Apple Service
Technical Procedures
Laser Printers
Volume Three

💧 Apple Technical Procedures

Apple Personal LaserWriter

Technical Procedures

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Note: All LaserWriter Printer changes are highlighted by a double line I I in the outside margins.

 Apple Technical Procedures

Apple Personal LaserWriter

Section 1 – Basics

❑ CONTENTS

❏ PRODUCT DESCRIPTION

The Apple® Personal LaserWriter® **(Figure 1-1)** is a low-cost, high-quality laser printer with the ability to produce full-page, high-resolution printing—for text as well as graphics—on standard photocopy paper, letterhead, envelopes, and transparency film. The Apple Personal LaserWriter is available in five versions: the Personal LaserWriter SC, Personal LaserWriter NT, Personal LaserWriter NTR, Personal LaserWriter LS, and Personal LaserWriter LS/L. All five versions use the same laser xerographic print engine. The LaserWriter SC, LaserWriter NT, and LaserWriter NTR have interchangeable I/O controller boards.

Front Access Door
(Paper Path, Fuser,
and Toner Cartridge

Stackability Guide
(Optional on the
LaserWriter NTR,
LS, and LS/L)

I/O Board

Multipurpose
Tray

Cassette Feeder Tray
(Optional on the
LaserWriter NTR, LS
and LS/L)

LED Status
Lights

Front Access
Door Release Button
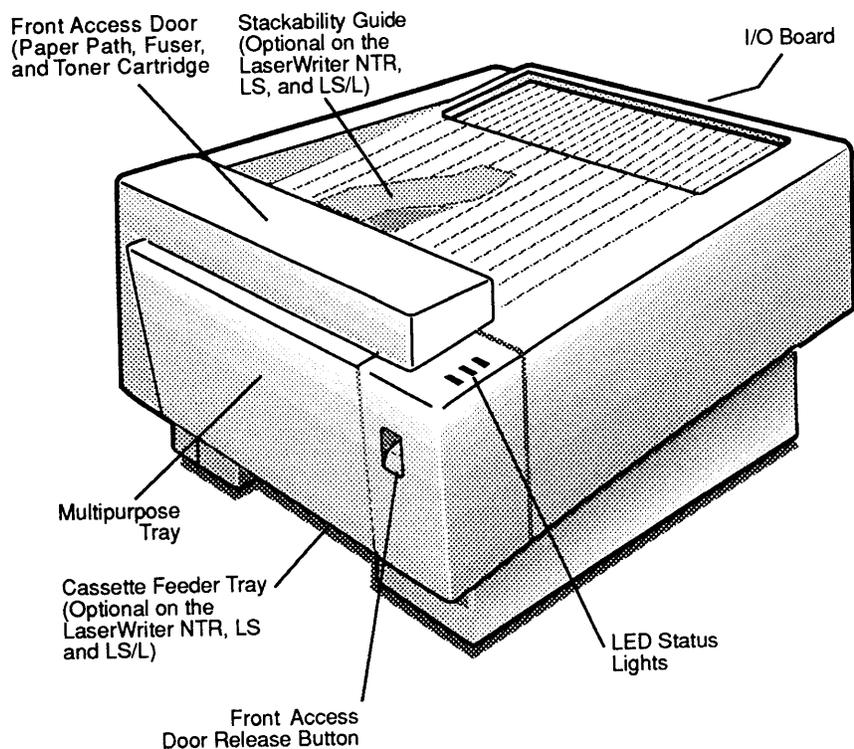
Figure 1-1 Apple Personal LaserWriter

**Personal
LaserWriter SC**

The Personal LaserWriter SC is a single-user QuickDraw™ printer that connects to any Macintosh® (except the Macintosh 512K) computer through the SCSI port. The Personal LaserWriter SC is easily upgraded to a Personal LaserWriter NT or NTR by replacing the I/O controller board.

**Personal
LaserWriter NT**

The Personal LaserWriter NT is a Postscript® printer that can be used with any Macintosh or Apple IIGS® computer and with any Apple IIe computer equipped with an Apple II Workstation Card. LocalTalk® networking capabilities are built into the Personal LaserWriter NT, so connection to a single Macintosh or a network simply involves plugging in the LocalTalk cable. The Personal LaserWriter NT is easily upgraded to a Personal LaserWriter NTR by replacing the I/O controller board.

The Personal LaserWriter NT can also print documents created and stored on computers running MS-DOS or OS/2. To connect the Personal LaserWriter NT to a computer running MS-DOS or OS/2, you must do one of the following:

• Install a LocalTalk PC card in the computer, connect the computer to an AppleTalk network system, and connect the printer to the same network.

• Connect the serial port on the computer to the RS-232-C (25-pin serial) port on the Personal LaserWriter NT.

**Personal
LaserWriter NTR**

The Personal LaserWriter NTR is a high-performance, networkable PostScript printer that can be used with any Macintosh, Sun, or IBM-PC-compatible computer. Equipped with a high-speed RISC (Reduced Instruction Set Computing) microprocessor, the Personal LaserWriter NTR can print documents 3 to 5 times faster than the Personal LaserWriter NT.

The Personal LaserWriter NTR features RS-232 and RS-422 (LocalTalk™) serial ports and a 36-pin Centronics parallel port. The port arbitration capabilities of the Personal LaserWriter NTR enable it to process jobs from all three ports simultaneously without changing the DIP or thumbwheel switch settings. All interfaces are simultaneously active.

**Personal
LaserWriter LS**

The Personal LaserWriter LS is a single-user QuickDraw™ printer that works with any Macintosh (except the Macintosh 512K) computer. The I/O board connects the print engine to a host computer via a high-speed RS-422 serial interface. This serial interface uses the standard Apple System/Peripheral—8 Cable.

**Personal
LaserWriter LS/L**

The Personal LaserWriter LS/L is a redesigned version of the Personal LaserWriter LS that features improved performance and a reduced price. Like the Personal LaserWriter LS, the Personal LaserWriter LS/L is a single-user QuickDraw printer that connects to any Macintosh (except the Macintosh 512K) computer via a high-speed RS-422 serial interface. This serial interface uses the standard Apple System/Peripheral—8 Cable.

**LaserWriter LS and LS/L
Differences**

Although the Personal LaserWriter LS and Personal LaserWriter LS/L function similarly, there are some design differences between the two printers, as described below (see **Figure 1-2** on the following page).

1. Personal LaserWriter LS:

    *   The power switch is on the left rear of the printer.

    *   The plastic rear cover has an opening for the metal I/O board bracket and displays the family number **M2000.**

    *   Print density is manually adjustable.

2. Personal LaserWriter LS/L:

    *   The I/O and DC controller boards are combined into one module—the serial controller.

    *   The power switch is on the right rear of the printer.

    *   The rear cover is solid plastic and displays the family number **M2002.**

    *   Print density is adjusted through the Personal LaserWriter LS driver software.
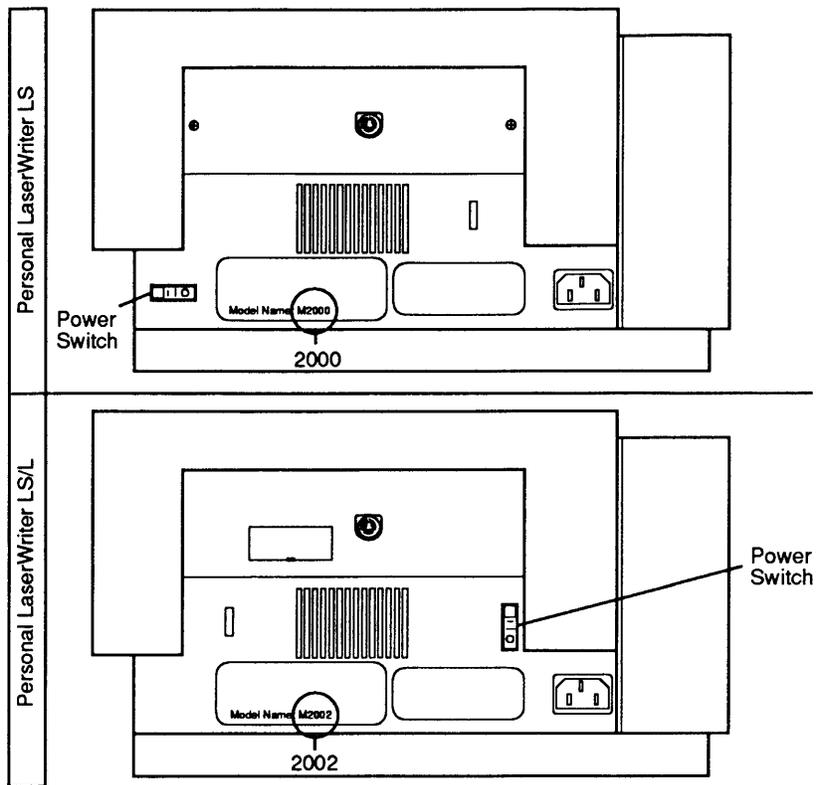
Figure 1-2 Personal LaserWriter LS and LS/L

LaserWriter LS and LS/L
Module Compatibility

The Personal LaserWriter LS/L parts and modules are not interchangeable with those of the Personal LaserWriter LS. Refer to the *Illustrated Parts List* for information on specific parts and part numbers.

