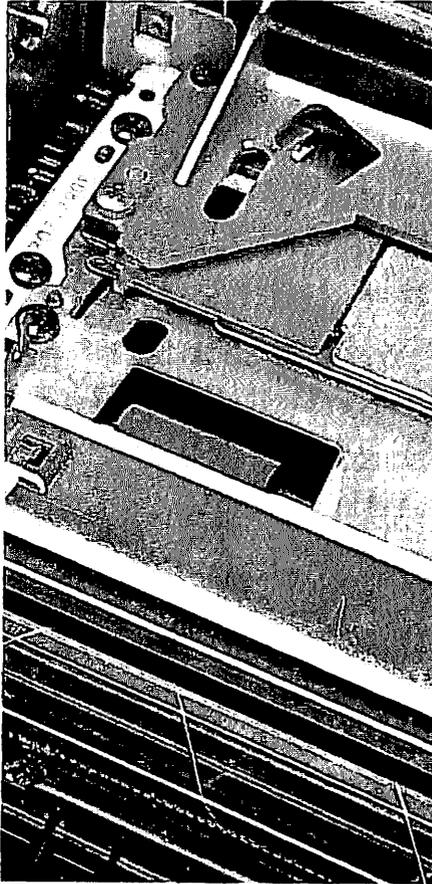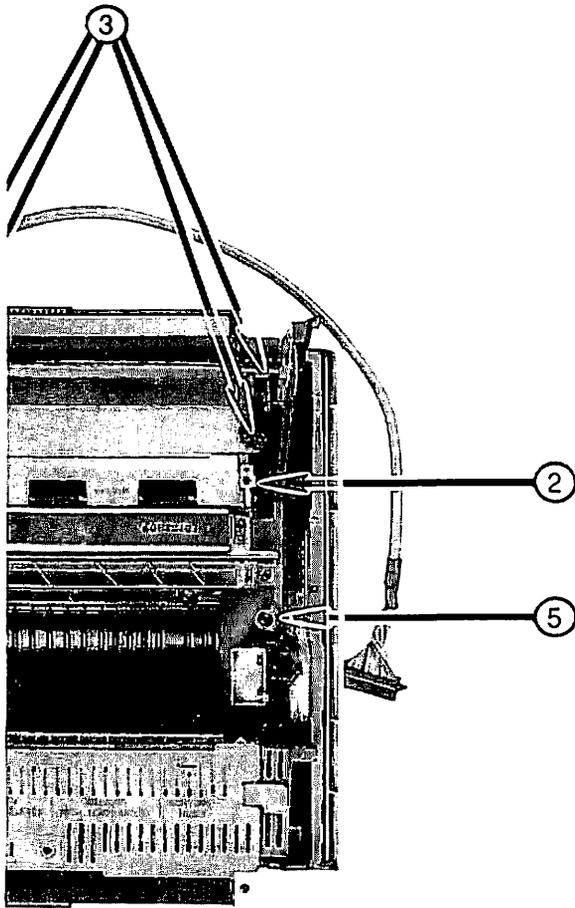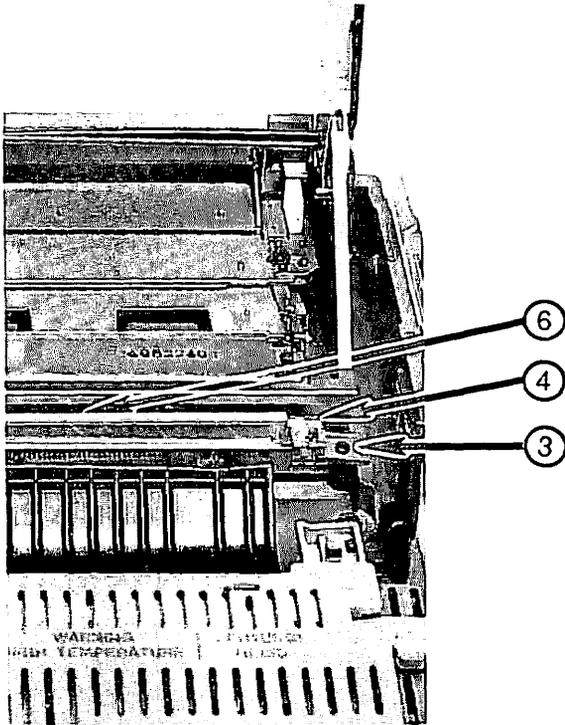·Writer with I/O Board Removed

Main Body of Printer

Body near Separation Belt

ower Main Body

wer Main Body
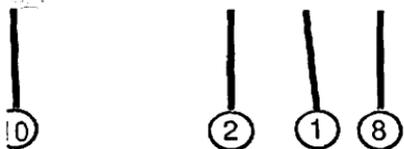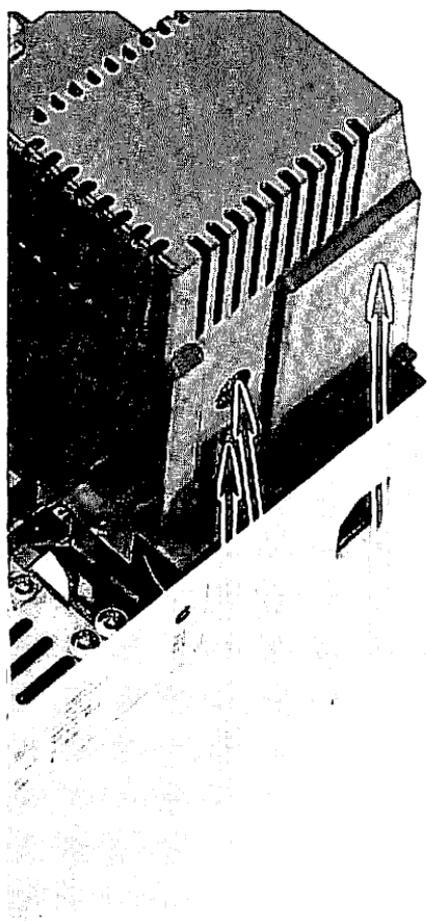
ear Corner of Printer
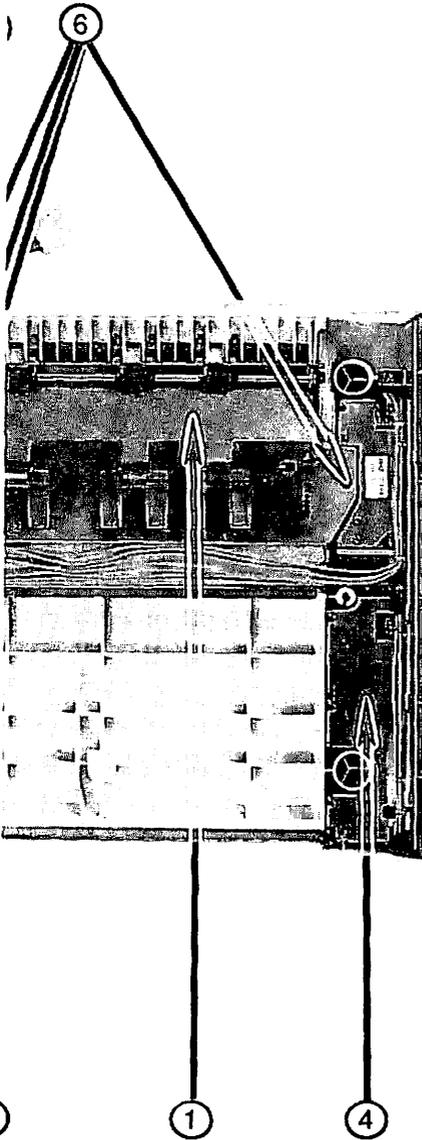
LaserWriter Pedestal

LASERWRITER PLUS TECHNICAL PROCEDURES

TABLE OF CONTENTS

LaserWriter Plus Technical Procedures

Section 1

LaserWriter Plus Kit

WARNING: This installation may involve soldering a socket
onto a four-layer board. If soldering is necessary and you
are not an experienced solder technician, do not attempt
this procedure. Call your regional Apple Support Center for
an Advance Exchange Module.

Contents:

INTRODUCTION

The LaserWriter Plus Kit features:

1 megabyte ROM   Thirty-five typeset-quality built-
                           in fonts.

New LaserWriter   Support for downloadable fonts or
Driver   customized fonts from 3rd party
                           vendors.

                           Support for printing from a 128K
                           Macintosh.

                           Compatible with Hard Disk 20.

Fractional Pixel   True screen to printer fidelity,
Width Fonts   when coupled with Macintosh Plus
                           ROMs. (This may be application-
                           dependent.)

IMPORTANT THINGS TO REMEMBER

1. Original versions of the LaserWriter I/O board can have
    either sixteen 256K ROMs or eight 512K ROMs.
    Regardless of how many ROMs are on the original board,
    you will be removing ALL the original ROMs and
    installing sixteen 512K ROMs to make a LaserWriter Plus
    configuration.

2. LaserWriter I/O boards with serial numbers above
    A545300 already have the necessary socket and the
    configuration block installed.

3. LaserWriter and LaserWriter Plus can coexist on the
    same AppleTalk network; however, **ALL users on the
    network should upgrade at the same time to the new
    printer software that is included in the LaserWriter
    Plus Kit.**

4. Be sure to follow the ESD Prevention rules on the next
    page during installation.

ELECTROSTATIC DISCHARGE PREVENTION

ESD (Electrostatic Discharge) can cause severe damage to sensitive microcircuits. Just touching a chip or brushing it with a nylon sleeve can degrade a circuit so that it never performs again to specifications. Some microcircuits are sensitive to as little as 500 volts, or about one-sixth as much static electricity as you can feel.

Certain preventive measures must be taken to avoid ESD damage to the new LaserWriter Plus ROMs. When you are unwrapping, installing, or replacing these or any other microcircuits, observe the following precautions:

BEFORE HANDLING BOARDS OR ROMs, GROUND YOURSELF!

Wear a grounding wriststrap and attach it to your work-bench pad. The pad must then be grounded to a workbench that is grounded to the building's ground.

GROUND THE LASERWRITER TO THE SAME POTENTIAL YOU HOLD.

Place the UNPLUGGED LaserWriter on the grounded work-bench pad and connect the ground pin of the power cord to the workbench pad via an alligator clip.

USE ANTI-STATIC BAGS FOR CARRYING BOARDS AND ROMs.

Whenever the ROMs or board are to be stored or moved, first put them in antistatic bags. Be sure to touch the bags before touching the ROMs.

HANDLE ROMs BY THE BODY, NOT THE LEADS.

You may safely touch the leads only if you are grounded.

DO NOT WEAR POLYESTER CLOTHING OR BRING PLASTIC, VINYL, OR STYROFOAM INTO THE AREA.

The static field around these materials cannot be removed.

DO NOT PLACE BOARD OR ROMs ON ANY METAL SURFACE.

Place them on the grounded workbench pad or on antistatic or nonconductive foam.

INSTALLATION PROCEDURES

The LaserWriter Plus Kit contains sixteen 512K ROMs, a new socket and configuration block, a new label for the LaserWriter case, a new manual, and two diskettes. Original versions of the LaserWriter board have either sixteen 256K ROMs or eight 512K ROMs. Regardless of how many ROMs are on the original board, you will be removing ALL the original ROMs and installing a configuration block.

NOTE: LaserWriter I/O boards with serial numbers above A545300 already have the socket and configuration block installed.

Before beginning the installation, plug in the LaserWriter to make sure it produces its automatic test print. Follow the steps on the next page.
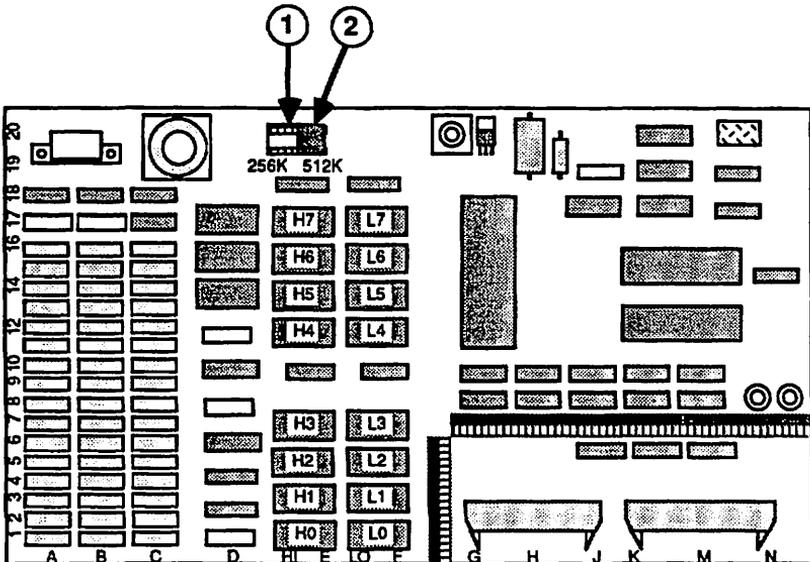

FIGURE 1

1. **READ THE RULES FOR ESD PREVENTION BEFORE BEGINNING!**

    The LaserWriter ROMs are sensitive and expensive
    microcircuits. Electrostatic discharge can ruin them.
    For trouble-free installation, follow all ESD
    prevention rules.

2. Turn off and unplug the LaserWriter. Then, to be sure
    you and the LaserWriter are grounded to the same
    potential, set up your grounded workstation and attach
    yourself (via wriststrap) and the LaserWriter (via
    alligator clip) to the grounded workbench pad.

3. Remove the top cover of the LaserWriter and the card
    cage cover. Disconnect the cables attached to the I/O
    board and remove the board from the card cage. Place
    the I/O board on the grounded workbench pad. Orient the
    board so that it appears as in Figure 1. (Refer to the
    LaserWriter Technical Procedures, Section 2, Take-Apart
    for detailed safety and take-apart information.)

4. Using an IC extractor, carefully remove the original
    ROMs from rows E and F on the I/O board and place them
    on the grounded workbench pad. (There may be eight or
    sixteen original ROMs. Remove them all.)

5. The upgrade kit includes a 16-pin socket that you must
    solder at position E-20 (See Figure 1, #1) if the
    socket is not present. To install the socket, follow
    the directions below:

    a. Desolder and discard the four jumper wires present
        at the socket location.
    b. Desolder (clear) all sixteen holes at the socket
        location.
    c. Install the socket (on the component side of the
        board) so that the sixteen pins of the socket match
        the sixteen holes on the board. Solder all pins.

6. Install the configuration block (see Figure 1, #2) into
    the right eight holes of the socket (labeled "512K").
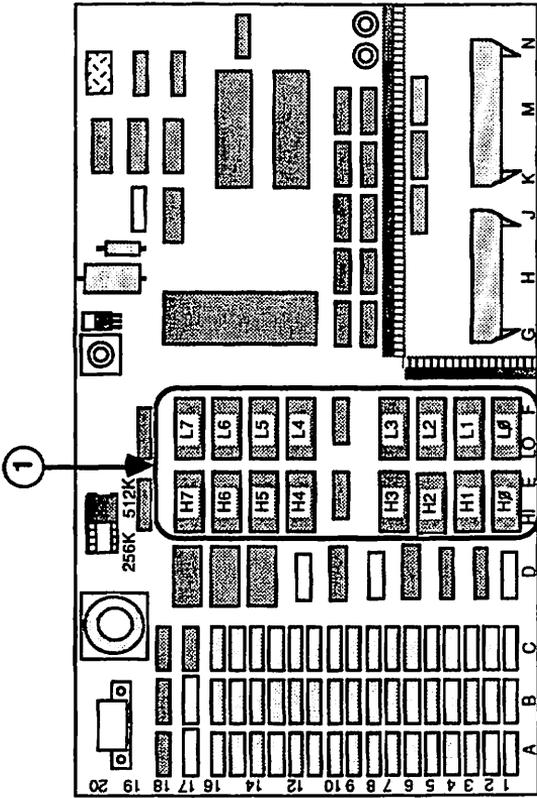

CONTINUED ON NEXT PAGE

FIGURE 2

7. Look at the markings on each new ROM. At the end of
   the third line of print, you will see one of the
   following markings:

   HØ, H1, H2, H3, H4, H5, H6, or H7 (H = High side)
                           OR
   LØ, L1, L2, L3, L4, L5, L6, or L7 (L = Low side)

   The corresponding locations are marked on the board.