Additional
Documentation

Following is a list of documents that contain additional information on the Personal LaserWriter printers:

Personal LaserWriter SC Owner's Guide
Personal LaserWriter NT Owner's Guide
Personal LaserWriter NTR Owner's Guide
Personal LaserWriter LS Owner's Guide

Module Identification

Figures 1-3, 1-4, and **1-5** on the following pages identify the major assemblies and subassemblies of the Apple Personal LaserWriter.
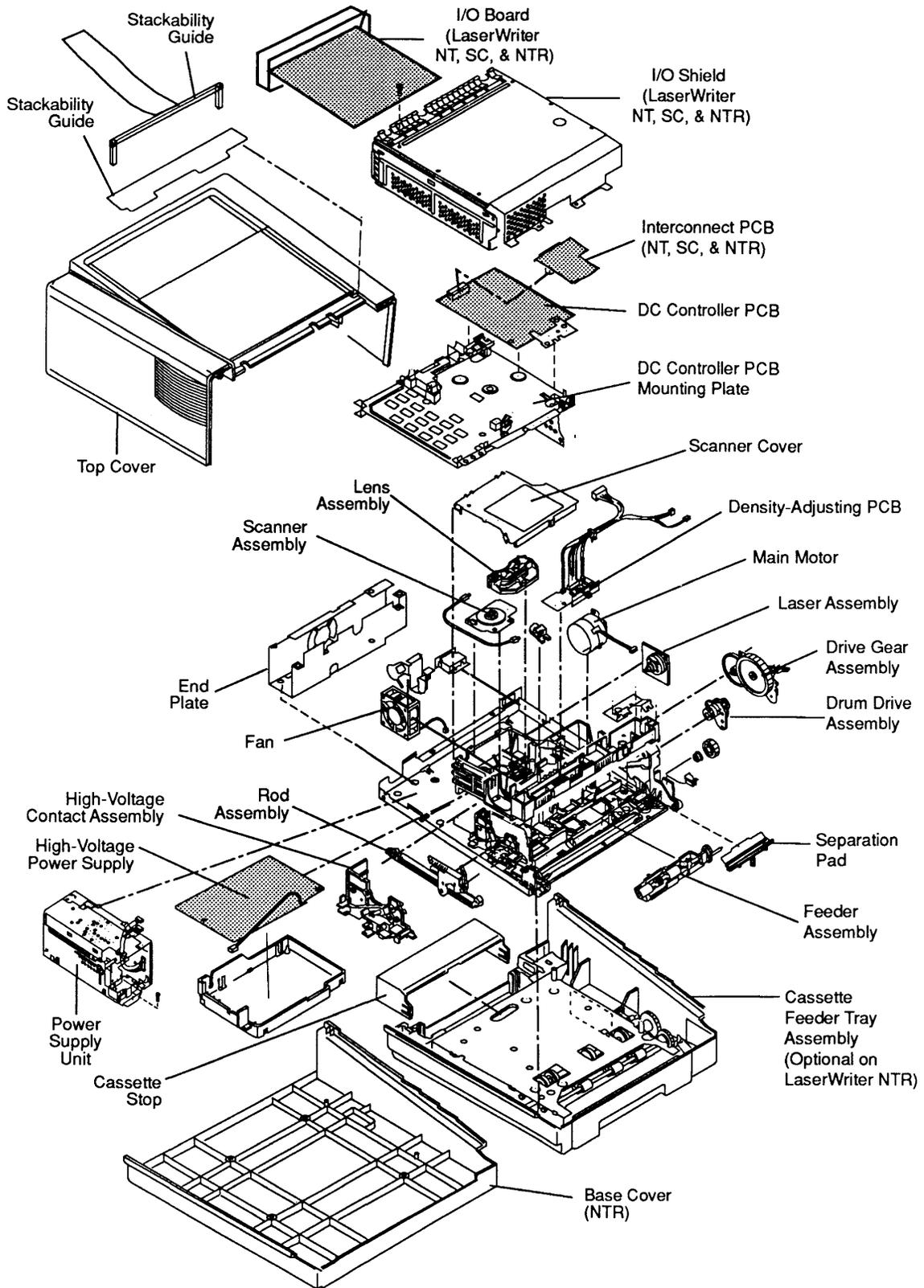
Figure 1-3 Major Assemblies (LaserWriter NT, SC, and NTR)

PCB Shield (LS/S)

I/O Shield (LS)

PCB Duct Plate (LS/S)

DC Controller PCB Mounting Plate (LS)

Serial Controller PCB (LS/L)

Top Cover

DC Controller PCB (LS)

PCB Mounting Plate (LS/L)

Scanner Cover

I/O Board Bracket (LS)

Lens Assembly

Density-Adjusting PCB (LS) Fan and Sensor PCB (LS/L)

Scanner Assembly

Main Motor

Laser Assembly

Fan

Drive Gear Assembly

End Plate (LS)

I/O Board (LS)

Drum Drive Assembly

High-Voltage Contact Assembly

Rod Assembly

Separation Pad

High-Voltage Power Supply

Feeder Assembly

Power Supply Unit

Cassette Stop

Cassette Feeder Tray Assembly (Optional on LaserWriter LS and LS/L)

Base Cover

Figure 1-4 Major Assemblies (LaserWriter LS and LS/L)

Pickup Roller Assembly

Multipurpose Cable Assembly

Transfer Roller Assembly

Left Transfer Roller Mount

Face-Down Delivery Assembly

Fuser Assembly

Right Transfer Roller Mount

Face-Up Cover Assembly

Deflector

Fuser PCB & Cable Connector

Face-Up Delivery Drive Assembly

Front Access Door Assembly

Face-Up Tray

Front Cover

Multipurpose Tray

LED Cover
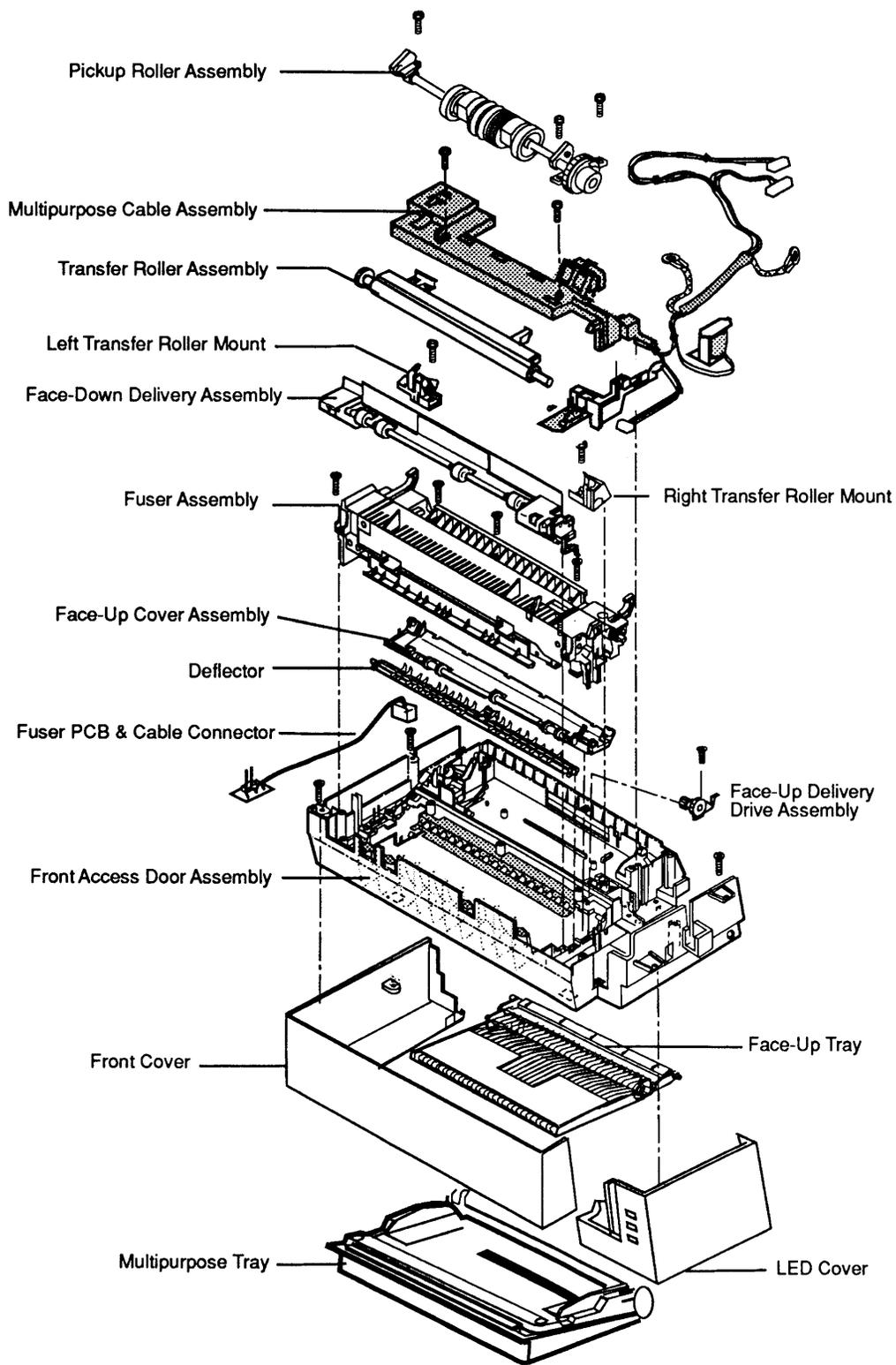
Figure 1-5 Front Access Door Assemblies
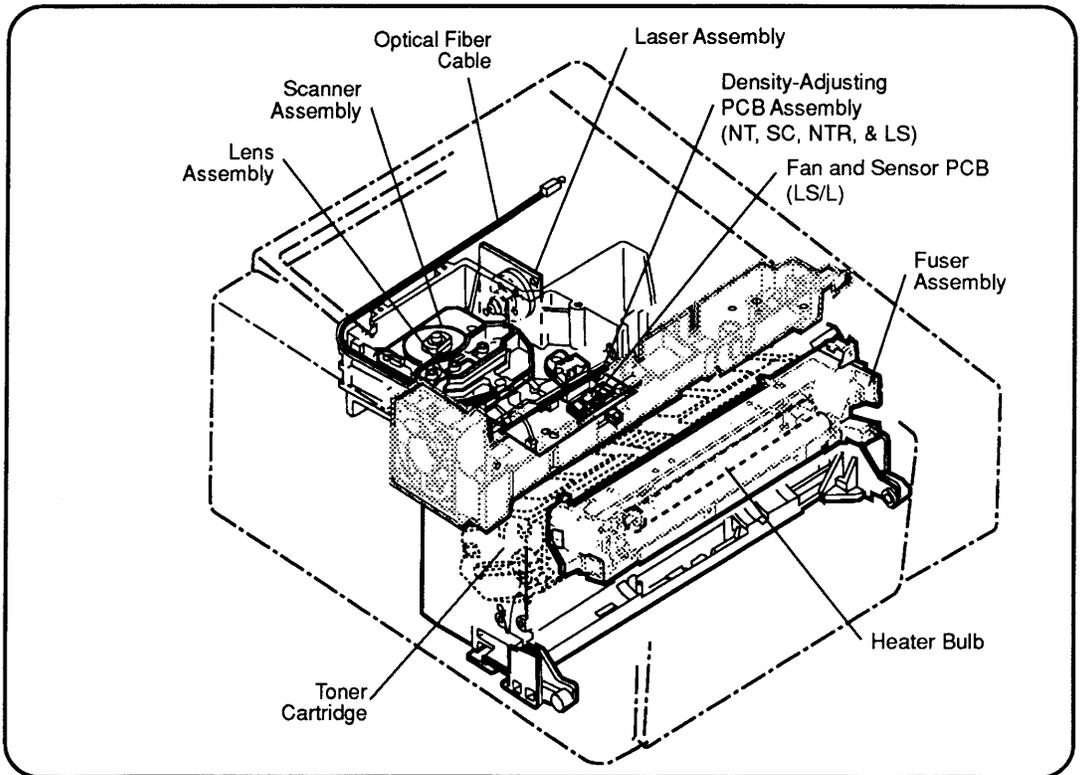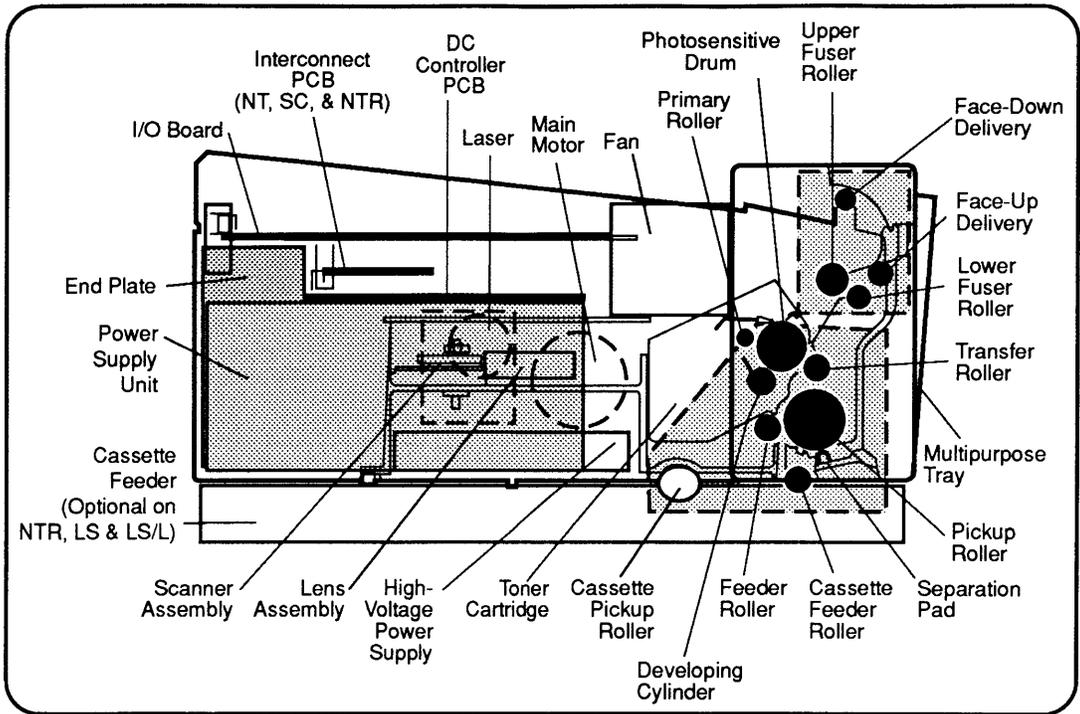
Figure 1-6 Internal Assembly Locations

❏ PRINT ENGINE SPECIFICATIONS

Specifications for the print engine used in all versions of the Apple Personal LaserWriter are listed below.

General

Printing Method:
Electrophotography using single-component dry toner

Optical System:
Semiconductor laser and a rotating scanning mirror

Printing Resolution:
300 dots-per-inch for text and graphics

Printing Speed:
4 pages-per-minute maximum; actual performance depends on the application

Electrical

Line Voltage:
US/Japan	100/115 volts, 50/60 Hz
Europe/Australia	220/240 volts, 50 Hz

Power Consumption:
600 W maximum at 100/115 V
550 W maximum at 220/240 V

Environmental

Operating Temperature:
50° to 90.5°F (10° to 32.5°C)

Operating Humidity:
20% to 80% relative humidity

Noise Level:
Printing:	Under 53 dB(A)
Standby:	Under 43 dB(A)

Physical

Dimensions:	NT, NTR, and SC	LS and LS/L
Weight:	32 lbs (15 kg)	31 lbs (14.5 kg)
Height:	9.8 in (24.8 cm)	8 in (20.3 cm)
Width:	15 in (38 cm)	15 in (38 cm)

Performance

Print Delivery:
Face-down or face-up (manually selectable)

Life Expectancy:
150,000 pages, with no monthly page limit

Paper Weight

Cassette feed:	20-lb, single-sheet, photocopy, or typewriter bond
Manual feed:	20-28 lb, letterhead and colored stock, medium-weight transparency material, envelopes, and labels

Cassette Sizes

U.S. letter, U.S. legal, A4, B5 (Japanese Industry Standard), and envelope cassettes are available as options

Cassette Capacity

Automatic:	250 sheets
Manual:	50 and 70 sheet capacity
Envelope:	15 envelopes

Envelope cassette holds 15 envelopes. Use only envelopes whose size falls within these ranges:

Minimum:	86 x 178 mm (3.5 x 7 in)
Maximum:	188 x 267 mm (7.4 x 10 in)

Output Tray Capacity

Face-down tray	50 sheets
Face-up tray	20 sheets

❏ I/O BOARD SPECIFICATIONS

General   Following are the I/O board specifications for all
                                          Personal LaserWriter printers.

	SC	NT	NTR	LS	LS/L
CPU	68000 (7.275 MHz)	68000 (12 MHz)	68000 (12 MHz)	N/A	N/A
DRAM	1 MB	2 MB; expandable to 8 MB	3 MB; expandable to 6 MB	512K; expandable to 1 MB	512K; expandable to 1 MB
ROM	32K	1.25 MB	3 MB	N/A	N/A
I/O	SCSI	LocalTalk, RS-232/422	LocalTalk, RS-232/422, Centronics parallel	RS-422	RS-422
Printer Imaging Languages	QuickDraw	PostScript, HP LaserJet Plus, and a subset of Diablo 630 printer	PostScript, HP LaserJet Plus, and a subset of Diablo 630 printer	QuickDraw	QuickDraw
Built-in Fonts	N/A	ITC Avant Garde®, ITC Bookman, Courier, Helvetica®, Helvetica Narrow, New Century Schoolbook, Palatino, Symbol, Times®, ITC Zapf Chancery, ITC Zapf Dingbats	ITC Avant Garde®, ITC Bookman, Courier, Helvetica®, Helvetica Narrow, New Century Schoolbook, Palatino, Symbol, Times®, ITC Zapf Chancery,ITC Zapf Dingbats, IBM PC Graphics Extended Character Set (ECS)	N/A	N/A