8. One at a time, carefully remove the new ROMs from their
   antistatic pad, handling them by the body, not the
   leads. Match the markings on the ROMs with the
   appropriate socket (see Figure 2, #1). Install the
   ROMs. Make sure you install the ROMs so that the notch
   along the edge of each ROM is on the left.

   **MAKE SURE THE ROM PINS ARE PLACED CORRECTLY IN THE
   SOCKET.** If a ROM is installed one pin off from the
   socket, or with a pin bent, the LaserWriter will not
   work.

9. Place the old ROMs in the kit packaging to return to
   Apple for credit. The LaserWriter Plus Return Form,
   included in the kit, must be used when returning the
   old LaserWriter ROMs for credit.

10. Replace the I/O board, the card cage cover, and the top
    cover of the printer. Attach the LaserWriter Plus
    label just below the serial number plate on the back of
    the printer.

11. Power on the LaserWriter Plus. It should produce its
    test print within two minutes.

    If it does not, check to see that the ROMs are properly
    installed.

    If it still doesn't produce the test print, run the
    built-in diagnostics as described in **Section 2,
    LaserWriter Plus Diagnostics.** This procedure will
    narrow it down to specific ROMs. Exchange any ROMs
    specified by the built-in diagnostic.

    If it still doesn't produce the test print, replace all
    the ROMs with ROMs from a new LaserWriter Plus Kit.

    When a good test print is produced, leave the printer
    on overnight.

12. The next day, test the LaserWriter Plus with a
    Macintosh using the following steps:

    a. Connect the LaserWriter Plus to the Macintosh using
        AppleTalk cables.

    b. Switch on the LaserWriter Plus and wait two minutes
        for a test page.

    c. Be sure the Macintosh is switched off. Then insert
        the Printer Installation Disk into the disk drive
        and switch on the Macintosh.

    d. Open the disk icon, if it is not already open.

    e. Choose **Control Panel** from the **Apple** menu and click
        the **AppleTalk Connected** button if it is not already
        selected.

    f. Close the **Control Panel**.

    g. Choose **Chooser** from the **Apple** menu. Click on the
        LaserWriter icon as the printer type.

        When the LaserWriter's name appears, select the
        name by clicking on it.

    h. Close the **Chooser**.

    i. Choose **Print Catalog** from the **File** menu.

    j. Click **OK** or press **<RETURN>** in the print dialog box.

    h. When the document has been printed, eject the
        Printer Installation diskette.

LaserWriter Plus Technical Procedures

Section 2

Diagnostics

Contents:

INTRODUCTION

The LaserWriter Plus has on-board diagnostics which verify
that the ROMs on the board are good. This procedure will
explain what equipment is needed to access the built-in
diagnostics, how to access them, and how to interpret the
results you receive.

EQUIPMENT REQUIRED

Macintosh or Macintosh Plus
ImageWriter Cable for the Macintosh or Macintosh Plus
MacTerminal diskette
LaserWriter Plus

IMPORTANT THINGS TO REMEMBER

1. An ImageWriter cable for the Macintosh or a Macintosh
    Plus with an adapter cable must be used.

2. The mode selection switch on the rear of the
    LaserWriter Plus does not need to be set to anything in
    particular for the built-in diagnostics to run.

3. The built-in diagnostics check ONLY the ROMs and work
    ONLY on the LaserWriter Plus or on the LaserWriter with
    eight 512K ROMs.

4. If a ROM is indicated as bad, exchange the ROM. Do not
    exchange the entire board.

5. If ROMs H0 and L0 are bad, a solid failure (no test
    print and/or internal diagnostics do not run) will
    occur.

6. If a completely dead ROM is on the I/O board a solid
    failure (no test print and/or internal diagnostics do
    not run) will be seen.

RUNNING THE BUILT-IN DIAGNOSTICS

1. Set up the Macintosh or a Macintosh Plus with adapter cable.

2. Connect the ImageWriter cable from the printer port on the rear of the Macintosh to the RS232 connector on the LaserWriter. The setting switch on the back of the LaserWriter Plus does not need to be changed.

NOTE: DO NOT TURN ON THE LASERWRITER PLUS UNTIL INSTRUCTED TO DO SO.

3. Insert the MacTerminal diskette into the internal drive on the Macintosh or Macintosh Plus.

4. Open the MacTerminal diskette icon. Open a MacTerminal document.

5. Pull-down the **Settings** menu and select **Compatibility**.

6. Set the settings by clicking once in the appropriate circle. The settings that should be selected are shown below.

```
┌────────────────────────────────────────────┐
│ Compatibility Settings                     │
│                                            │
│ Baud Rate  ○ 50    ○ 75    ○ 110   ○ 134.5 │
│            ○ 150   ○ 200   ○ 300   ○ 600   │
│            ◉ 1200  ○ 1800  ○ 2000  ○ 2400  │
│            ○ 3600  ○ 4800  ○ 9600  ○ 19200 │
│                                            │
│ Bits per Character  ○ 7 Bits   ◉ 8 Bits    │
│                                            │
│ Parity      ○ Even  ○ Odd  ◉ None          │
│                                            │
│ Handshake   ◉ XOn/XOff  ○ None             │
│                                            │
│ Connection  ○ Modem     ◉ Another Computer │
│                                            │
│ Connection Port  ○ 📞  ◉ 🖨  ( OK ) (Cancel)│
└────────────────────────────────────────────┘
```

7. Turn on the LaserWriter Plus.

   The MacTerminal screen will scroll and display a number. See the next page for interpretation.
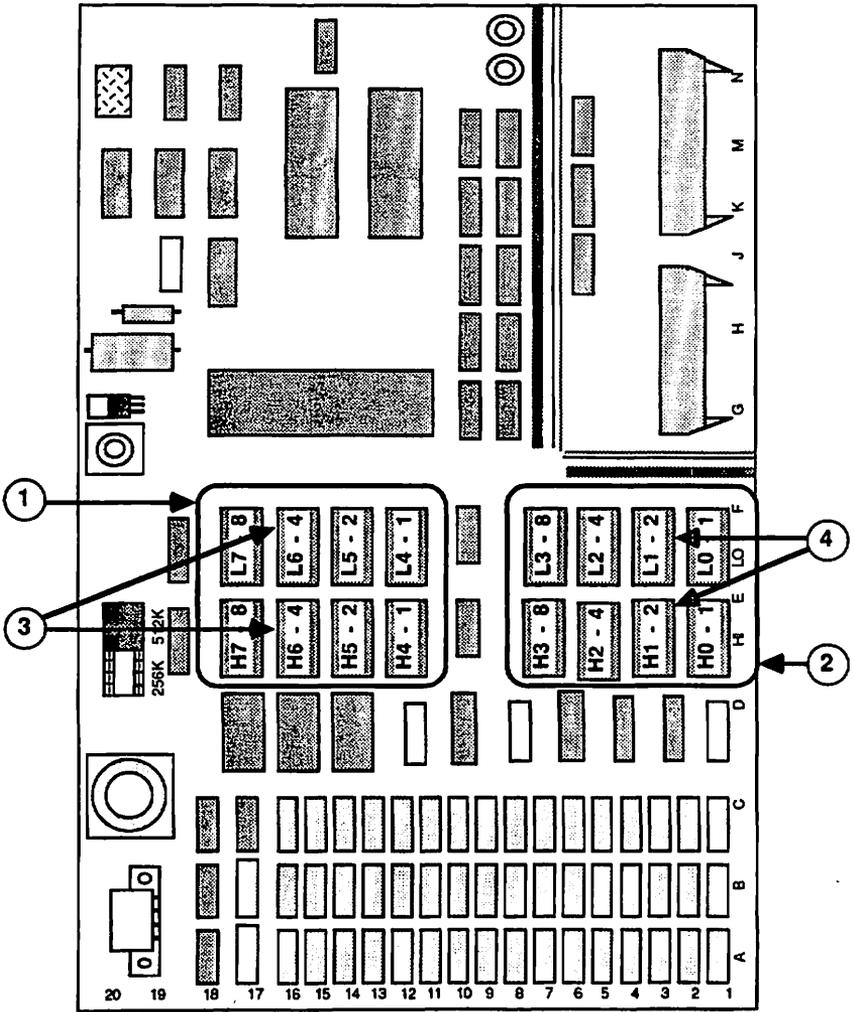
FIGURE 1

INTERPRETATING THE RESULTS

The MacTerminal screen will scroll and display the results in the following format: **XXXXXXTB**. The **XXXXXX** can be ignored.

If **T** > **Ø** an error was encountered in the top or upper bank of ROM (see Figure 1, #1).

If the **B** > **Ø** an error was encountered in the bottom or lower bank of ROM (see Figure 1, #2)

The value of **T** or **B** indicates which pair of ROMs may be bad. Figure 1 shows the values of the error codes next to the numbers of the ROMs.

For example, if you received the error XXXXXX4Ø the position of the "4" (corresponding to the **T**) in the error code indicates an error occurred in the top bank (see Figure 1, #1). The value "4" indicates which ROMs in the top bank may be bad. In this example, the indicated ROMs are H6 or L6 (see Figure 1, #3).

If you received the error XXXXXXØ2 the position of the "2" (corresponding to the **B**) in the error code indicates an error occurred in the bottom bank (see Figure 1, #2). The value "2" indicates which ROMs in the bottom bank may be bad. In this example, the indicated ROMs are H1 or L1 (see Figure 1, #4).

When you have determined where the error took place, exchange the ROMs one at a time, and rerun the built-in diagnostics. When the error has been corrected, both **T** and **B** will have the value of **Ø**.

LaserWriter Plus Technical Procedures

Section 3

Troubleshooting

Contents:

LASERWRITER PLUS TROUBLESHOOTING

The LaserWriter Plus has built-in diagnostics which allow you to verify that the ROMs installed on the I/O board are good. If the LaserWriter has the new ROMs, and the following symptoms are displayed, run the built-in diagnostics:

Green test light is blinking

If a ROM is designated as bad, exchange the ROM(s) and rerun the built-in diagnostics.

If the first two ROMs (HØ and/or LØ) are bad, the LaserWriter Plus will display a green test light which is on steadily.

If exchanging ROMs does not solve the problem, go to the **LaserWriter Technical Procedures, Section 4, Troubleshooting** and follow the procedure given.
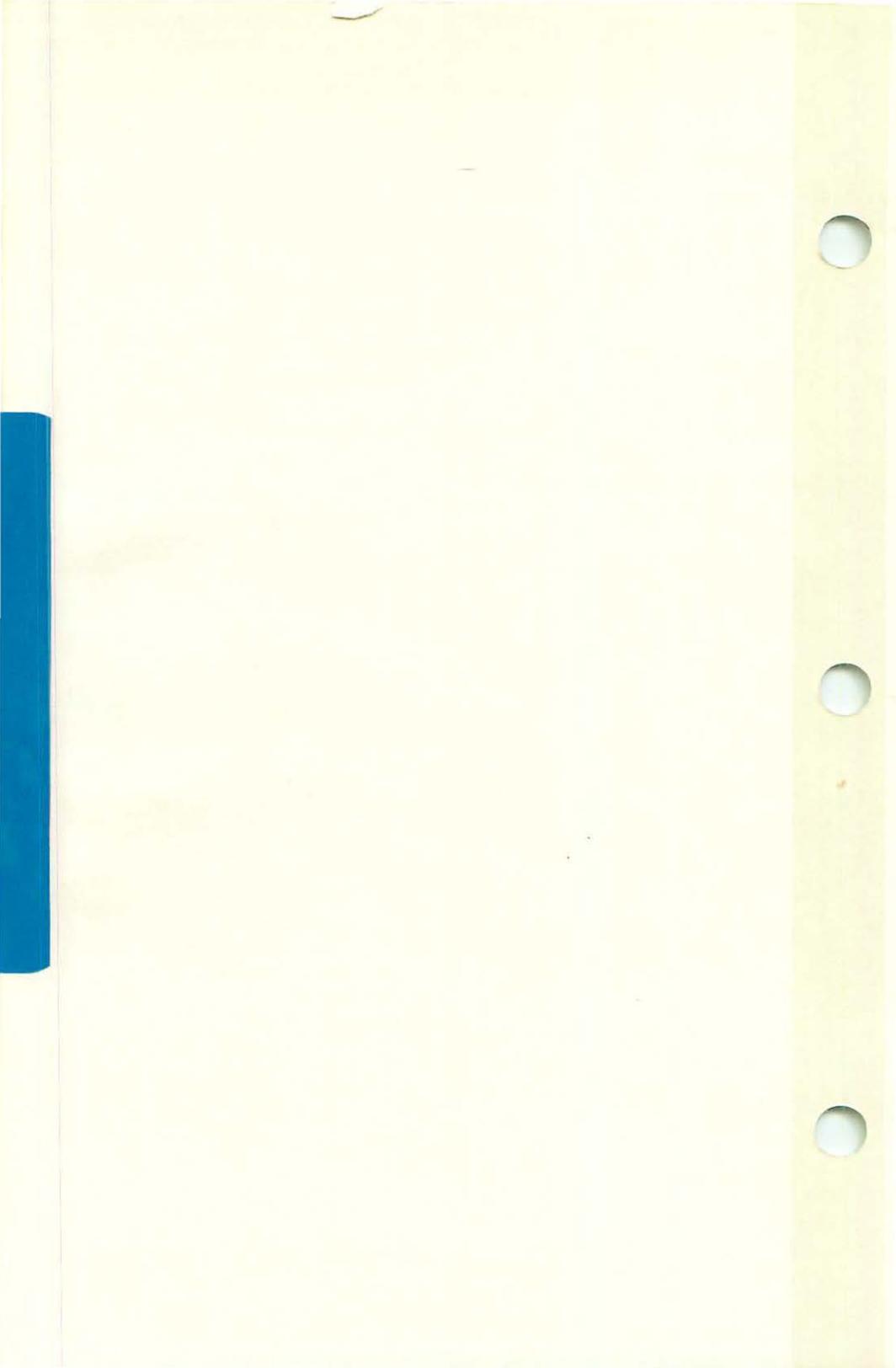
MACINTOSH OFFICE (APPLETALK)
TECHNICAL PROCEDURES

TABLE OF CONTENTS

Section 1: Macintosh Office Troubleshooting

Section 2: NetCheck

Appendix A: AppleTalk Hardware Description

MACINTOSH OFFICE (APPLETALK)
TECHNICAL PROCEDURES

SECTION 1

Macintosh Office Troubleshooting

Contents:

MACINTOSH OFFICE TROUBLESHOOTING GUIDE

To Troubleshoot Your Macintosh™ Office:

(A) Collect the Following Items:

AppleTalk Installation Guide
LaserWriter (Owner's) Manual
2 Known Good LaserWriter Test Disks
AppleTalk™ Personal Network Components

(B) Familiarize Yourself With AppleTalk Components.

Refer to the Appendix to make sure you can identify the
AppleTalk Personal Network components.

(C) Draw a Node Location Diagram.

In order to isolate a problem to a particular node or
connection, you need to know where each node is located
in relation to the LaserWriter printer.

If you don't have an accurate diagram, turn
the page and follow the directions.

If you already have an up to date diagram,
then go to (D) "Perform the Troubleshooting Procedure".