❏ STATUS LIGHTS

Introduction

The Apple Personal LaserWriter has three status lights (**Figure 1-7**) on the front access door of the printer.
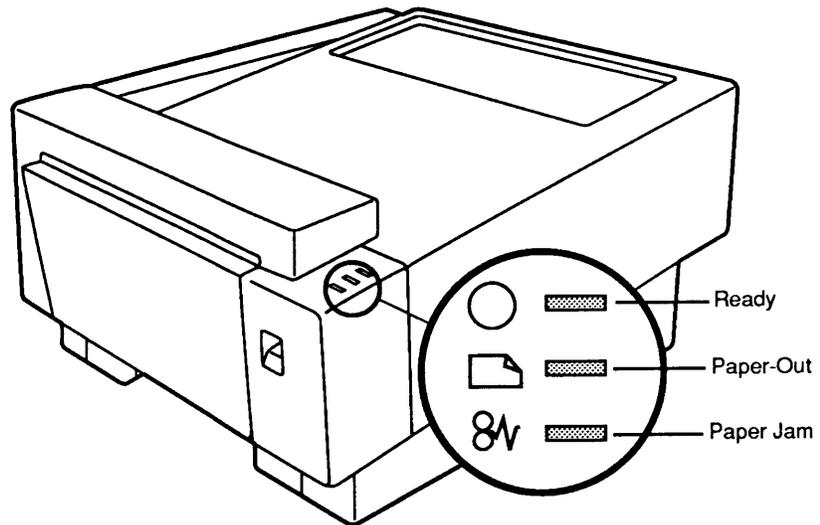
Figure 1-7 LaserWriter SC, NT, and NTR Status Lights

LaserWriter SC, NT, and NTR

When you switch on the Apple Personal LaserWriter NT, SC, or NTR, the I/O board executes a self-test diagnostic. At the conclusion of this test, the status lights indicate the status of the printer:

• The green ready light flashes during warmup and when the printer is operating. The light is steady when the printer is warmed up and ready to print. The light is off when the printer is not ready, an error condition exists, or the top cover is open.

• The yellow paper-out light is on and steady when the printer is out of paper or the paper tray is missing. The light flashes when the printer is ready to accept manually fed paper.

• The yellow paper jam light comes on and stays lit when there is a paper jam. The light stays on until the jam is cleared.

- When both the paper-out and paper jam lights flash, an error condition exists with either the I/O board or the LaserWriter print engine. Refer to Section 4, Troubleshooting, for diagnosis and repair.

The status light configurations listed in **Table 1-1** indicate the status or condition of the LaserWriter NT, LaserWriter SC, or LaserWriter NTR.

Ready Light	Paper-Out Light	Paper Jam Light	Printer Status
On	Off	Off	Ready
Off	On	Off	Paper cartridge not installed or Printer out of paper
Off	Off	On	Paper jam
Off	Off	Off	Front access door open or Toner cartridge not installed or Face-up cover assembly open
Flashing	Off	Off	Test printing or Engine warmup
Off	Flashing (Sync)	Flashing (Sync)	Fuser assembly error or Laser assembly malfunction or Scanner assembly malfunction
Off	Flashing (Toggle)	Flashing (Toggle)	I/O board failure

Table 1-1 LaserWriter NT, SC, and NTR Status Light Configurations

LaserWriter LS and LaserWriter LS/L

When the Personal LaserWriter LS or LS/L is hooked up to a Macintosh computer that is using the LS or LS/L software driver, a paper jam or a paper-out condition is indicated by the appropriate LED.

Because the LS and LS/L LEDs do not indicate as many error conditions as do the NT, SC, and NTR LEDs, the LaserWriter LS and LS/L software driver reports various alert messages on the monitor screen. See Section 4, Troubleshooting, "Status Lights," for more information.

❏ TEST PRINTS

The Apple Personal LaserWriter SC, NT, NTR, and LS produce a service test print **(Figure 1-9)** when you press the service test print button **(Figure 1-8)** on the DC controller PCB. The Personal LaserWriter LS/L produces a service test print **(Figure 1-9)** when you press the service test print button on the serial controller.

The Apple Personal LaserWriter NT, SC, and NTR also produce user test prints **(Figures 1-10 and 1-11)**.
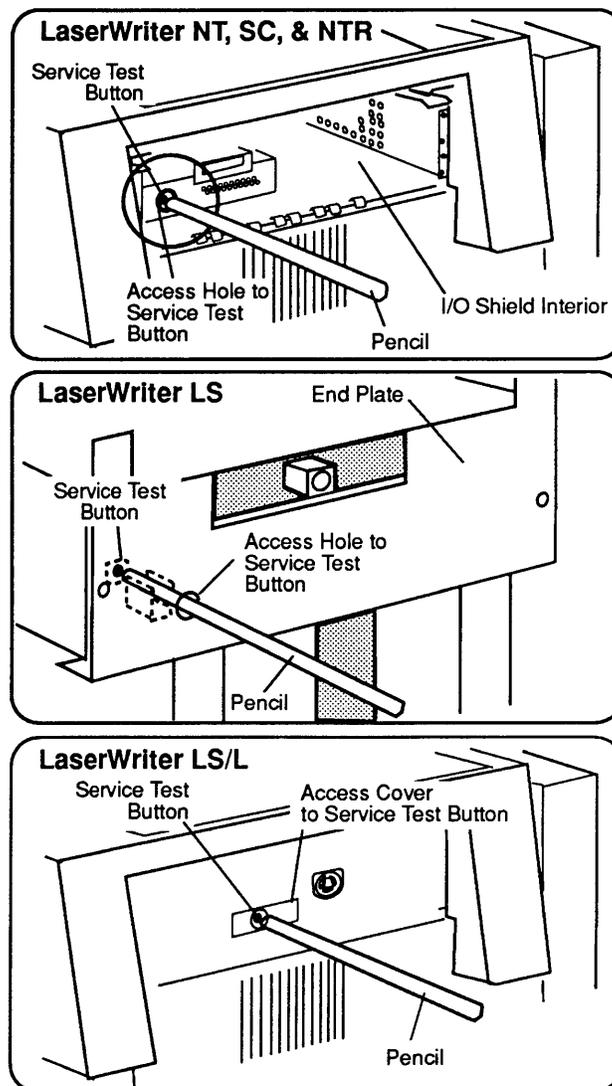
Figure 1-8 The Service Test Print Button

Service Test Print

The service test print that is generated by the DC controller PCB or the serial controller (in the case of the Personal LaserWriter LS/L) checks the registration adjustment and confirms the operation of the print engine. The print consists of vertical black stripes on a white background **(Figure 1-9)**. If a service test print does not appear after pressing the service test print button, refer to Section 4, Troubleshooting.
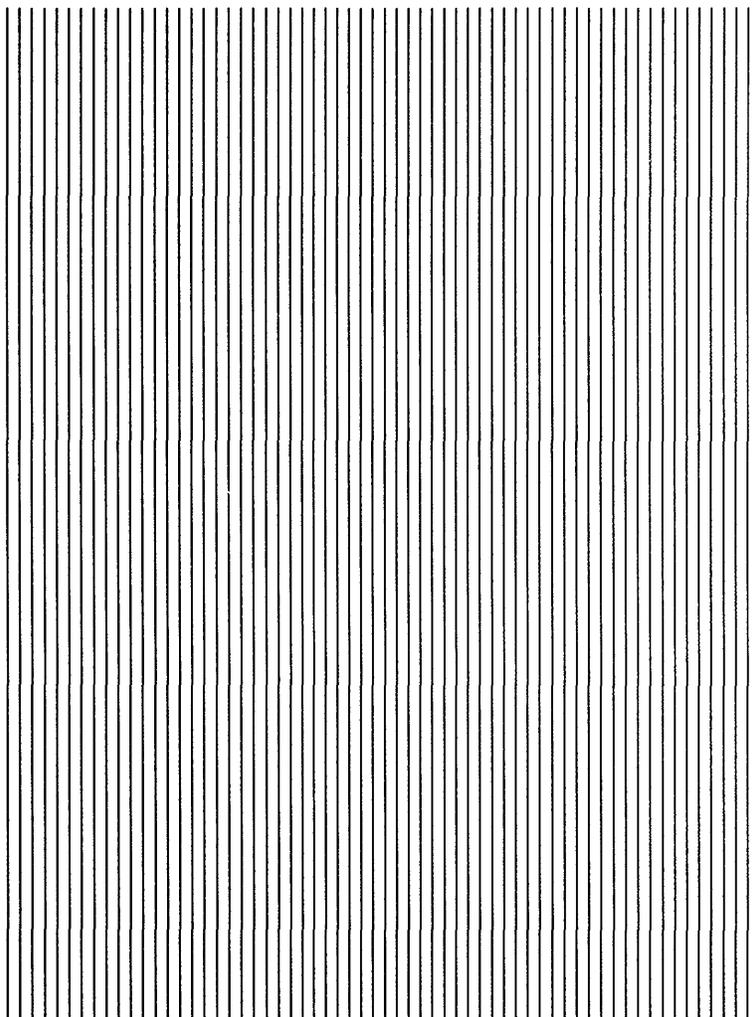
Figure 1-9 Service Test Print

LaserWriter SC
User Test Print

The LaserWriter SC I/O board produces the SC user test print **(Figure 1-10)** only if the SCSI ID number is set to "7." When the printer is switched on, the SC user test print will print repeatedly until the printer is out of paper. The user test print confirms the operation of the LaserWriter SC I/O board.
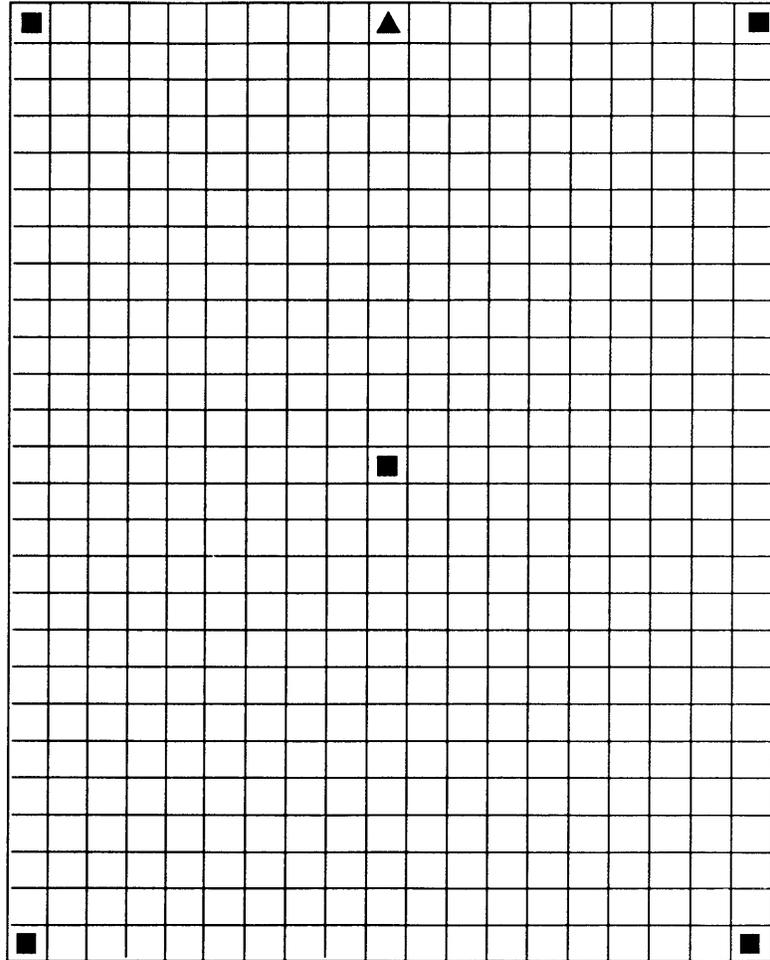
Figure 1-10 LaserWriter SC User Test Print

LaserWriter NT and NTR User Test Print

The LaserWriter NT and NTR I/O boards produce a single user test print (**Figure 1-11**) whenever you switch the printer on. The NT and NTR user test prints confirm the operation of the I/O board and provide the following information about the configuration and status of the printer:

- The name of the printer

- Whether RS-232 serial or AppleTalk® communication is selected

- The number of fonts stored in ROM

- The amount of RAM installed

- The number of prints produced by the I/O board
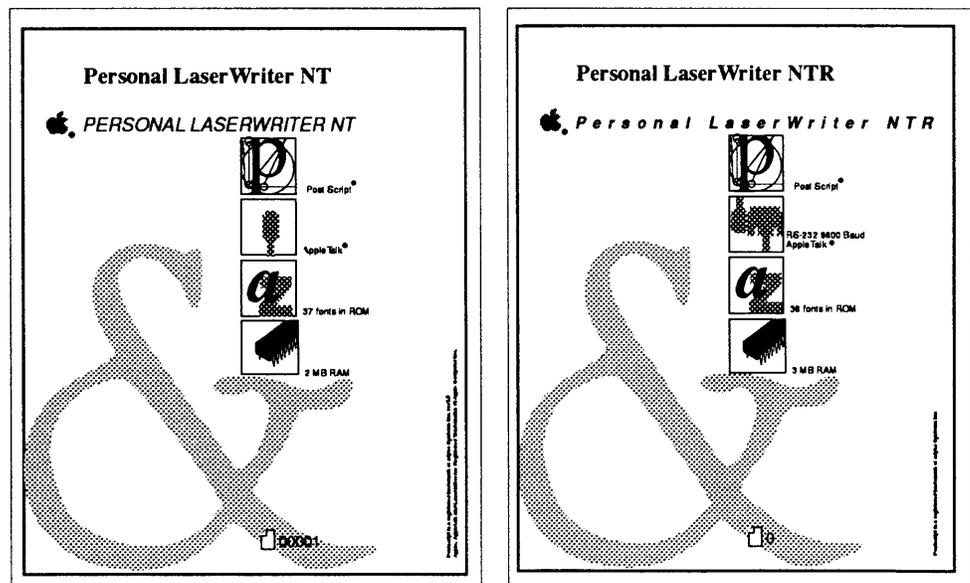
Figure 1-11 LaserWriter NT and NTR User Test Print

❑ TONER CARTRIDGE

Introduction

The toner cartridge **(Figure 1-12)**, an essential part of the image formation system, contains the photosensitive drum, the developing cylinder, the primary roller, and the cleaning blade.
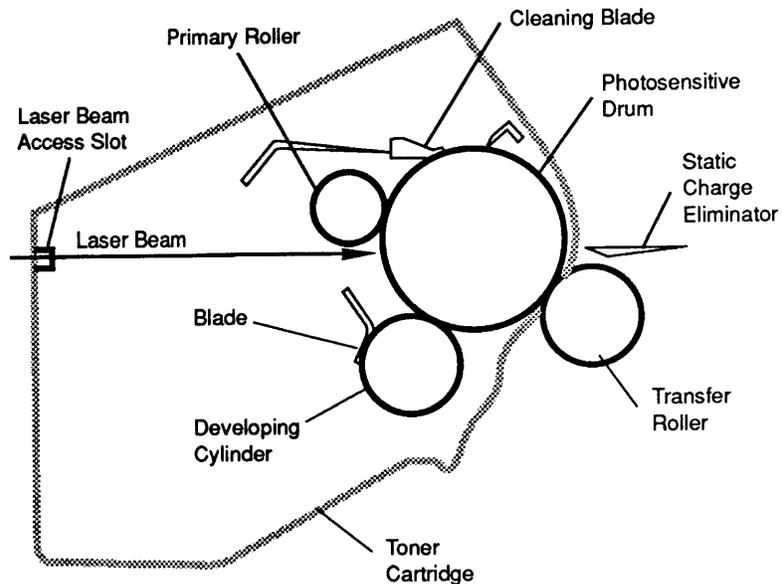
Figure 1-12 Toner Cartridge

Life Expectancy

The expected storage life of a toner cartridge packed in its original packaging is 2-1/2 years from the date of manufacture. The expiration date appears on the toner cartridge and the cartridge packing box. The printing life of a toner cartridge is about 3500 prints.

Laser Beam Access Slot

The toner cartridge does not have a shutter to cover the laser beam access slot **(Figure 1-12)**. The laser beam access slot allows the light from the laser beam to strike the surface of the photosensitive drum. When the cartridge is removed from the printer, cover the cartridge with a cloth or store the cartridge in its packing box or aluminum storage bag.

Storage

The toner cartridge is sensitive to environmental conditions, even when it is sealed in its aluminum storage bag. Please note the following storage requirements:

- Store the toner cartridge at a temperature between 32°F and 95°F (0°C and 35°C) and a relative humidity of 35% to 85%. Higher or lower temperature or humidity may reduce the storage life of the cartridge.

- Avoid storing the toner cartridge in direct sunlight or near a window.

- Do not store the toner cartridge in an automobile for an extended time in warm weather.

- Do not store the toner cartridge where temperature or humidity are high or subject to sudden change.

- Avoid storing the toner cartridge near ammonia or other corrosive gases.

Handling Suggestions

1. Keep the toner cartridge inside the printer until the cartridge is empty. Exposure to light may damage the cartridge.

2. Don't touch the surface of the photosensitive drum when the drum protection shutter is open.

3. The photosensitive drum is sensitive to light. Minimize the drum's exposure to light:

   - Keep the printer front access door closed

   - Reduce room lighting when clearing paper jams or changing the toner cartridge

4. If prints begin to fade due to low toner, hold the toner cartridge horizontally and slowly rock it from side to side, as illustrated on the cartridge, to distribute the toner evenly.

5. Do not stand the toner cartridge on end or turn it upside down.

6. Do not subject the toner cartridge to unnecessary vibration or shock.

❑ SETUP AND OPERATION

Instructions for setting up and operating the Apple Personal LaserWriter SC, NT, NTR, LS, and LS/L are provided in the owner's guides. The guides cover the following topics:

1. Setting Up the LaserWriter: includes unpacking the printer, installing the toner cartridge, loading the paper cassette, and connecting the printer to the Macintosh computer.

2. Installing Printer Software: includes installing the printer drivers, fonts, and the Cleaning Page document.

3. Printing Documents: includes using the Chooser to select a printer, defining the page setup, printing from the paper cassette and the multipurpose tray, and printing to the face-down or the face-up tray.

4. Working with Fonts: covers the basics of Macintosh typography and the Personal LaserWriter fonts.

5. Maintenance: covers routine maintenance procedures such as replacing the toner cartridge, using the Cleaning Page document, and refilling the paper cassette.