NODE LOCATION DIAGRAM

GOES TO 3 GOES TO 1 GOES TO LW

GOES TO 2 GOES TO 2 GOES TO LW

AVERY
3

DAVID
2

FRED
1

LASERWRITER

GOES TO 3A GOES TO 1A GOES TO LW

GOES TO 2A GOES TO 2A

AVERY
3A

DAVID
2A

FRED
1A

GOES TO 1B

LASERWRITER

GOES TO 1B

GOES TO 3B GOES TO 1B

GOES TO 2B GOES TO 2B GOES TO LW

ED
3B

JUDI
2B

JOHN
1B
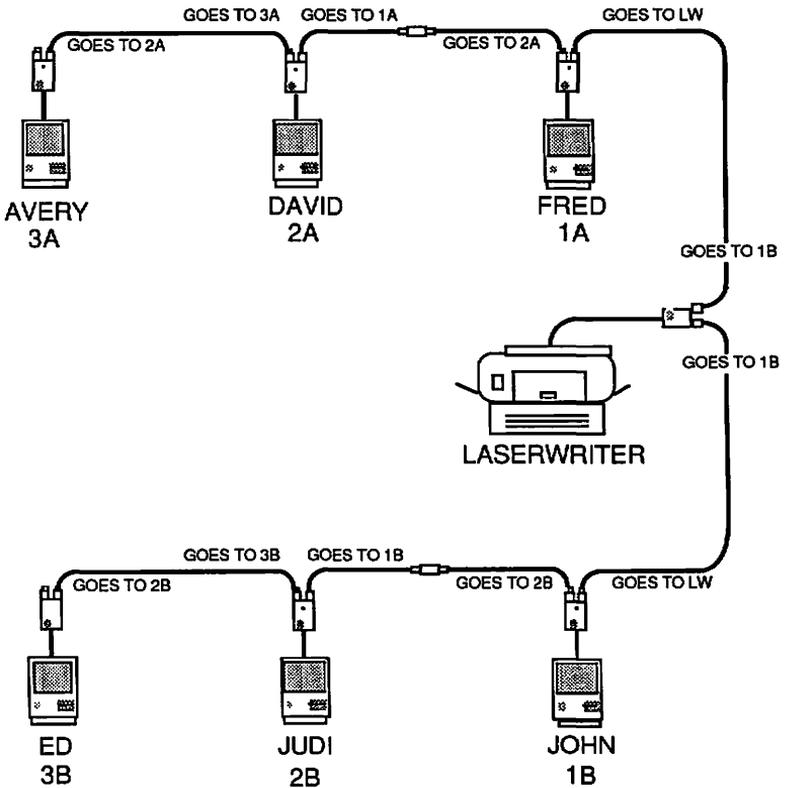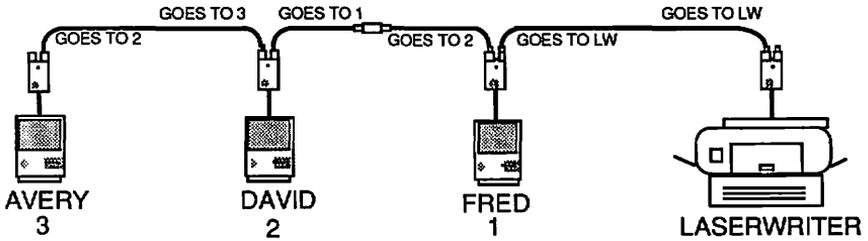
Ⓒ Draw a Node Location Diagram. (continued)

A *node* is an AppleTalk connector and the device attached to it (Macintosh, Macintosh XL, LaserWriter, etc.).

A *Node Location Diagram* is a drawing of a Macintosh Office installation showing the location of all the devices on the network (Macintoshes, file servers, LaserWriters, etc.).

1. Number each node according to its sequence away from the LaserWriter (see the illustration on the opposite page).

If the LaserWriter is somewhere in the middle of the network, number one side 1A, 2A, 3A etc. and the other side 1B, 2B, etc.

Distances are not important for the diagram.
The main reason for the diagram is to show which node is the first one connected to the LaserWriter, which is second, etc., and where the cable extenders are located.

2. Label all of the connector boxes in the network with their respective node numbers.

3. Label the plugs on both ends of every network cable with the node to which the cable leads (see the illustration on the opposite page).

Go to Ⓓ "Perform the Troubleshooting Procedure".

Ⓓ Perform the Troubleshooting Procedure.

IMPORTANT:

You need to know that:

1. A _node_ is an AppleTalk connector and the device attached to it (Macintosh, LaserWriter, etc.).

A _network bus_ is the entire connected length of network cables and connection boxes.

2. Troubleshooting may interfere with the customer's use of the network -- so, if possible, perform this procedure when there is little or no activity (for example, at lunch time or after work).

3. Each troubleshooting procedure is made up of flowcharts. If you have a question about one of the steps in a flowchart, you can find an explanation of that step on the opposite page.

4. As you perform this procedure, connect just one LaserWriter at a time to the network. If no trouble is found, disconnect the LaserWriter just tested, connect the next one, and reperform the troubleshooting procedure. Continue this process until all LaserWriters have been tested.
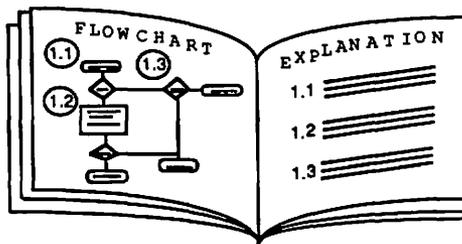
Find the Proper Flowchart.

AppleTalk network problems become apparent when attempting to print to the LaserWriter. These printing problems may present themselves in a variety of ways. They may be seen on a node computer as a system error message, system hang, constantly running disk drive, etc.

On the following page, determine which symptom best describes the problem. Then perform the suggested procedure.
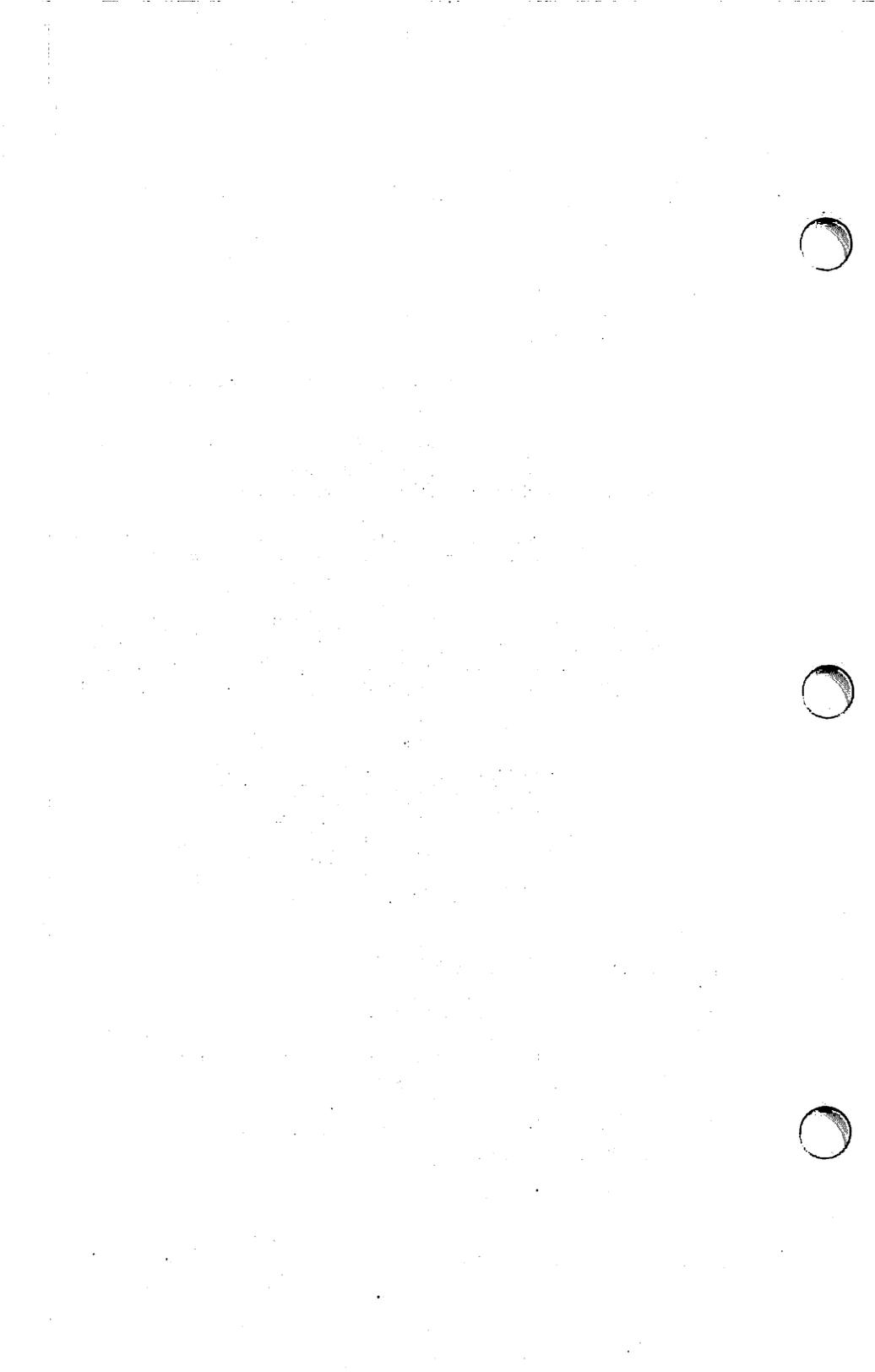
SYMPTOM: Problems Printing to a LaserWriter Due To Installation Error.

Mistakes made during installation include:
- Connecting the AppleTalk Network cable so that it forms a closed loop (circular network).
- Not terminating the network cable into a connection box (dangling cable).
- Starting up an AppleTalk device before connecting it to the network.

If you have problems with a recently installed network, refer to the Troubleshooting section in the *AppleTalk Installation Guide*.

SYMPTOM: Only One Node Has Problems Printing to the LaserWriter.

This problem is usually caused by a loose connection but could be a malfunctioning computer. Go to the ONE NODE flowchart.

SYMPTOM: Two or More, But Not All Nodes Have Problems Printing to the LaserWriter.

This problem is usually a result of:
- Starting up AppleTalk on a device before connecting it to the Network OR
- A disconnected or broken network cable.

Go to the TWO OR MORE, BUT NOT ALL flowchart.

SYMPTOM: All Nodes on the Network Have Problems Printing to the LaserWriter.

This problem condition is usually a result of:
- A malfunctioning LaserWriter printer OR
- An Improperly terminated network cable (broken or not terminated into a connection box) OR
- A malfunctioning node putting electronic noise on the AppleTalk network cable.

Go to the ALL NODES flowchart.

ONE NODE

1.1

1. CHECK THAT THE NETWORK CABLES ARE FIRMLY
   INSERTED INTO THE BAD NODE'S CONNECTOR MODULE.

2. a. *IF THE COMPUTER IS A MACINTOSH:*
   (1) CHECK THAT THE CABLE FROM THE APPLETALK
       CONNECTOR IS FIRMLY INSERTED
       INTO THE PRINTER PORT.

   (2) TURN OFF THE MACINTOSH, LOAD THE LASERWRITER
       TEST DISK, THEN TURN THE MACINTOSH BACK ON.

   b. *IF THE COMPUTER IS A MACINTOSH XL:*
   (1) CHECK THAT THE APPLETALK CONNECTOR
       IS FIRMLY INSERTED INTO PORT B.

   (2) START UP MACWORKS.

   (3) INSERT THE LASERWRITER TEST DISK.

3. PRINT THE LASERWRITER TEST DOCUMENT.
      (SEE COMMENTS 1 AND 2)

═══ C O M M E N T 1 ═══
THE LASERWRITER TEST DISK IS A KNOWN
GOOD PRECONFIGURED PROGRAM WHICH
ELIMINATES DISK CONFIGURATION AS A
POSSIBLE PROBLEM.

═══ C O M M E N T 2 ═══
PRINTING PROBLEMS CAN BE INDICATED BY
A SYSTEM ERROR MESSAGE, CONSTANTLY RUNNING
DISK DRIVE, SYSTEM HANG, ETC.

═══ C O M M E N T 3 ═══
IF THE NODE PRINTS CORRECTLY WITH THE
TEST DISK, THE HARDWARE MUST BE OK.
THE CONFIGURATION OF THE ORIGINAL DISK
SHOULD NOW BE CHECKED SINCE IT MAY HAVE
BEEN THE CAUSE OF THE PROBLEM.

1.2

TEST PRINT OK ?
(SEE COMMENT 2) → **N** → REPLACE THE APPLETALK CONNECTOR
THEN RETRY THE PRINT.

↓ **Y**

REFER TO THE LASERWRITER OWNER'S
MANUAL TO CHECK THE CONFIGURATION
OF THE APPLICATION DISK USED WHEN
THE PROBLEM WAS ENCOUNTERED
        (SEE COMMENT 3).

TEST PRINT OK ? → **N** → REPLACE THE NODE'S
COMPUTER. REFER TO
THE APPROPRIATE LEVEL 1
TECHNICAL PROCEDURE
TO REPAIR THE COMPUTER.

↓ **Y**

EXIT

Explanation for the ONE NODE Flowchart

1.1   This procedure should be performed if only one user
      node has problems printing to the LaserWriter.

      The first step is to make sure that the AppleTalk
      connector is inserted into the correct socket for the
      type of computer used.

      Using the LaserWriter Test Disk eliminates the
      possibility that the problem is being caused by a bad
      disk.

1.2   If you can't print with the preconfigured test disk,
      there is a hardware problem, which may be a bad
      AppleTalk connector or a malfunctioning computer.

      The LaserWriter is not at fault since the other nodes
      in the network are not affected.

      Usually the problem is not in the network cable because
      they are connected serially through the AppleTalk
      connectors, and if a network cable is broken, all of
      the nodes beyond the break are affected. However, if
      there were a bad network cable for a node on either end
      of the bus, then it would probably only affect the one
      end node.

      If the print is successful with the test disk, the node
      computer is properly connected to the network and is
      working properly. In this case, suspect the
      application disk used when the original failure
      occurred.

(2.1) TWO OR MORE BUT NOT ALL SHEET 1

(2.2) MAKE A LIST OF EVERY NODE THAT WILL NOT PRINT TO THE LASERWRITER. THEN PERFORM THE PROCEDURE ON THIS SHEET FOR EVERY "BAD NODE" ON THE LIST (SEE COMMENT 1).

A

1. CHECK THAT THE NETWORK CABLES ARE FIRMLY INSERTED INTO THE BAD NODE'S CONNECTOR MODULE.

2. a. *IF THE COMPUTER IS A MACINTOSH:*
   (1) CHECK THAT THE CABLE FROM THE APPLETALK CONNECTOR IS FIRMLY INSERTED INTO THE PRINTER PORT.
   (2) TURN OFF THE MACINTOSH, LOAD THE LASERWRITER TEST DISK, THEN TURN THE MACINTOSH BACK ON.

   b. *IF THE COMPUTER IS A MACINTOSH XL:*
   (1) CHECK THAT THE APPLETALK CONNECTOR IS FIRMLY INSERTED INTO PORT B.
   (2) START UP MACWORKS.
   (3) INSERT THE LASERWRITER TEST DISKETTE.

3. PRINT THE LASERWRITER TEST DOCUMENT.
   (SEE COMMENTS 2 AND 3)

B

TEST PRINT OK ? (SEE COMMENT 3) — N →

IS THIS THE FIRST TRY AT PRINTING WITH THE TEST DISK ? — Y →

RETRY THE PRINT WITH THE OTHER MACWRITE TEST DISK TO ENSURE THAT THE TEST DISK WAS NOT THE PROBLEM. → **B**

↓ N

↓ Y

ELIMINATE THE NODE FROM THE "BAD NODE" LIST.