6. Troubleshooting: provides solutions for common problems that may occur when using the Apple Personal LaserWriter.

❑ THEORY OF OPERATION – PRINT ENGINE

The Apple Personal LaserWriter has two basic functional areas: the print engine and the I/O board. The following section presents a functional overview of the print engine.

The print engine **(Figure 1-13)** includes the DC control system, the laser/scanner system, the image formation system, the power distribution system, and the paper pickup and feed system.
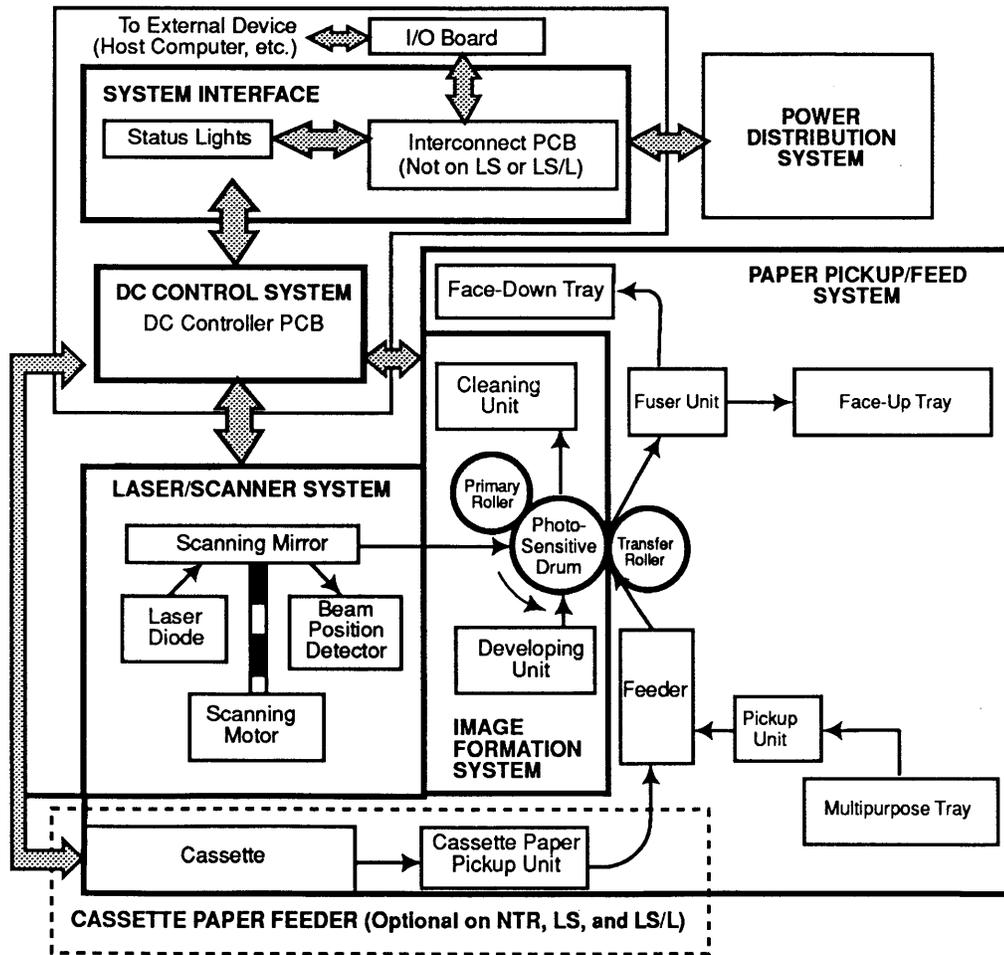
Figure 1-13 Print Engine Overview (LaserWriter NT, SC, and NTR)

DC Control System

The heart of the print engine is the DC controller PCB **(Figure 1-14)**. The DC controller PCB exchanges signals with all the other systems in the printer and the I/O board. The DC controller PCB also generates the control signals for the printer's various functions and coordinates all activities involved in the printing cycle.

Note: The Personal LaserWriter LS/L combines the I/O and DC controller boards into one module: the serial controller.
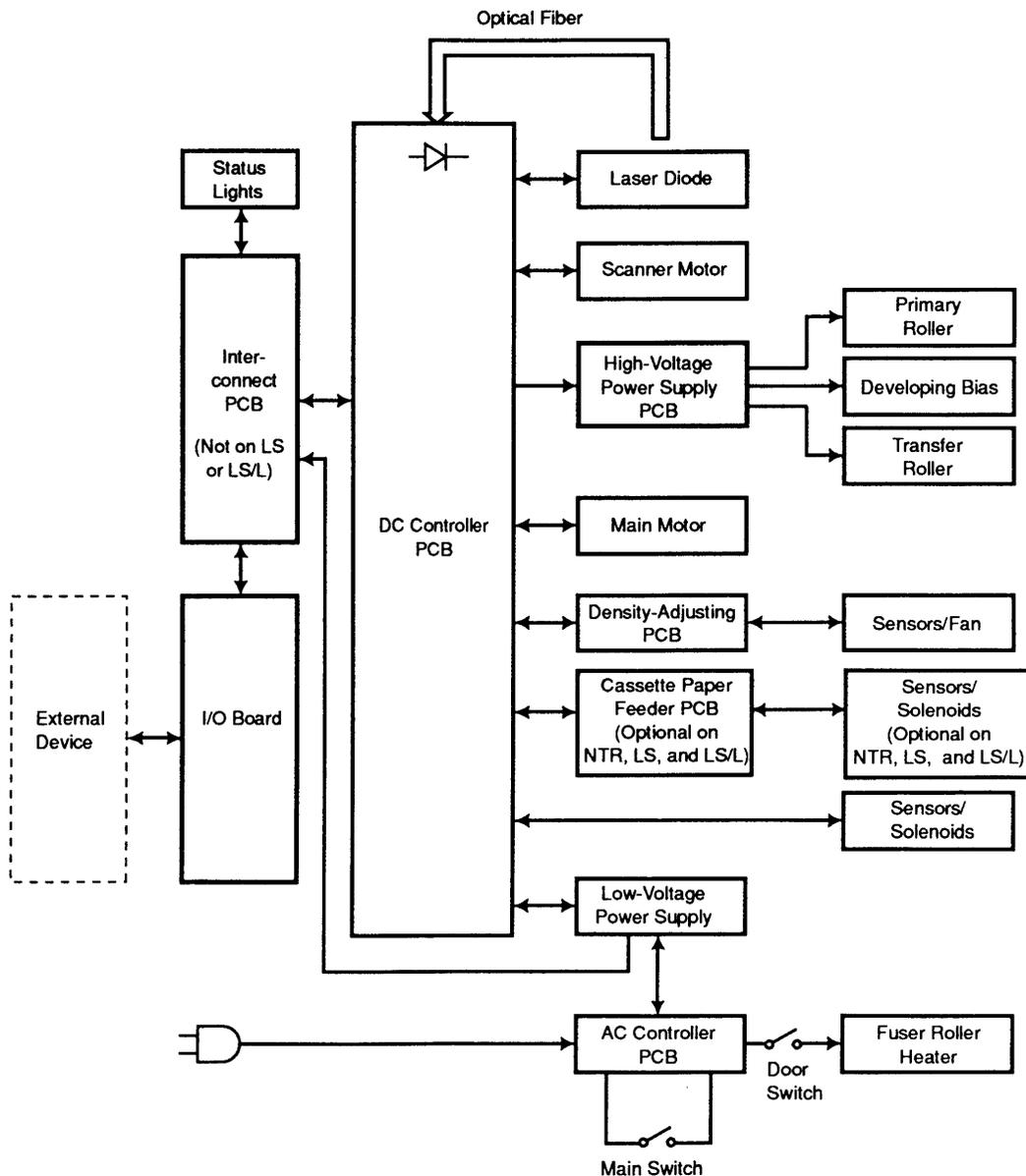
Figure 1-14 DC Controller Block Diagram (LaserWriter NT, SC, and NTR)

The DC controller PCB acts as an interface between the I/O board and the print engine. When the I/O board receives a print command from the host computer, it sends a corresponding print command to the DC controller PCB. Upon receipt of this print command, the DC controller PCB generates the signals that

- Start the main motor, which turns the photosensitive drum and the developing cylinder

- Activate the laser beam and the scanner motor to begin image generation

- Activate the paper pickup and feed system to deliver paper for the image transfer and to deliver the paper to one of the output trays

- Activate the high-voltage power supply, which provides power to the transfer rollers and heats the fuser rollers to complete the image transfer process

The DC controller PCB monitors the entire printing process—the laser beam scan position, paper pickup and transport, whether the print has been delivered to the output tray or whether the I/O board is sending more information. The DC controller PCB controls output functions by activating solenoids, motors, and the laser diode; the DC controller PCB monitors input functions by reading microswitch and photosensor status.

A

External Device

I/O Board

$\overline{BD}$ $\overline{VDO}$

DC Controller (PCB)

BD APCIN

$\overline{SCNON}$ $\overline{VDOUT}$ LSRPWR

Focusing Lenses
Scanning Mirror
Scanner Motor

Optical Fiber

Collimator Lens

Laser Driver

Beam Detector Mirror

Photosensitive Drum

B

Photosensitive Drum

Laser Beam

Scanning Mirror

Video Signal

C

t_1
t_2
t_3

Photosensitive Drum

Laser Beam

Scanning Mirror

Video Signal

t_2 t_3
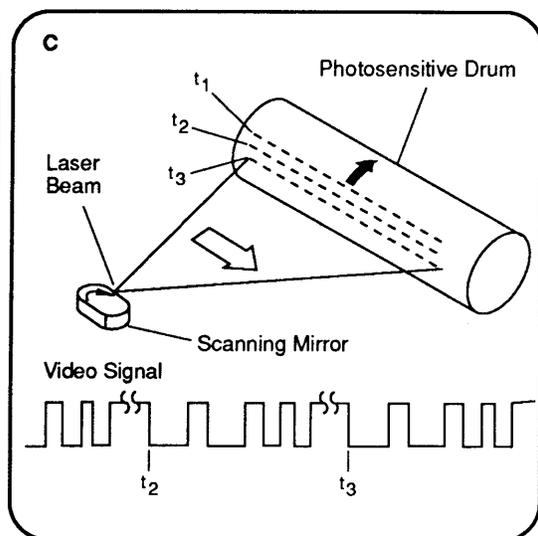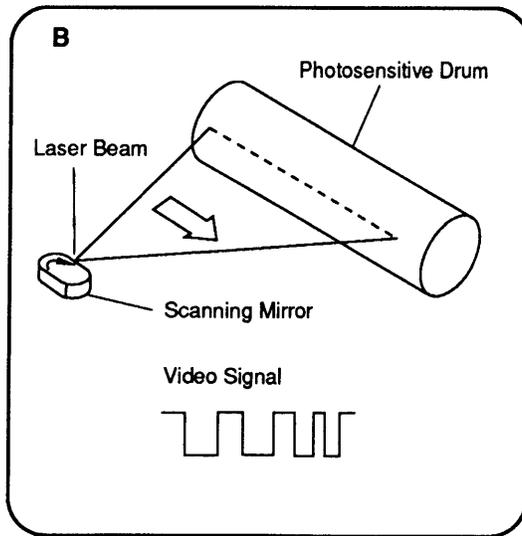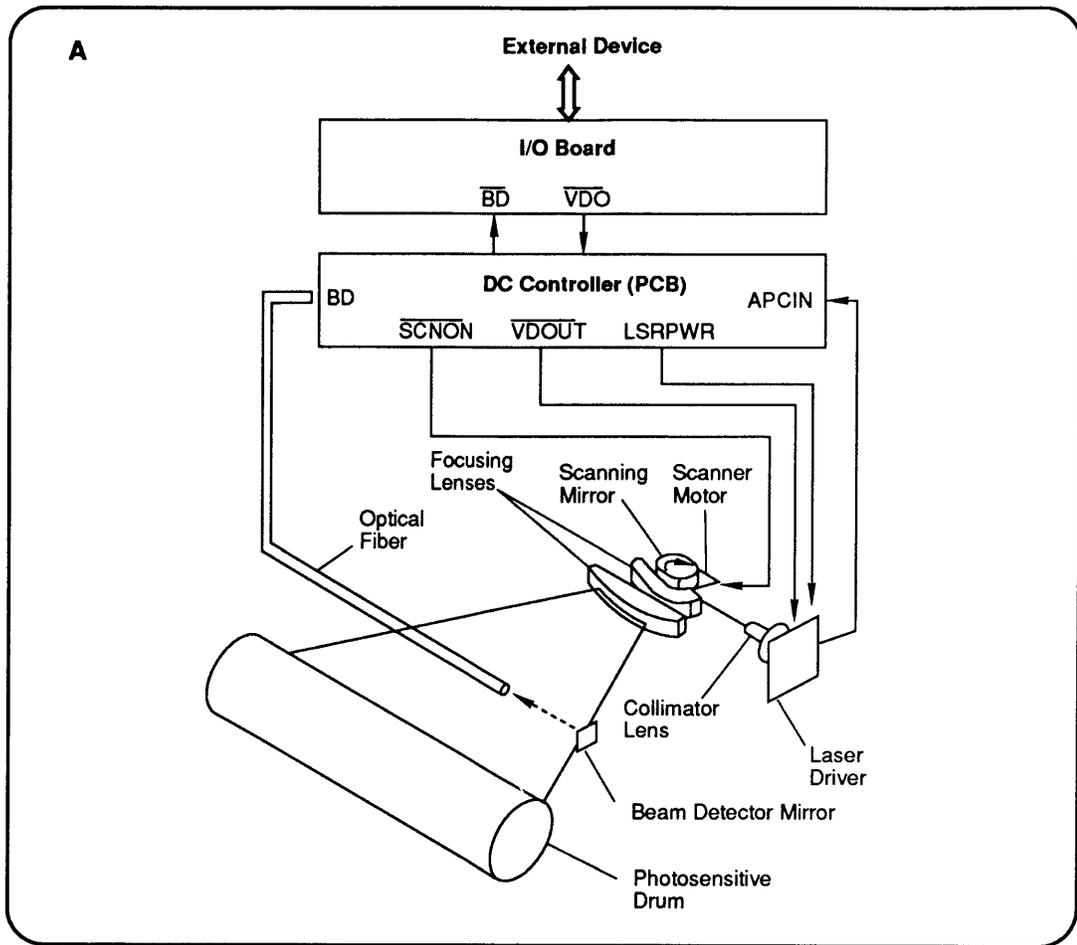
Figure 1-15 Laser/Scanner System

**Laser/Scanner
System**

The laser/scanner assembly generates the laser beam (**Figure 1-15A**) that creates the electrostatic latent image on the photosensitive drum. This image is later developed into a visible image. The laser/scanner assembly is made up of the laser driver, the scanning mirror, the scanner motor, and the focusing lenses.

When the DC controller PCB receives a video signal (/VDO) from the I/O board, the DC controller sends a Video-Out (/VDOUT) command to the laser unit. This Video-Out (/VDOUT) signal modules the laser beam to form the image on the drum.

The image is formed when the laser beam passes through the collimator lens and strikes a rotating two-sided scanning mirror (**Figure 1-15B**). As the mirror rotates, the laser beam reflects off the mirror and passes through focusing lenses to the photosensitive drum.

The photosensitive drum rotates at a constant speed that matches the speed of the beam scanned across it (**Figure 1-15C**). That is, in the time it takes for the beam to return to its original position, the drum surface shifts downward enough (85μm or 1/300th of an inch) to accept the next line of scanning. When the laser beam returns to the start of a scan line to begin printing a new line, the light reflects via the beam detect mirror—located slightly to the right of the photosensitive drum—to an optical fiber. The optical fiber carries the beam detect light signal (/BD) to the DC controller PCB (J204) and thus indicates that the beam is about to scan a new line. As each successive beam scans across the drum surface, an image builds on the drum surface in the form of tiny dots that match the transmitted image.

A key part of the scanner is the scanning mirror with two reflective faces. The mirror is mounted to the scanner motor. The motor speed is controlled by the scanner drive circuit and monitored by the DC controller. The scanner driver applies motor drive voltage to the motor when the scanner receives the drive signal from the DC controller PCB. The scanner motor sends a tachometer signal to the DC controller PCB to detect proper motor speed. If the scanner motor does not reach the specified rotation rate within 15 seconds after starting rotation, the DC controller PCB stops the scanner motor and notifies the I/O board of the scanner motor speed error.
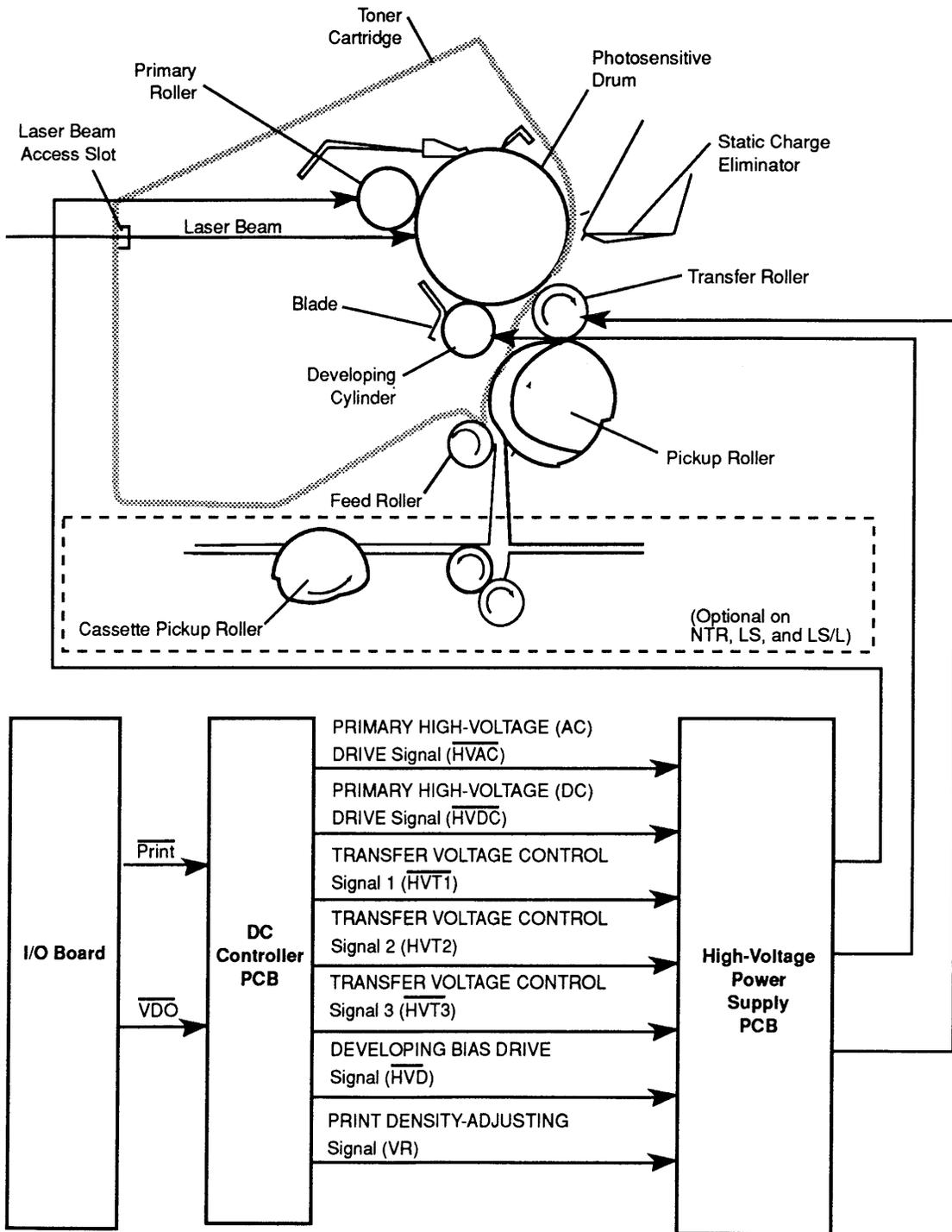
Figure 1-16 Image Formation System