(2.3) HAS THE ABOVE PROCEDURE BEEN PERFORMED ON ALL BAD NODES ? — N →

PERFORM THE ABOVE PROCEDURE ON THE NEXT BAD NODE ON THE LIST. → **A**

↓ Y

(2.3) HAS THE ABOVE PROCEDURE BEEN PERFORMED ON ALL BAD NODES ? — N →

PERFORM THE ABOVE PROCEDURE ON THE NEXT BAD NODE ON THE LIST. → **A**

↓ Y

(2.4) HAVE ALL BAD NODES BEEN DELETED FROM THE LIST ? — N →

↓ Y

EXIT

GO TO "TWO OR MORE BUT NOT ALL" SHEET 2
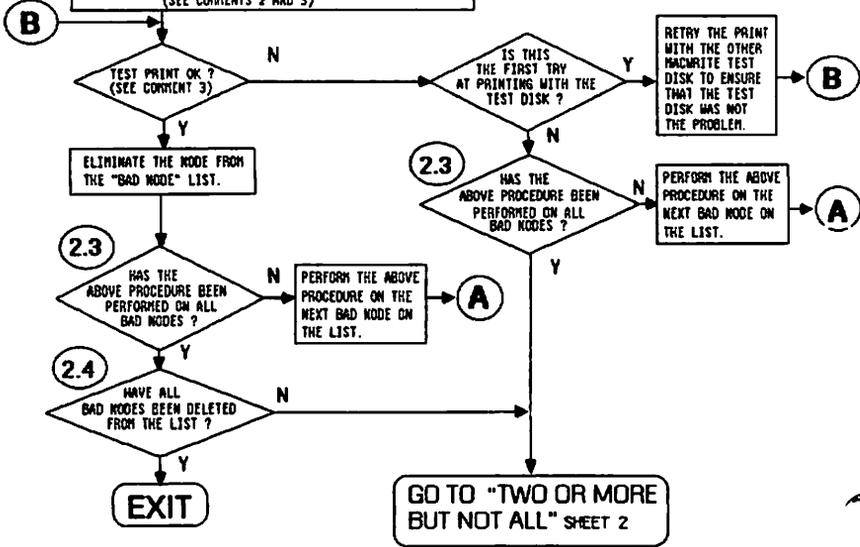
Explanation for the TWO OR MORE BUT NOT ALL Flowchart

(2.1) This procedure should be performed if more than one, but not all, of the nodes are having problems printing to the LaserWriter.

The most probable cause of this type of problem is duplicate addresses or a dangling/broken network cable.

A disk configuration problem is not likely since more than one node is involved. In any event, by using the LaserWriter Test Disk to perform the test print, you eliminate the possibility of a bad disk.

Nor can the problem be with the LaserWriter because if it were, then all the nodes would be affected.

(2.2) Whenever a node starts up on the network, it assigns itself an address number so other nodes will have a means of directing messages to it.

Before a node can assign itself an address number, it must check to make sure there is no other node on the network with the same address.

To do this, the node transmits an inquiry message onto the network, containing the address the node wants to use for itself.

If there is another node on the network with that address, the other node will respond to the inquiry.

(2.2) (continued)

If the original node receives a response, it will
select another address to test. This will go on until
the node finds an address that is not being used by any
other node on the network.

When the node finds an unused address it will claim
that address as its own until it is taken off the
network. When the node is started up again it will
repeat the above process to find a usable address.

Once a node has obtained an address on the network, it
will compare it to the address in every message that is
sent by the other nodes on the network.

When the node recognizes its own address, it will read
the message attached to the address.

Starting up a node while it is not connected to the
network and then connecting it afterwards can cause
redundant addresses. This is because if a node is not
connected to the network when started up, then the rest
of the nodes cannot respond to its address inquiry.

In the case described above, the node will always
assume the first address it tests is OK. Yet another
node on the network may be using that same address.

(2.2) (continued)

When two nodes have the same address, both will respond when the address is used. Since no more than one node can be transmitting on the network at a time, these responses collide and are unintelligible, much the same as when two people are speaking at the same time.

Starting up each bad node while it is connected to the network will cause it to perform a proper address inquiry, thereby eliminating possible duplicate addresses.

(2.3) Duplicate addresses or a dangling/broken network cable are the most common reasons for performing the "TWO OR MORE BUT NOT ALL" flowchart.

Sheet 1 is concerned with eliminating duplicate addresses while Sheet 2 is directed at hardware problems.

Sheet 2 requires that you know the location of all the bad nodes with hardware problems.

Because duplicate address problems can be confused with hardware problems Sheet 1 has you eliminate **all** duplicate address problems (see 2.2 above) first before going to Sheet 2.

(2.4) If all the bad nodes can print after the procedure to eliminate duplicate addresses (see 2.2 above) then that must have been the only problem.

TWO OR MORE BUT NOT ALL
SHEET 2 (SEE COMMENT)

COMMENT
THIS USUALLY OCCURS BECAUSE SOME ONE HAS ACCIDENTLY PULLED THE CABLE FROM A CONNECTOR MODULE AND TERMINATED THE BUS IN THE WRONG LOCATION.

FIND THE "BAD NODES" ON THE NODE LOCATION DIAGRAM YOU DREW AT THE BEGINNING OF THIS PROCEDURE.

(2.5) IS THERE A CONTINUOUS SEQUENCE OF BAD NODES FROM ONE OF THE ENDS OF THE NETWORK CABLE?

N → PERFORM THE "ONE NODE" FLOWCHART PROCEDURE ON EACH OF THE "BAD NODES". → **GO TO "ONE NODE"**

Y

PERFORM THE FOLLOWING PROCEDURE ON THE BAD NODE CLOSEST TO THE PRINTER.

REPLACE THE APPLETALK CONNECTOR ON THE NODE. THEN RELOAD THE LASERWRITER TEST DISK AND TRY TO PRINT THE LASERWRITER TEST DOCUMENT.

TEST PRINT OK?

N → REPLACE THE APPLETALK CABLE BETWEEN THE BAD NODE AND THE NEXT NODE ON THE PRINTER SIDE, THEN RELOAD THE LASERWRITER TEST DISK AND TRY TO PRINT THE LASERWRITER TEST DOCUMENT.

Y

TEST PRINT OK?

N → REPLACE THE NODE'S COMPUTER THEN RELOAD THE LASERWRITER TEST DISK AND PRINT THE LASERWRITER TEST DOCUMENT.

Y

EXIT

Explanation for the TWO OR MORE BUT NOT ALL Flowchart

(2.5) Since the network cables are connected serially through
the AppleTalk connectors, if a network cable is broken,
all of the nodes beyond the break will be affected.

The idea at this point is to determine whether the
nodes are bad due to a broken or dangling network
cable, or due to node specific problems that are
unrelated to each other.

If there is a broken or dangling cable, then the bad
nodes will be located in sequence from one end of the
network bus. The "TWO OR MORE BUT NOT ALL" flowchart
procedure checks each hardware component that could be
causing this kind of problem.

If the bad nodes are not in sequence, their problems
are probably unrelated. By performing the "ONE NODE"
flowchart procedure on each bad node, you check each
hardware component that could be causing this type of
problem.

ALL NODES
SHEET 1

3.1

1. TURN OFF THE LASERWRITER, THEN TURN IT
   ON AND *WAIT* FOR A TEST PRINT.
2. COMPARE THE TEST PRINT WITH FIGURE 1 ON
   THE OPPOSITE PAGE.
3. CONFIRM THAT THE PRINTOUT IS CLEAR AND
   THAT THE "COMMUNICATIONS INDICATOR" IS
   "APPLETALK" AS SHOWN IN THE DIAGRAM.
   (SEE COMMENT 1)

═══ C O M M E N T 2 ═══

BY DISCONNECTING THE REST OF THE BUS FROM THE NODE
CLOSEST TO THE PRINTER, YOU ELIMINATE ANY EFFECTS
A FAULTY BUS MIGHT HAVE ON COMMUNICATIONS BETWEEN THE
FIRST NODE AND THE PRINTER.

IF YOU CAN NOW PRINT FROM THE FIRST NODE, THE
PRINTER'S COMMUNICATIONS FUNCTION MUST BE OK.

3.2

◇ TEST PRINT OK? **N** ──────────►

┌─────────────────────────┐
│ GO TO THE "LASERWRITER   │
│ TROUBLESHOOTING   │
│ PROCEDURE".   │
└─────────────────────────┘

Y

STEPS 1 AND 2 ISOLATE THE LASERWRITER AND ONE
NODE FROM THE REST OF THE NETWORK (SEE COMMENT 2).

1. IF THERE ARE NODES CONNECTED TO BOTH SIDES OF THE
   PRINTER, THEN GO TO THE PRINTER; DISCONNECT THE
   NODES ON ONE SIDE AND LEAVE THE OTHER SIDE CONNECTED.

2. FIND THE FIRST NODE NOW CONNECTED TO THE PRINTER.
   FIND THE NODE'S APPLETALK CONNECTOR. UNPLUG THE
   NETWORK CABLE FROM THE NODE'S APPLETALK CONNECTOR
   WHICH LEADS AWAY FROM THE PRINTER.
   LEAVE THE CABLE GOING TO THE PRINTER
   CONNECTED (SEE FIGURE 2 ON PAGE 21).

3. CHECK THAT THE NETWORK CABLE PLUG IS FIRMLY
   INSERTED INTO THE NODE'S CONNECTOR MODULE.

4. *a.* *IF THE COMPUTER IS A MACINTOSH:*
   (1) CHECK THAT THE CABLE FROM THE APPLETALK
       CONNECTOR IS FIRMLY INSERTED
       INTO THE PRINTER PORT.

   (2) TURN OFF THE MACINTOSH, LOAD THE LASERWRITER
       TEST DISK, THEN TURN THE MACINTOSH BACK ON.

   b. *IF THE COMPUTER IS A MACINTOSH XL:*
   (1) CHECK THAT THE APPLETALK CONNECTOR
       IS FIRMLY INSERTED INTO PORT B.
   (2) START UP MACWORKS.
   (3) INSERT THE LASERWRITER TEST DISK.

3. PRINT THE LASERWRITER TEST DOCUMENT FROM THE TEST
   DISK (SEE COMMENTS 3 AND 4).

═══ C O M M E N T 3 ═══

THE LASERWRITER TEST DISK IS A KNOWN
GOOD PRECONFIGURED PROGRAM WHICH
ELIMINATES DISK CONFIGURATION AS A
POSSIBLE PROBLEM.

═══ C O M M E N T 4 ═══

PRINTING PROBLEMS CAN BE INDICATED BY
A SYSTEM ERROR MESSAGE, CONSTANTLY RUNNING
DISK DRIVE, SYSTEM HANG, ETC.

3.3

◇ TEST PRINT OK ?
(SEE COMMENT 4) **N** ──────►

┌─────────────────┐
│ RETRY THE PRINT │
│ WITH THE OTHER   │   ┌──────────────────────┐
│ LASERWRITER   │ ───► │ GO TO "FIRST NODE"   │
│ TEST DISK TO   │   └──────────────────────┘
│ ENSURE THAT THE │
│ TEST DISK WAS NOT│
│ THE CAUSE OF THE │
│ PROBLEM.   │
└─────────────────┘

Y

┌──────────────────────┐
│ GO TO "ALL NODES"   │
│ SHEET 2   │
└──────────────────────┘

Explanation for the ALL NODES Flowchart

(3.1) Problems which cause all nodes on the network to malfunction include:

* A LaserWriter malfunction.

* A communications problem between the LaserWriter and the closest node.

* A network bus problem common to all nodes on the network.

   The ALL NODES flowchart is concerned with isolating the problem to one of the three possibilities above.

(3.2) The print functions of the LaserWriter are those electromechanical operations that must be performed in order for a print to occur. Every time the LaserWriter is turned on, it will produce a test print to test these functions. If the printout is clear, then the hardware which performs the print functions is operating correctly.

FIGURE 1
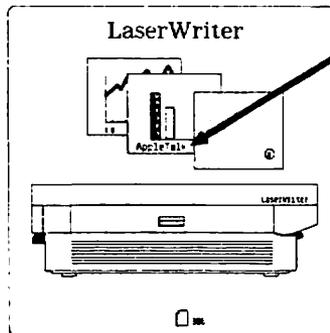
LaserWriter

ENSURE THAT THE COMMUNICATIONS INDICATOR IS "APPLETALK" AS SHOWN HERE

(3.3) A successful test print eliminates LaserWriter malfunction as the source of the problem (see 3.2). Nor can the problem be caused by a faulty bus since the rest of the network has been disconnected. The only remaining potential cause is a communications problem between the first node and the LaserWriter.

The FIRST NODE flowchart addresses the LaserWriter - first node communication problem.

(Continued on the next page).

ALL NODES
SHEET 2

RECONNECT THE REST OF THE NETWORK TO
THE NODE JUST TESTED. THEN RETRY THE
TEST PRINT FROM THE SAME NODE.

3.4

TEST PRINT OK ?

A

N → **GO TO "RARE CASE"**

Y

WITHOUT DISCONNECTING ANY NODES,
TRY THE TEST PRINT FROM EACH NODE
IN THE NETWORK, BEGINNING WITH
THE NODE NEXT CLOSEST TO THE
PRINTER AND MOVING OUT.

3.5

DO
ALL NODES PRINT
OK ?
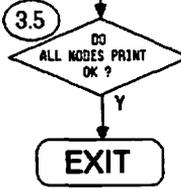
N → REPLACE THE APPLETALK
CONNECTOR MODULE ON
THE FAULTY NODE. THEN
RELOAD THE LASERWRITER
TEST DISK AND TRY TO
PRINT FROM IT.

Y

EXIT

TEST PRINT OK ?

N → REPLACE THE NODE'S
COMPUTER. REFER TO
THE APPROPRIATE LEVEL I
TECHNICAL PROCEDURE
TO REPAIR THE COMPUTER.

Y

A
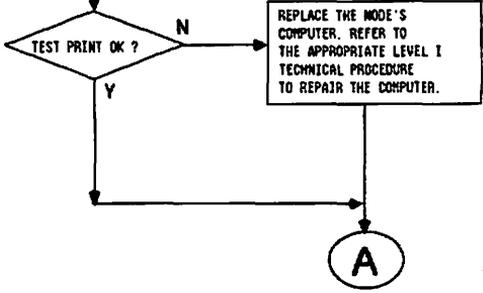
(3.4) If a node works when isolated from the rest of the network but doesn't work when reconnected to the network, a network bus problem is indicated.

The RARE CASE flowchart addresses this situation.

(3.5) At this point, you have proven that the print functions of the LaserWriter, the communications between the LaserWriter and the closest node, and the network cable bus all operate properly.

The rest of the ALL NODES flowchart is concerned with checking that the remainder of the nodes in the network operate correctly.

UNPLUG THE CONNECTOR WHICH
LEADS AWAY FROM THE PRINTER.

LEAVE THE CABLE
LEADING TO THE
PRINTER CONNECTED.

NODE TO
BE TESTED
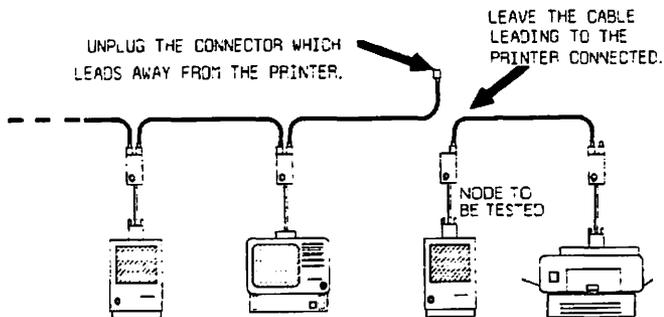
FIGURE 2

Figure 2 is referred to by Sheet 1 of the ALL NODES flowchart.

FIRST NODE
SHEET 1

REPLACE THE APPLETALK
CONNECTOR ON THE LASERWRITER.
RELOAD THE LASERWRITER TEST
DISK FROM THE NODE CLOSEST
TO THE PRINTER AND TRY
TO PRINT.

(4.1)

TEST PRINT OK ? **N** → REPLACE THE APPLETALK
CONNECTOR ON THE FIRST
NODE. THEN RELOAD THE
LASERWRITER TEST DISK
AND TRY TO PRINT.

Y

TEST PRINT OK ? **N** → ## GO TO "FIRST NODE"
SHEET 2

Y

GO TO "ALL NODES"
SHEET 2

Explanation for the FIRST NODE Flowchart

(4.1) This procedure should be used if the communications between the LaserWriter and the node closest to it are isolated and an attempt to print from the node is still unsuccessful.

The "FIRST NODE" flowchart procedure has you replace each hardware item that could possibly cause the problem.

```
┌─────────────────────┐          ┌──────────────────────────┐
│   FIRST NODE        │          │  The opposing page       │
│     SHEET 2         │          │  intentionally           │
└─────────────────────┘          │  blank.━━━━━━━━━▶         │
         │                       └──────────────────────────┘
         ▼
┌─────────────────────┐
│ REPLACE THE APPLETALK│
│ CABLE BETWEEN THE    │
│ PRINTER AND THE FIRST│
│ NODE; RELOAD THE     │
│ LASERWRITER          │
│ TEST DISK AND TRY TO │
│ PRINT.               │
└─────────────────────┘
         │
         ▼
```

```
                                         ┌··················┐
        ◇              N  ┌────────────┐ ┊ C O M M E N T    ┊
    TEST PRINT OK ?──────▶│REPLACE THE │ ┊ THE PRINTER PCB  ┊
        ◇                 │FIRST NODE'S│ ┊ SHOULD BE THE    ┊
        │Y                │COMPUTER.   │ ┊ LAST ITEM YOU    ┊
        │                 │THEN RELOAD │ ┊ REPLACE BE-      ┊
        │                 │THE         │ ┊ CAUSE IT IS NOT  ┊
        │                 │LASERWRITER │ ┊ IN THE SPARES    ┊
        │                 │TEST DISK   │ ┊ KIT.             ┊
        │                 │AND TRY     │ └··················┘
        │                 │TO PRINT.   │
        │                 └────────────┘
        │                       │
        │                       ▼
        │              ◇              N  ┌──────────────────┐
        │          TEST PRINT OK ?──────▶│REPLACE THE       │
        │              ◇                 │APPLETALK PRINTED │
        │              │Y                │CIRCUIT BOARD ON  │
        │              │                 │THE PRINTER. THEN │
        │              │                 │RELOAD THE        │
        │              │                 │LASERWRITER TEST  │
        │              │                 │DISK AND TRY      │
        │              │                 │TO PRINT (SEE     │
        │              │                 │COMMENT).         │
        │              │                 └──────────────────┘
        │              │                        │
        ▼              ▼                        ▼
```

```
                    ┌──────────────────────┐
                    │  GO TO "ALL NODES"   │
                    │      SHEET 2         │
                    └──────────────────────┘
```

5.1

RARE CASE
SHEET 1

5.2

PERFORM THE PROCEDURE ON THIS PAGE ON EACH
NODE IN THE NETWORK, BEGINNING WITH THE NODE
CLOSEST TO THE PRINTER AND MOVING OUT.

A

1. FOR THE FOLLOWING TEST, FIND THE CLOSEST NODE TO THE PRINTER
   THAT HAS NOT BEEN TESTED (SEE COMMENT).

2. LEAVE THE NODE YOU ARE TESTING CONNECTED TO THE SEGMENT OF THE
   NETWORK THAT IS CONNECTED TO THE PRINTER. DISCONNECT THE CABLE
   LEADING FROM THE NODE TO THE REMAINDER OF THE NETWORK.

3. PRINT THE LASERWRITER TEST DOCUMENT FROM THE NODE TO BE TESTED.

TEST PRINT OK ? — **N** →
REPLACE THE APPLETALK
CONNECTOR ON THE NODE,
THEN RELOAD THE
LASERWRITER TEST DISK AND
TRY TO PRINT.

Y

TEST PRINT OK ? — **N** →
REPLACE THE APPLETALK CABLE
BETWEEN THE BAD NODE AND
THE NEXT NODE ON THE PRINTER
SIDE, THEN RELOAD THE
LASERWRITER TEST DISK AND
TRY TO PRINT.

Y

TEST PRINT OK ? — **N** →
GO TO
"RARE CASE"
SHEET 2

Y

TRIED ALL
NODES ON THE
NETWORK ? — **N** →
PERFORM THE
ABOVE PROCEDURE
ON THE NODE
NEXT CLOSEST TO
THE PRINTER.
(SEE COMMENT)
→ **A**

Y

IT IS A SOFTWARE PROBLEM.

EXIT

GO TO "ALL NODES"
SHEET 2

Explanation for the RARE CASE Flowchart

(5.1) This procedure should be performed if the communications between the LaserWriter and the node closest to it worked correctly when isolated, but a test print failed when the network bus was reconnected, indicating a bad network bus.

(5.2) There are two problems which result in a bad network bus:

(1) An improperly terminated (dangling or broken) network cable anywhere on the bus. For example, a network cable which has been accidently disconnected from its AppleTalk connection box (the dangling cable below) could result in an unbalanced impedance which could cause the whole bus to fail.
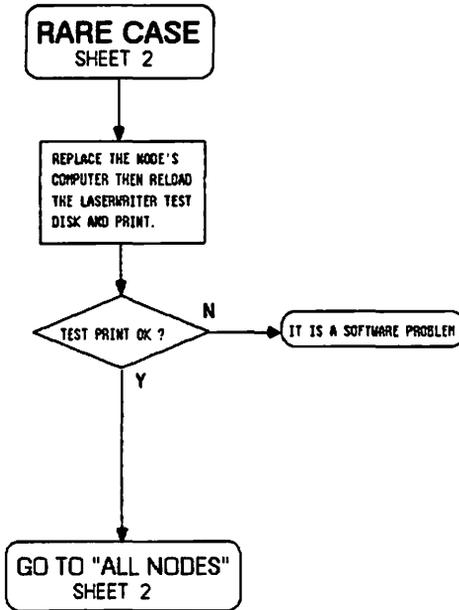

Dangling Cable
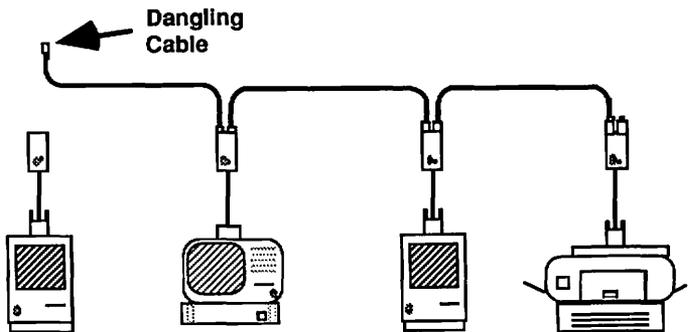
A broken network cable could cause the same problem.

(2) A malfunctioning node that puts a constant level of electric noise on the network bus. In this case no other node would try to transmit because the system appears "busy".

NOTE: For more information on noisy node problems and bus termination problems (i.e. dangling cables and circular networks) refer to the Appendix.

```
┌─────────────────────┐
│   RARE CASE         │
│     SHEET 2         │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│ REPLACE THE NODE'S  │
│ COMPUTER THEN RELOAD│
│ THE LASERWRITER TEST│
│ DISK AND PRINT.     │
└─────────────────────┘
          │
          ▼
      ╱╲                    N
    ╱    ╲──────────────────────► ( IT IS A SOFTWARE PROBLEM )
   ╱ TEST  ╲
   ╲ PRINT ╱
    ╲ OK? ╱
      ╲╱
       │ Y
       │
       ▼
┌─────────────────────┐
│ GO TO "ALL NODES"   │
│     SHEET 2         │
└─────────────────────┘
```

(5.2) Two problems which result in a bad network bus:
(continued)

For Sheet 1 of RARE CASE, each node in the network is
tested sequentially, beginning with the node closest to
the LaserWriter.

As each node is being tested, it is connected to the
nodes that have proven that they can print. The known
good nodes and the node being tested are disconnected
from the rest of the network.

When the node causing the network bus problem is
connected, the test print will fail.

Once the bad node is found, the flowchart procedure
checks each of the hardware components between the bad
node and the nearest known good node.

Macintosh Office (AppleTalk)

Technical Procedures

Section 2

NetCheck

Contents:

INTRODUCTION

NetCheck is a "roll call" test for the AppleTalk network.
It can be used to test a network when it is first set up, to
track down a problem when two or more devices (e.g.,
Macintoshes, IIe's) aren't communicating, or to check whether
LaserWriter™ printers, file servers, gateways, etc., are
connected.

The NetCheck diskette can be used both on the Macintosh and
on the Lisa™/Macintosh XL running MacWorks™ (version 3.0 or
later). If you are unfamiliar with the use of the Macintosh
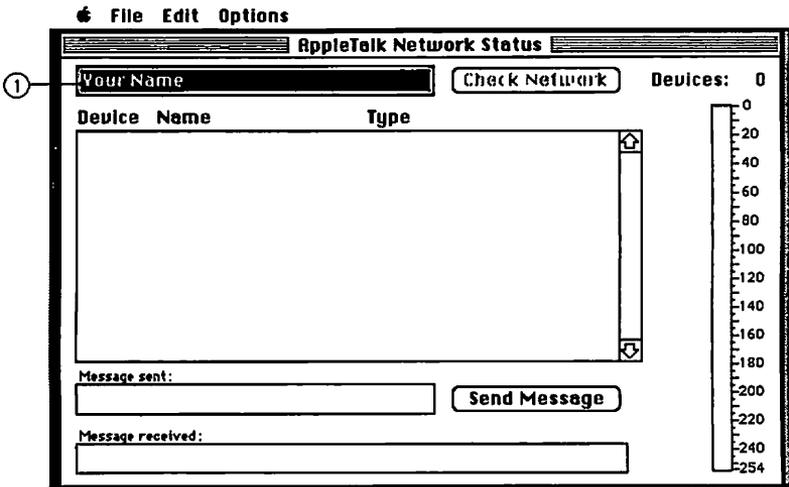or MacWorks, refer to the appropriate owner's guides.
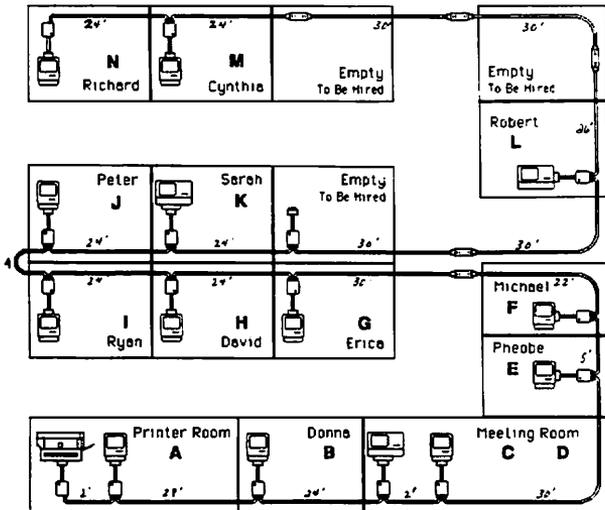
FIGURE 1

FIGURE 2

STARTING UP NETCHECK

1. Insert the NetCheck diskette and power up the system. [On
    a Macintosh XL, first insert the MacWorks start up
    diskette (version 3.0 or later) and power up the system.
    When the MacWorks diskette is ejected, insert the
    NetCheck diskette.]

2. Select and open the NetCheck disk icon.

3. Select and open the NetCheck icon.

After a few moments, the "AppleTalk Network Status" window
will appear.

NOTE: If you see the message: "AppleTalk isn't installed
properly on system disk," check to see that the AppleTalk
connector is connected properly.

USING THE APPLETALK NETWORK STATUS WINDOW

Naming Your Computer

Each time one of the network's computers or shared devices is
turned on, a unique number (called a "device number") is
assigned. The device number can be different every time the
device is turned on. The NetCheck program can detect all of
the devices on the network by their assigned device numbers,
but it can only "talk" to the ones that are given a name.
LaserWriters and other shared devices have names (and types)
"built in," but Macintoshes and other computers do not. To
name the computers on your network, you must start up
NetCheck on each terminal and assign each a name.

The "Your Name" field in the "AppleTalk Network Status"
window (Figure 1, #1) is activated as soon as you enter the
program. Enter a name (up to 32 characters) for the computer
you are working on. You can use the real person's name who
uses that computer, or a letter code like A, B, C, etc. It
is helpful to enter the name that appears on the network
cabling diagram that was made at the time the system was set
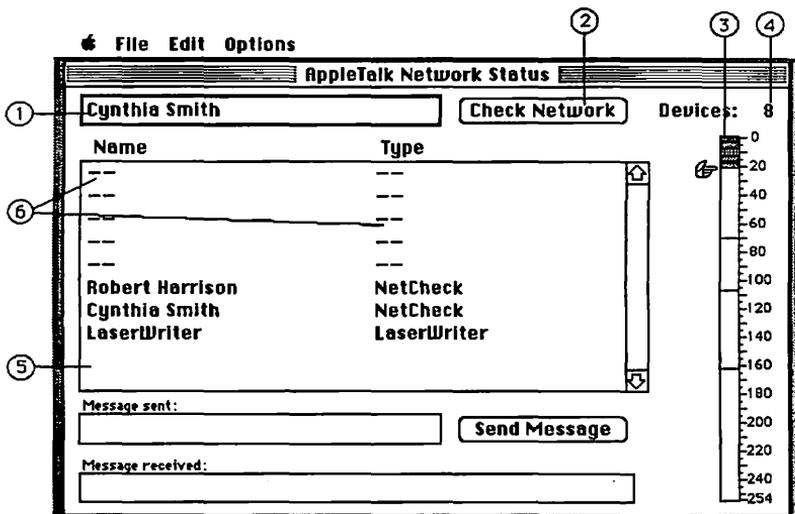up (see Figure 2).

◆ File Edit Options

② ③ ④

AppleTalk Network Status

① Cynthia Smith   [Check Network]   Devices: 8

Name	Type
--	--
--	--
--	--
--	--
--	--
Robert Harrison	NetCheck
Cynthia Smith	NetCheck
LaserWriter	LaserWriter

⑥

⑤

0
20
40
60
80
100
120
140
160
180
200
220
240
254

Message sent:

[   ]   [Send Message]

Message received:

[   ]

FIGURE 3

◆ File Edit Options

②

AppleTalk Network Status

Cynthia Smith   [Check Network]   Devices: 8

Device	Name	Type
2	--	--
8	--	--
10	--	--
12	--	--
17	--	--
70	Robert Harrison	NetCheck
107	Cynthia Smith	NetCheck
162	LaserWriter	LaserWriter

①

0
20
40
60
80
100
120
140
160
180
200
220
240
254

Message sent:

[   ]   [Send Message]

Message received:
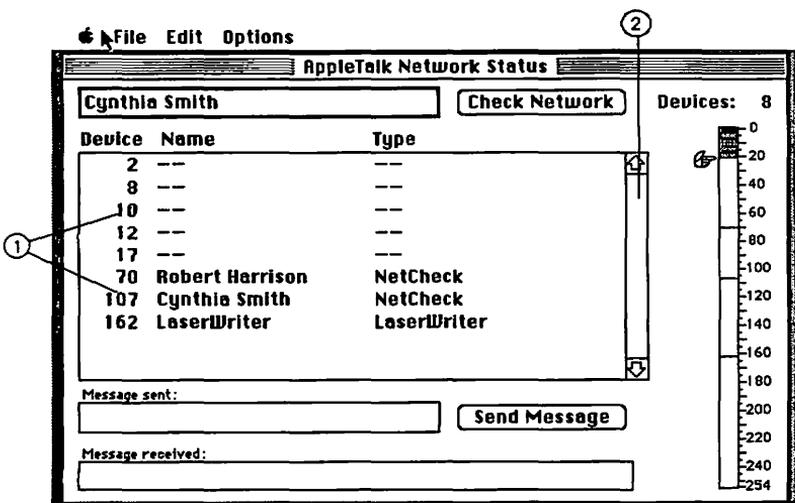
[   ]

FIGURE 4

Checking the Network

After you have made an entry for "Your Name" (Figure 3, #1), press <RETURN> or click on "Check Network" (Figure 3, #2). NetCheck registers the new name on the network and starts "looking" to see if there are any other devices on the network.

After the name you have entered is registered on the network, NetCheck broadcasts to the network, in effect, "I am looking for devices. Please respond." When NetCheck receives a response from a device, a line appears at its device number on the scale (Figure 3, #3). This process is actively demonstrated by the hand icon which moves down the left side of the scale, highlighting each device number as that device is "heard."

The scale, with the numbers 0 through 254, illustrates all the device numbers that can be assigned to the devices on the network. The numbers 0-127 are reserved for computers; 128-254 are reserved for LaserWriters and other shared devices.

"Devices" (Figure 3, #4) will show you how many named devices NetCheck finds on the network, OR the total of all devices. The Options menu allows you to choose whether NetCheck displays "All Devices" or "Named Devices Only" (the default). (For listing of available menu items, see NETCHECK APPENDIX.)

Named devices, as they respond, are listed in the NetCheck window (Figure 3, #5) by Name and Type. If you have chosen "All Devices" from the Option menu, the unnamed devices will be also be displayed, but represented only by dashes (Figure 3, #6).

You can list the devices by their device numbers as well as their names (Figure 4, #1), by choosing "Show Device Numbers" from the Options menu. (If all devices are being displayed, unnamed devices will be represented by numbers and dashes on the screen.) If there are more devices on the network than can fit on the screen, use the scroll arrows in the list box to display the remaining devices (see Figure 4, #2).

AppleTalk Network Status

Device	Name	Type
2	Kathi Venz	NetCheck
8	--	--
10	--	--
12	--	--
17	--	--
24	--	--
33	--	--
41	--	--
59	--	--
70	Robert Harrison	NetCheck
82	--	--
90	--	--
94	--	--
95	--	--
107	Cynthia Smith	NetCheck
115	--	--
162	LaserWriter	LaserWriter

FIGURE 5

AppleTalk Network Status

Device	Name	Type
107	Cynthia Smith	NetCheck

FIGURE 6

Printing Device Information

You may print out any or all information in the NetCheck
window. To print device information for all devices, choose
"Print All Devices" from the File menu. If the option "Show
Device Numbers" was selected from the Options menu, the
device information printed will also contain the device
numbers, as well as names and types. Figure 5 shows a
printout from an AppleTalk Network Status display listing all
devices and their numbers.

To print information about a specific device or devices,
first highlight the device(s) in the NetCheck window list by
clicking on the device name. (For multiple device selection,
hold down the <SHIFT> key and click on each selection). Then
choose "Print Selected Devices" from the File menu. Figure 6
shows the printout for a single selected device.

NOTE: The NetCheck diskette must be in the disk drive of the
computer from which you give the print command. And in order
to print, you must have previously set up and configured a
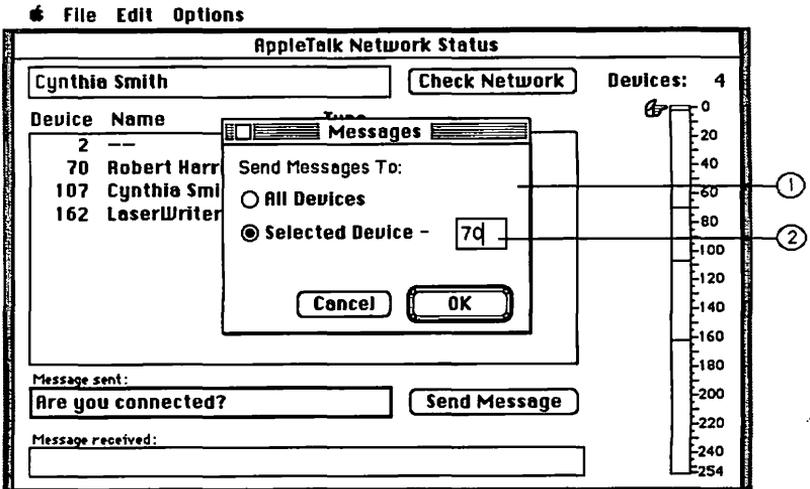printer for the network (see **APPENDIX**).

AppleTalk Network Status

Cynthia Smith   [Check Network]   Devices: 4

Device	Name	Type
2	--	--
70	Robert Harrison	NetCheck
107	Cynthia Smith	NetCheck
162	LaserWriter	LaserWriter

Message sent:

Are you connected?   [Send Message]

Message received:

(70) I'm all hooked up!

FIGURE 7

AppleTalk Network Status

Cynthia Smith   [Check Network]   Devices: 4

Device	Name	Type
2	--	
70	Robert Harr	
107	Cynthia Smi	
162	LaserWriter	

Messages

Send Messages To:

○ All Devices

◉ Selected Device – [70]

[Cancel]   [OK]

Message sent:

Are you connected?   [Send Message]

Message received:

FIGURE 8

Sending Messages

You can use the "Message sent:" box (Figure 7, #1) to enter any message you wish to send to other devices on the network:

1. Highlight the "Message sent:" box by clicking on it or by pressing the <TAB> key. Then enter a message (up to 50 characters long) -- something like: "Are you connected?"

2. When you have finished typing your message, click on "Send Message" (Figure 7, #2). (If the "Message sent:" box is highlighted, pressing <RETURN> will also send the message.)

Your message will be broadcast to all devices on the network.

To send a message to a specific device, choose "Send Message To..." from the Options menu and click on "Selected Devices." Then, in the display which appears on the screen (Figure 8, #1), enter the desired device number in the box (Figure 8, #2) and click on "OK."

You can also identify the selected device by clicking on its name in the NetCheck window display list. Then choose "Send Message To..." from the Options menu, click on "Selected Devices," and click on "OK."

Receiving Messages

Messages are received in the "Message received:" box (Figure 7, #3). Each message is preceded by the device number of the sender (Figure 7, #4).

Messages from more than one device may be received, but only the last message received from each device will be shown. If more than one message is in the "queue," small scroll arrows will appear and allow the different messages to be scrolled into the "Message received:" box.

You can clear the "Message received:" box by choosing "Check Network" or turning off the computer.
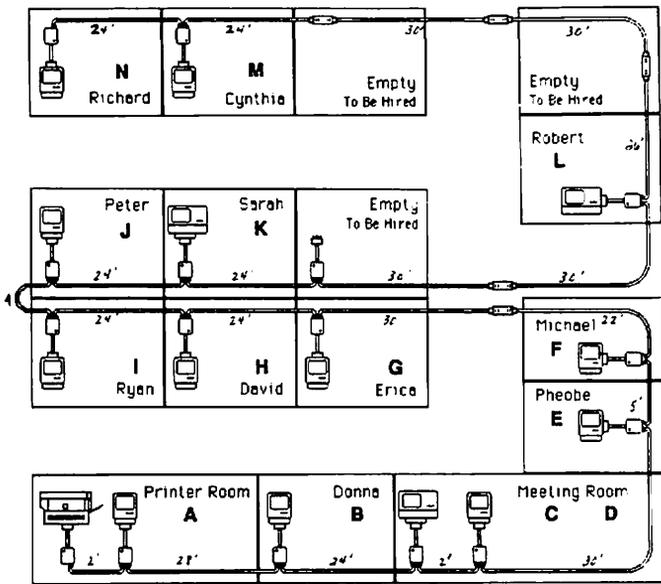
FIGURE 9

SETTING UP A NETWORK

As you set up a network it is a good idea to use NetCheck to ensure that all of the devices are correctly connected to the network. To do this:

1. Draw a cabling diagram and assign each computer a name (Figure 9).

2. Run NetCheck on each computer as it is connected to the network: start up NetCheck on the computer, enter the computer's assigned name, and click on "Check Network." All computers and shared devices that are connected to this computer should be displayed on the screen.

    NOTE: You can start up NetCheck on all the devices using the same NetCheck diskette. Once the program is started up, simply select "Eject" from the **File** menu and take the diskette to the next device. The diskette is necessary only for starting up the program, for using desk accessories, and for printing.

3. When you have hooked up the last device and run NetCheck on it, all of the assigned names should be listed on the "AppleTalk Network Status" display. If they are all listed, the network is functioning.

Sending Messages: An Option to Help You Set Up the Network

If you are setting up a network in several different rooms or floors of a building, the "Send Message" option can save you a lot of time and footwork.

You can broadcast a message on the network, and an assistant can acknowledge your message by sending you a return message using the same method. All you have to do is wait for a response in the "Message received:" window.

If you know the device number of your helper's computer, you can send the message to that specific device instead of to "All Devices," and he can send his message to your specific device also.

NetCheck can be used when diagnosing a problem with the
network. Here are two suggested methods.

Taking Down the Whole System

If it is possible to take everyone off the network, start up
NetCheck on each computer and assign the names that appear on
the cabling diagram. If a computer's assigned name is
missing from the listing, that computer, or the associated
AppleTalk connector, or the network cabling is at fault. If
any of the shared devices is missing, check the NetCheck
windows of the CPUs near the device to further isolate the
problem.
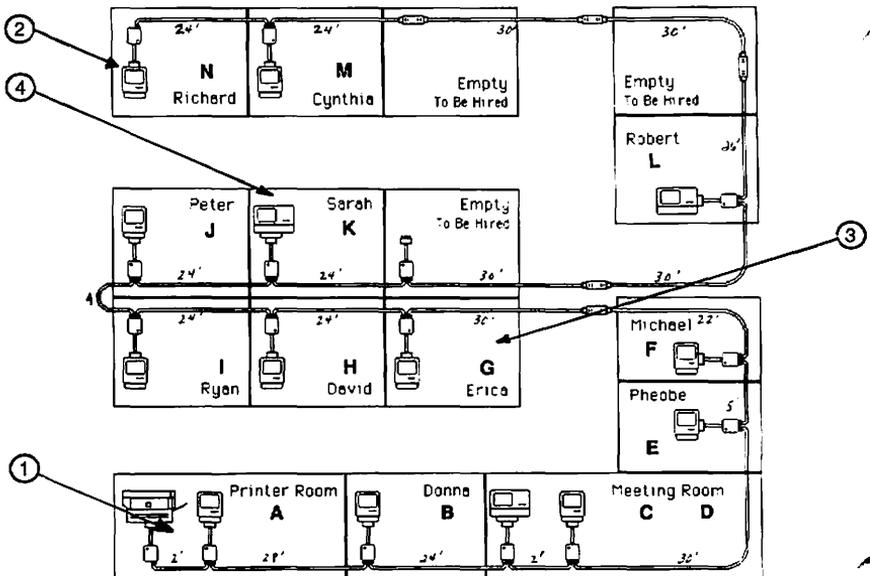
FIGURE 10

Split-half Search

You can troubleshoot the network while allowing some work to continue on the network by using a "split-half search" technique:

1. Start up NetCheck at each end of the system. For example, in the office diagrammed at left, we could start up NetCheck on the computers named A and N (Figure 10, #1 & #2) -- the two ends of the network.

2. Are both A and N listed in the NetCheck window?

    If they are, the network cable (the "bus") is OK. The problem may be that one or more shared devices are not working, that AppleTalk is not configured or connected to the printer port, or that the LaserWriter or another shared device is not configured correctly.

    NOTE: AppleTalk only works when connected to the printer port (Port B on a Macintosh XL).

3. If A and N are not both listed, start up NetCheck on a computer in the middle of the network. In our example, you would start up NetCheck on computer G (Figure 10, #3).

4. If computer G lists one end (computer A or N) as <u>there</u>, that half (the network bus in that direction) is OK. You know the problem must be in the other half of the network. For example, if computer G's display lists A but not N, you know the problem must be located in the half of the network between G and N.

5. Now split the bad half of the network in half again, and check to see which side is listed (and therefore OK). For example, run a "Check Network" from computer K (Figure 10, #4). If N is listed on the display, you know that the section of the network between K and N is OK, and the problem must be located somewhere between G and K.

6. Keep eliminating the good half and splitting the bad half until you have isolated the problem.

Some Common Troubleshooting Problems

1. **Problem:**   When running NetCheck on a Macintosh XL, the error message: "Having trouble obtaining device names" appears <u>constantly</u>.
   Explanation: Using a version of MacWorks earlier than 3.0.

2. **Problem:**   When you run "Check Network", your computer lists the other devices, but the other devices do not list your computer on their screens. ("You can see them but they can't see you.")
   Explanation: Your computer was started up before the AppleTalk cable was attached to it. Turn off the computer and hook up the AppleTalk cable. Then insert the NetCheck diskette and power up the system. Also, check all connections for a tight fit and make sure the ends are terminated correctly. (Hint: Be careful not to create a "loop network" -- that is, a network that is connected in a circle.)

3. **Problem:**   Running "Check Network" on your computer lists some computers but not others.   Other computers do not list your computer.
   Explanation: Faulty AppleTalk connection or connector on your computer. Check connections. If OK, replace AppleTalk connector.

4. **Problem:**   This error message appears: "Having technical difficulties with AppleTalk."
   Explanation: This message can indicate that the LaserWriter is having problems, or that there is a loose connection on the network that is causing intermittent communication.

5. **Problem:**   This error message appears: "AppleTalk not installed correctly on system disk."
   Explanation: AppleTalk must be installed on the boot disk (if other than the NetCheck diskette). If it is not, you can copy the system folder from the NetCheck diskette onto the other boot disk (or use the AppleTalk installer program); then reboot.   Also, on a Macintosh XL, the Apple-Talk connector must be installed in Port B.

6. **Problem:**   Error message: "Unable to send message."
   Explanation: There may be a bad connection in the network, or the device that was to receive the message is no longer on the network.   Try sending the message again.   Or try sending it to another device which is registered on the network (or "All Devices").

NETCHECK APPENDIX

Desktop and Application Menus

The **Apple, File,** and **Edit** menu options function as they do in other applications. The **Apple** menu contains help screens which tell about NetCheck's uses. Unusual menu options are described below.

The **File** menu has the following special options:

> "Print All Devices" prints a copy of the full NetCheck device list.

> "Print Selected Devices" allows you to print device information about devices you have selected from the NetCheck window list.

> "Quit" allows you to exit the program. If you have changed program options, you are asked if you want to save the program options before quitting. The term "program options" refers to those options, if any, that you have chosen from the **Options** menu. If you choose "Yes," the options you have selected during this session will be in effect the next time you start up NetCheck. If you select "No," the options will revert to those that were in effect before this session. If you select "Cancel," you will be returned to the program without quitting.

> "Eject" allows you to eject the diskette from the drive.

The **Options** menu has the following special items:

> "Show Device Numbers/Don't Show Device Numbers" allows you the option of displaying the devices' address numbers.

> "Named Devices Only/All Devices" allows you to display only those devices that have names (devices running NetCheck or shared devices), or to display all of the devices on the network.

> "Send Message To..." gives you the choice of sending a message to one selected device or to all of the devices on the network. This is useful for setting up and troubleshooting a network.

> "Sound", when checked, makes NetCheck audibly "beep" whenever a message is received and whenever a device changes its name or logs on or off the system.

Putting NetCheck on a Hard Disk

You can install NetCheck on the hard disks of network computers, so that you can check the network at any time without using a NetCheck diskette.

1. First, make sure the AppleTalk device driver is installed on the Macintosh XL hard disk (under MacWorks). (Use the AppleTalk Install Program.)

2. Insert the NetCheck diskette into the drive.

3. Select and open the NetCheck diskette icon.

4. Select the NetCheck icon and drag it on top of the hard disk icon.

The program will be copied from the diskette to the hard disk.

AppleTalk and Printer Configuration

If you wish to print out NetCheck's device information, you must configure the computer(s) to print with an attached or shared printer. This must be done from the desktop. With 128K systems, the printer configuration must be set up <u>before</u> you open the NetCheck icon, and you must not open the "Choose Printer" option after beginning the NetCheck program. With 512K systems, the "Choose Printer" icon may be accessed at any time during the running of NetCheck.

1. Make sure the NetCheck diskette is in the computer's internal disk drive.

2. Select "Choose Printer" from the **Apple** Menu.

3. Choose the appropriate printer and the proper (modem or printer) port.

3. Click on "OK."

NOTE: If the desk accessory "Choose Printer" is not available from the Apple menu, copy the NetCheck icon to a diskette containing the "Choose Printer" accessory.

MACINTOSH OFFICE (APPLETALK)
TECHNICAL PROCEDURES

APPENDIX

TABLE OF CONTENTS

Contents:

WHAT IS THE APPLETALK PERSONAL NETWORK?

The AppleTalk Personal Network allows any Macintosh, or
Macintosh XL user to share the use of a single LaserWriter
Printer. In the future, other devices such as **file servers**
(large capacity disk drives) and **communication servers**
(devices that provide access to other computer networks)
will be added to the network (shown below). Macintosh, and
Macintosh XL users will also be able to communicate
instantaneously with each other over the network when the
appropriate software becomes available.
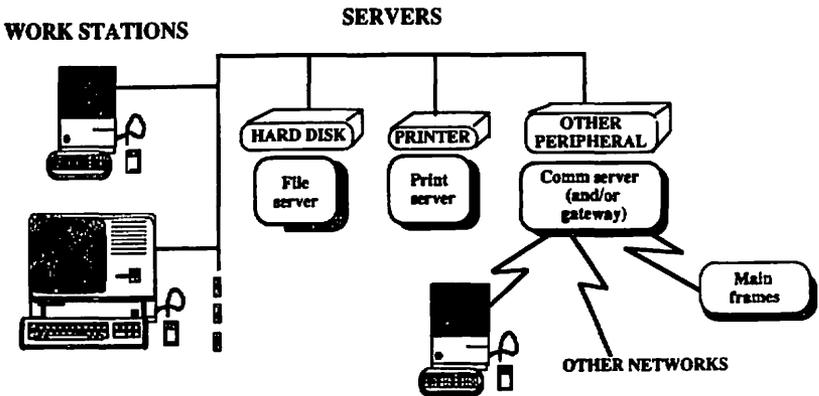
The AppleTalk Personal Network has three physical
components: the **network cable**, the **AppleTalk connector**, and
the **cable extender**, (shown below).
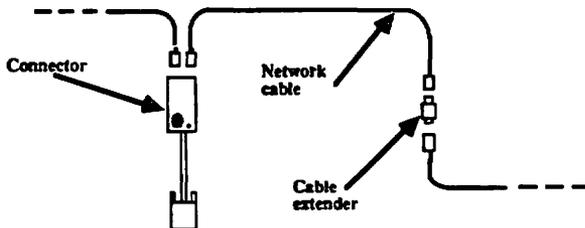
The AppleTalk connector is attached to a computer or other
device; the individual AppleTalk connectors are then linked
by means of the network cables. When all of the lengths of
network cable are connected, they form a **network bus**.

Macintosh Office Troubleshooting   rev. Mar 85   page A.3

Each device location on an AppleTalk network is called a
node. When we refer to a node, we mean the device itself
and the AppleTalk connector attached to it.

The AppleTalk Components

AppleTalk Network Cable is sold in two and ten meter
lengths with preassembled connector plugs. It is also
sold in kit form for custom installations. The kit
contains a one hundred meter spool of cable with
unassembled connector plugs. The installer cuts the
length of cable needed and then attaches a plug to each
end.

The network cable is made up of two wires wrapped in a
metal shield, which is then wrapped in electric
insulation (shown below).

**NETWORK
CABLE**

**Message
Signal Wires**

Shield

Insulation
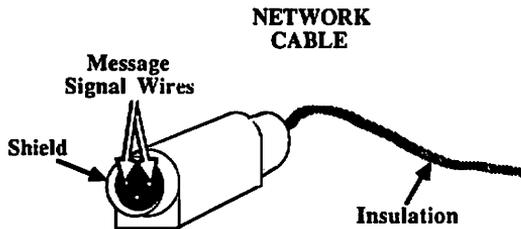
The two wires conduct the electric message signal to the
AppleTalk connectors around the network.

The conductive metal shield covering the wires in the
network cable protects them from electronic noise that
may come from other devices in the area. Without the
shield, the noise would interfere with communications on
the network.

The third pin on the network cable plug is not used.

An **AppleTalk Connector** is composed of a **plug** that fits
into the back of the computer, a **cable** leading from the
computer to the network, and a **connection box** (see the
illustration below).

APPLETALK CONNECTOR
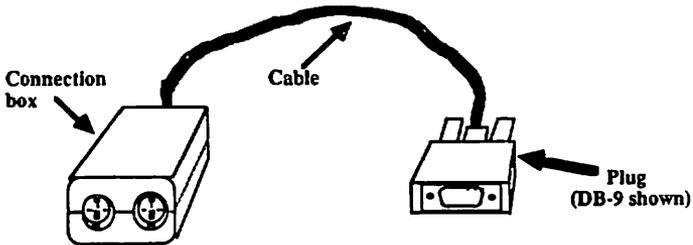
The **AppleTalk connector cable** permanently attaches the
plug to the connection box. The plug for the Macintosh
is a 9 pin DB type connector. For the Macintosh XL, the
plug is a standard DB-25 connector.

The **connection box** provides the node with a connection
point onto the network. The connection box has
electronic components inside and two sockets for network
cable plugs.

The sockets on the connection box are interchangeable.
It makes no difference which one a network cable is
plugged into.

An **AppleTalk Cable Extender** is a small double ended
connector that allows two pieces of network cable to be
joined together to form a longer cable. A cable extender
should not be used to terminate the cable.

WHY NOISY NODES CAN CAUSE NETWORK BUS PROBLEMS

Only one node may transmit (put message signals on the
network cable) at a time. If two nodes were allowed to
transmit at the same time, their signals would collide and
be incoherent to the rest of the network. This is similar
to two people speaking at the same time preventing anyone
from understanding them.

To make sure that only one node is transmitting on the bus
at a time, all AppleTalk nodes follow a set of rules called
Carrier Sense, Multiple Access with Collision Avoidance
(CSMA/CA).

Carrier Sense means that before a node can transmit anything
on the network, it will check the network cable to see if
another node is transmitting. If there is, the node that is
trying to transmit will wait for a designated period of time
and then listen again; if the network is still busy, it will
wait again, and so on. This will go on until the node
detects that the bus is idle (no node is transmitting on the
network). At this time the node will wait for a period of
time to make sure that no other node is going to transmit
and then begin its own transmission (see collision avoidance
below).

Multiple Access means that every node has equal access to
the network cable through its connection box.

Collision Avoidance means that AppleTalk tries to minimize
collisions by having each node wait a different amount of
time after the bus becomes idle before they transmit.

If the interface electronics in a node failed and put
electric noise on the bus, the other nodes might sense the
noise and assume that the bus was always busy. If this were
to happen the other nodes would never transmit any messages.

The Circuit on the AppleTalk Network Cable

NOTE: For the following explanations, many of the terms and concepts have been simplified.

The network cable is made up of two message signal wires wrapped in a metal shield, which is then wrapped in electric insulation (shown below).
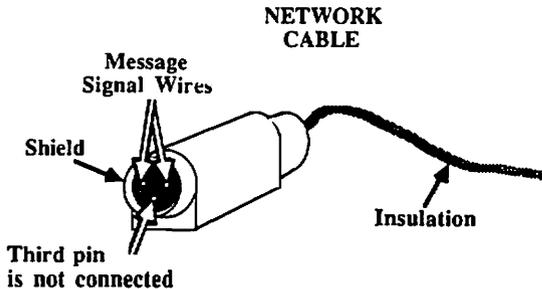
The two wires carry the message signals around the network.

The message signals have a maximum **frequency** of 230.4 KHz. That means that a transition from the most positive to the most negative voltage levels of the signal can happen up to 230.4 thousand times a second.

There is an electronic component called a **transformer** in every connection box. Each node's transformer couples the node to the network bus. When a node transmits, it sends the message signal to the transformer which conveys it onto the message signal wires of the network cable. The transformers in the other node's connection boxes allow them to read the message signal from the bus.

The message signal is put on the network cable in a differential fashion. That means that at any given time if the message signal voltage on one of the wires is positive, then the other wire will be negative, and vice versa.

Since electric current is often thought of as flowing from negative to positive, we will call the negative wire the **source** wire and the positive wire the **return** wire.

When the voltages change, the direction of current will change, thus the role of the wires alternate. However, at any given instant during a transmission, one wire will be the source and one the return.

NOTE: The AppleTalk bus conforms to the electrical interface specifications defined in the Electronic Industries Association's RS-449/422 Standard. For more detailed information on the RS-449/422 interface, refer to that document.

When a signal enters a connection box from a length of network cable, it will do one of two things depending on whether or not a network cable is plugged into the other socket.

  (1) **Cables plugged into both sockets.**

      All of the nodes except those on the two ends of the network bus will have cables plugged into both sockets. In this case the signal flows from one socket through to the other into the next length of cable (shown below).

Transformer
Return
Source
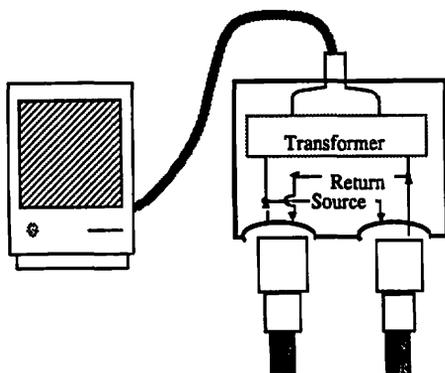
**CONNECTOR BOX
WITH CABLE IN
BOTH SOCKETS**

NOTE: The direction of current
      can reverse at up to
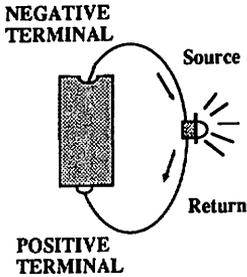   230.4 thousand times
      a second.

(2)   **Cable plugged into only one socket.**

The end nodes will have a cable plugged into only one
socket. Each connection box is designed so that if a
socket is empty, a switch inside the box connects the
signal wires from the other socket to a terminating
resistor. The message signal current in the source
wire flows through the terminating resistor back to
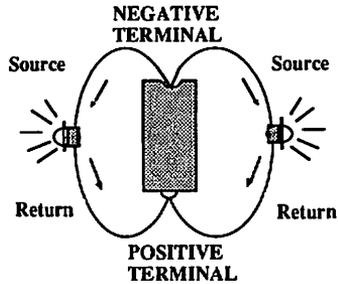the return wire completing the circuit (shown below).

**CONNECTOR BOX
WITH AN
EMPTY SOCKET**

Transformer

Resistor
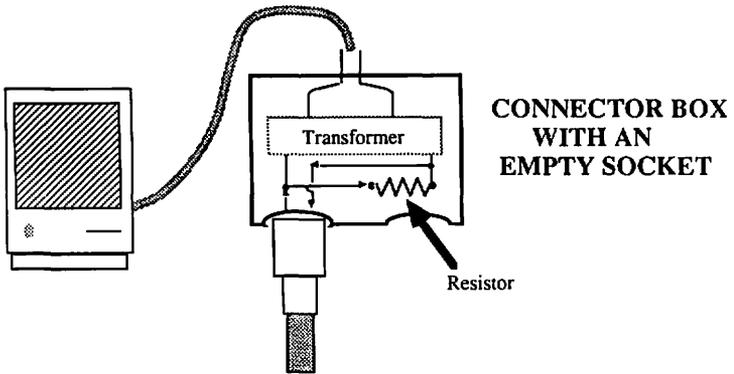
The AppleTalk Network Bus circuit is like the circuit in a
flashlight.

FLASHLIGHT CIRCUIT   ## FLASHLIGHT CIRCUIT
WITH ONE BULB   ## WITH TWO BULBS

NEGATIVE   NEGATIVE
TERMINAL   TERMINAL
           Source   Source   Source

           Return   Return   Return
POSITIVE   POSITIVE
TERMINAL   TERMINAL

The current from the source (negative) wire flows through
something called a load (a bulb for the flashlight and a
terminating resistor for the AppleTalk bus) to the return
(positive) wire. In the flashlight example above, two bulbs
are shown to demonstrate that the current can be split at
its source to travel through two loads and arrive at the
same return point.

In the AppleTalk bus example below the same thing occurs.
The only difference is that the current is going through two
terminating resistors instead of two bulbs. In the
flashlight the battery provides the power, while in the
AppleTalk bus the transmitting node provides the power in
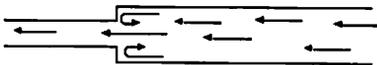the form of the message signal.

APPLETALK CIRCUIT
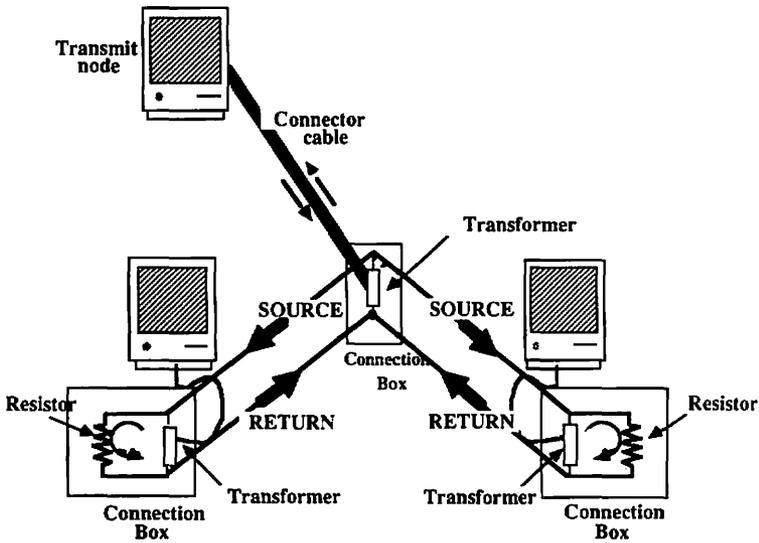
Impedance on the AppleTalk Network Cable

For the message signal current to flow smoothly and
accurately, the impedance (explained below) throughout the
network must be constant.

Electric current is commonly compared to water flowing
through a pipe. Impedance is like the resistance that the
walls of a pipe present to flowing water. As long as the
circumference of the pipe remains the same, the impedance to
the flow of water is the same.

If at some point the pipe's circumference is made smaller,
the impedance to the flow will increase at that point and
part of the water will be reflected back.

In an AppleTalk network the message signal current flows
through the source message wire the way water flows through
the pipe. It is important to avoid changes in impedance
since that can cause reflections of the message signal
similar to the reflections that occurred when the water
encountered the narrower pipe.

If an AppleTalk network bus is terminated properly, the
network cable on each end of the bus will be plugged into a
connection box with an empty socket.

The connection box with an empty socket channels the message
signal on the network cable's source wire through a
terminating resistor to the return wire.

The terminating resistor provides the same amount of
impedance as the network cable so there will be no
reflections of the message signal on the bus.
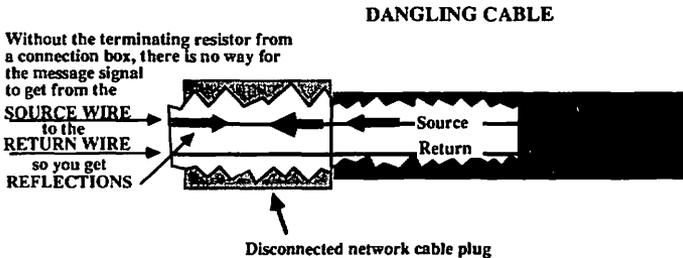
Dangling Cables

If a network cable is left dangling (shown below), when the current on the source wire reaches the unterminated end, it has no channel to take to the return wire.
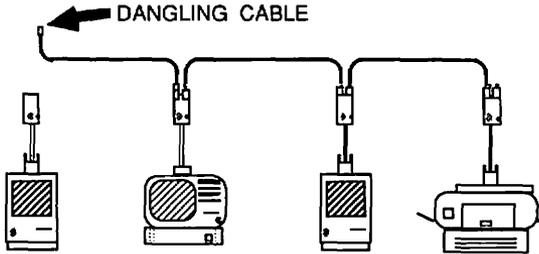
DANGLING CABLE

The message signal in a dangling cable has no place to flow once it reaches the end of the cable so it is reflected back on to the source wire, just like a flow of water run into a capped pipe (shown below).
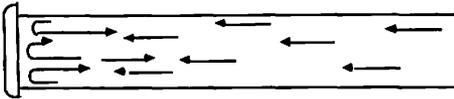
The reflections would bounce back along the source wire and mix with the original message signal (shown below). This would look like two nodes trying to talk at the same time, and that would interfere with communications.

DANGLING CABLE

Without the terminating resistor from
a connection box, there is no way for
the message signal
to get from the
SOURCE WIRE
    to the
RETURN WIRE
    so you get
REFLECTIONS
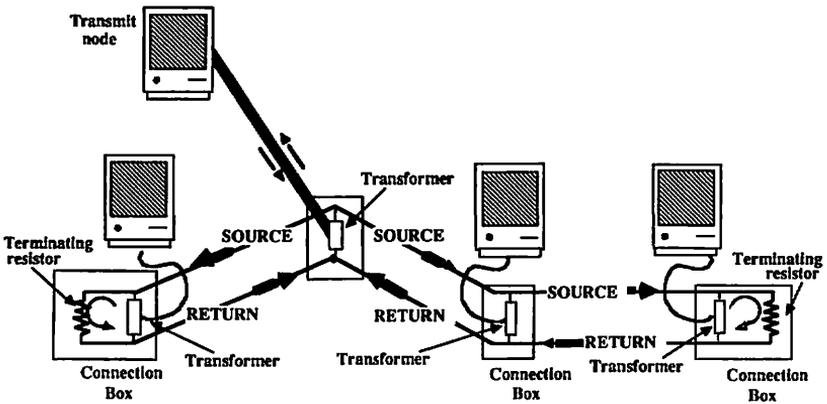
Source

Return

Disconnected network cable plug

To prevent reflections of the message signal on the network, it is very important to always terminate the ends of the network cable into a connection box.

Circular Networks

When a signal is transmitted onto the network cable by a
node somewhere in the center of a bus, the source signal is
sent to both sides of the bus. If both ends are properly
terminated (i.e. each end plugged into a connection box),
the message signal will flow through terminating resistors
to the return wires to complete the circuit (shown below).

PROPERLY TERMINATED BUS

If the network cables are connected so as to form a closed
loop, there is no way for the message signal on the source
wire to flow to the return wire so the signals on both sides
of the bus will collide with each other (shown below).

CIRCULAR NETWORK
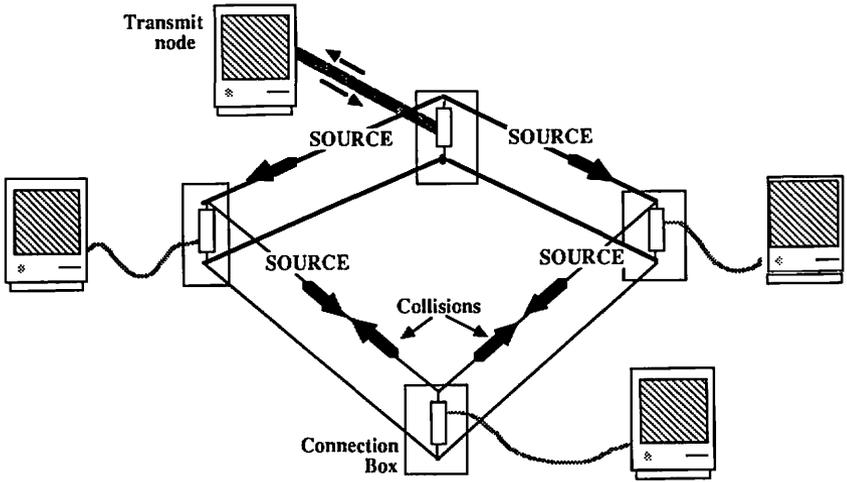
Transmit
node

SOURCE   SOURCE

SOURCE   SOURCE

Collisions

Connection
Box

This would look like two nodes trying to talk at the same
time, and that would interfere with communications.
Therefore, it is very important to always terminate the ends
of the network cable into connection boxes so that it does
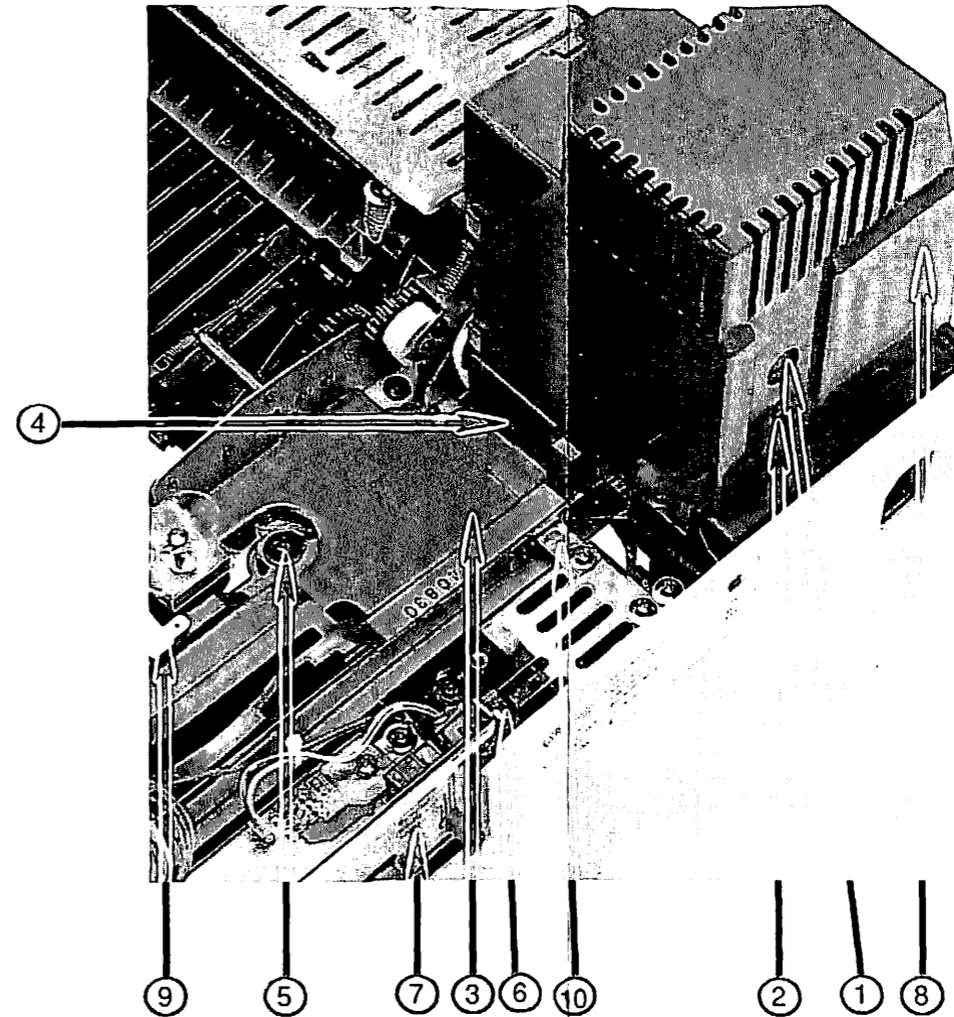not form a closed loop.

1. Separation Belt

2. Transfer Roller

3. Screw

4. Corona Wire Termination Cover

5. Corona Terminal

6. Corona Wire
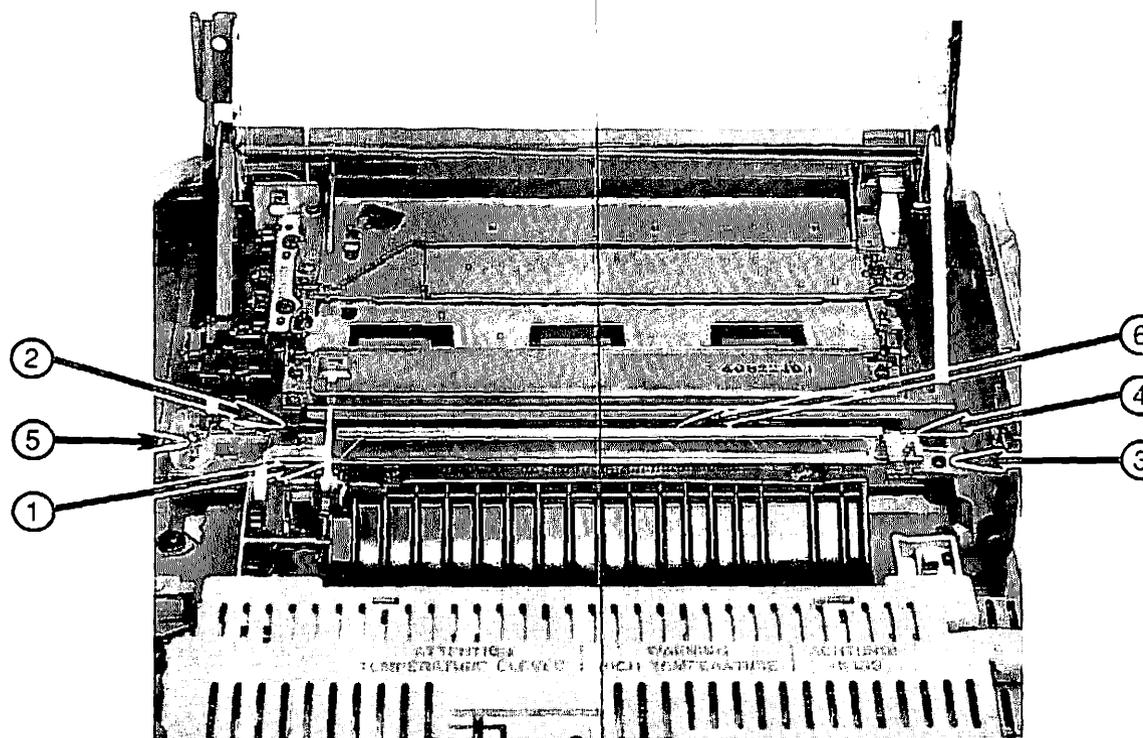
PHOTO #5: Lower Main Body

1. Circuit Breaker

2. Screw

3. Harness Cover

4. Plastic Tab

5. Main Pedestal Screw

6. Ground Wire

7. I/O Plate

8. Power Interlock Assembly

9. Ground Lug

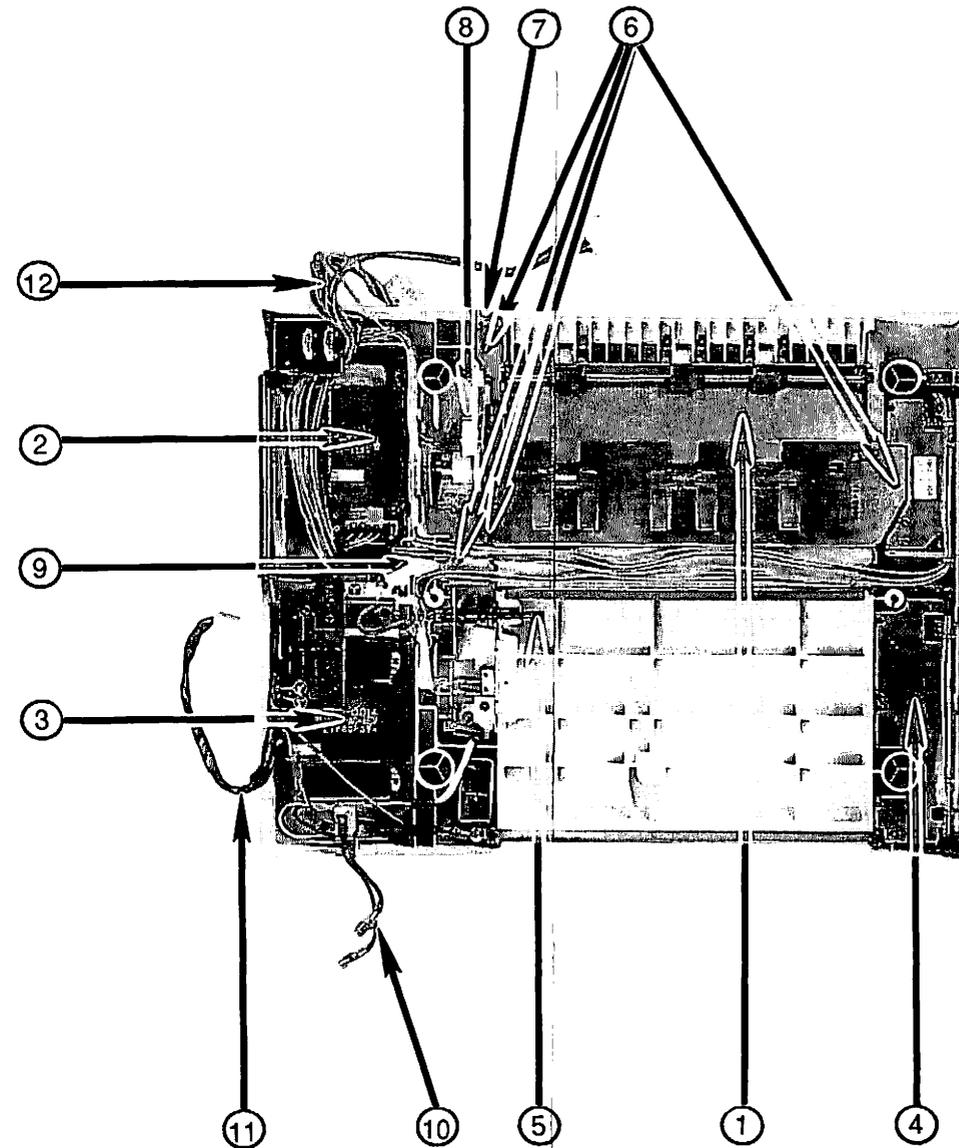10. Metal Tab

PHOTO #6: Left Rear Corner of Printer

1. Cassette Pickup Assembly

2. Transformer PT1

3. Transformer PT2

4. Interface Regulator

5. Paper-Out Sensor Assembly: Paper Detection Arm

6. Screws for Cassette Pickup Assembly

7. Manual Feed Guide Tab

8. Solenoid

9. Metal Plate

10. Wires to Power Interlock Assembly

11. Wire to J103

12. Wires to DC Power Supply and I/O Board

PHOTO #7: LaserWriter Pedestal