Labels in figure:
- Toner Cartridge
- Primary Roller
- Laser Beam Access Slot
- Laser Beam
- Blade
- Developing Cylinder
- Feed Roller
- Cassette Pickup Roller
- Photosensitive Drum
- Static Charge Eliminator
- Transfer Roller
- Pickup Roller
- (Optional on NTR, LS, and LS/L)

- I/O Board
- Print
- VDO
- DC Controller PCB
- High-Voltage Power Supply PCB

- PRIMARY HIGH-VOLTAGE (AC) DRIVE Signal ($\overline{\text{HVAC}}$)
- PRIMARY HIGH-VOLTAGE (DC) DRIVE Signal ($\overline{\text{HVDC}}$)
- TRANSFER VOLTAGE CONTROL Signal 1 ($\overline{\text{HVT1}}$)
- TRANSFER VOLTAGE CONTROL Signal 2 (HVT2)
- TRANSFER VOLTAGE CONTROL Signal 3 ($\overline{\text{HVT3}}$)
- DEVELOPING BIAS DRIVE Signal ($\overline{\text{HVD}}$)
- PRINT DENSITY-ADJUSTING Signal (VR)

Image Formation System

The image formation system **(Figure 1-16)** is the part of the printing process where the image actually forms on the photosensitive drum and transfers to paper. The image formation system includes the toner cartridge, the developing cylinder, and the primary roller. The image formation system uses parts of the other systems in the printer as well: the laser beam from the laser/scanner unit (which creates the charges that form the image) and the pickup/feed system (which sends the paper to receive the image).

The toner cartridge contains the photosensitive drum, developing cylinder, and drum-cleaning assembly.

Operation Overview

When the DC controller PCB receives a print command from the external device via the I/O board, the DC controller PCB activates the main motor to rotate the photosensitive drum and developing cylinder. After the drum surface receives a negative charge from the primary roller, the laser beam (modulated by the /VDO signal from the DC controller PCB) scans the drum to form a latent image. The latent image attracts toner from the developing cylinder; the charge from the transfer roller transfers the resulting image to the paper.

The cleaning blade removes any remaining toner from the drum, and the primary roller charges the drum to give it a uniform sensitivity in preparation for forming a new latent image. The DC controller PCB adjusts the laser beam to match a predetermined level of intensity. This matching is accomplished by monitoring the light output of the laser diode and adjusting the laser drive signal (LSRPWR) to obtain the desired intensity. The adjustment is automatic and occurs during both the initial rotation period and the between-page interval.

Unlike previous LaserWriter printers, the toner cartridge in the Personal LaserWriter does not contain a toner level sensor. If you attempt to operate the Personal LaserWriter SC or NT without a toner cartridge, the LEDs indicate a Top-Open error. If you attempt to operate the Personal LaserWriter LS without a toner cartridge, the LS driver displays an error message on the monitor screen.

The actual printing process can be divided into five **stages** and seven **steps** as shown in the diagram below (**Figure 1-17**).

> Stage 1: Electrostatic Latent Image Generation Stage
> > Step 1. Primary Charge
> > Step 2. Scanning Exposure
>
> Stage 2: Developing Stage
> > Step 3. Development
>
> Stage 3: Transfer Stage
> > Step 4. Transfer
> > Step 5. Separation
>
> Stage 4: Fixing Stage
> > Step 6. Fixing
>
> Stage 5: Drum-Cleaning Stage
> > Step 7. Drum Cleaning
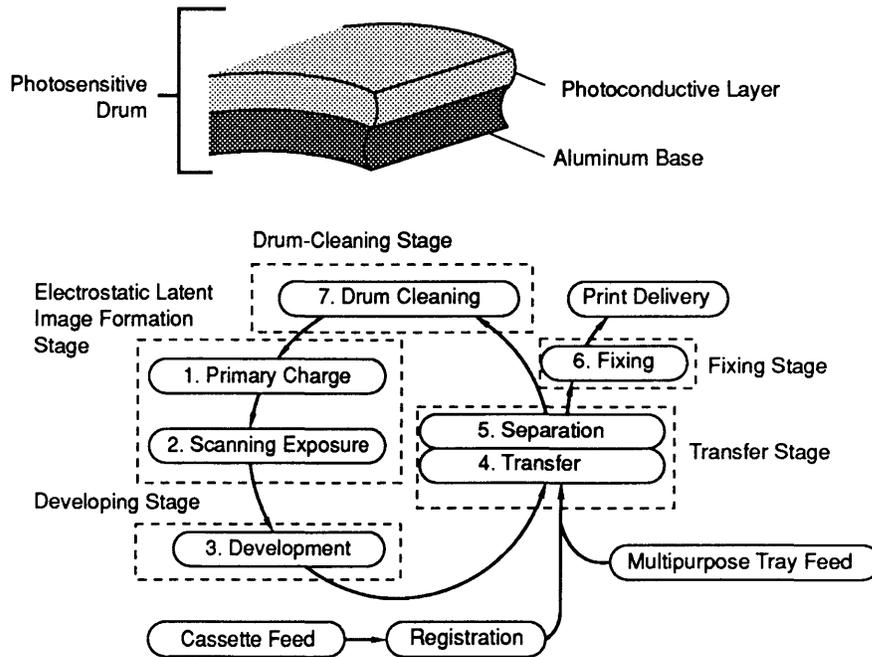
Figure 1-17 Printing Process Stages

Stage One:
Electrostatic Latent
Image Formation

The first stage is **electrostatic latent image formation stage**. This stage produces on the drum a pattern of electrical charges that reflects the image. The formation stage has two steps.

1. **Primary Charge:** In this step, the primary roller, composed of conductive rubber, applies a uniform layer of negative charge over the drum surface **(Figure 1-18)**. The print density adjustment lever controls the difference in potential between the photosensitive drum and the primary roller. The lever allows you to adjust for lighter or darker images.
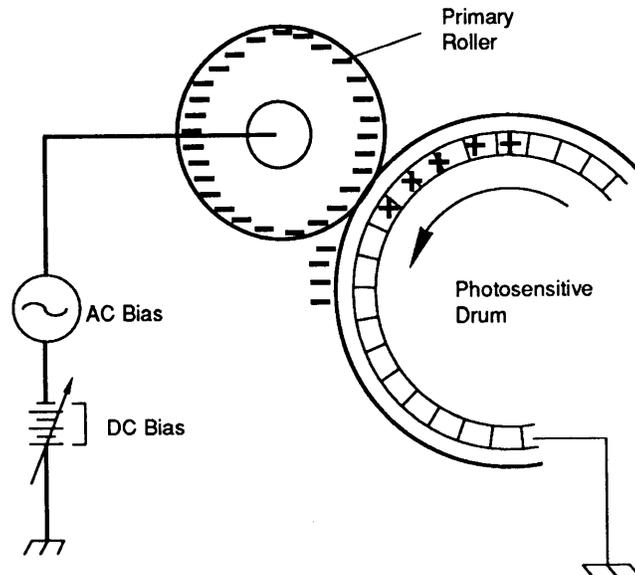
Figure 1-18 Primary Charge Application

2. **Scanning Exposure:** In this step, the laser beam scans over the drum surface **(Figure 1-19)**. In the area where the beam strikes the drum, the charge is neutralized. The charges remaining on the drum form an *electrostatic latent image,* an invisible pattern identical to the original image.
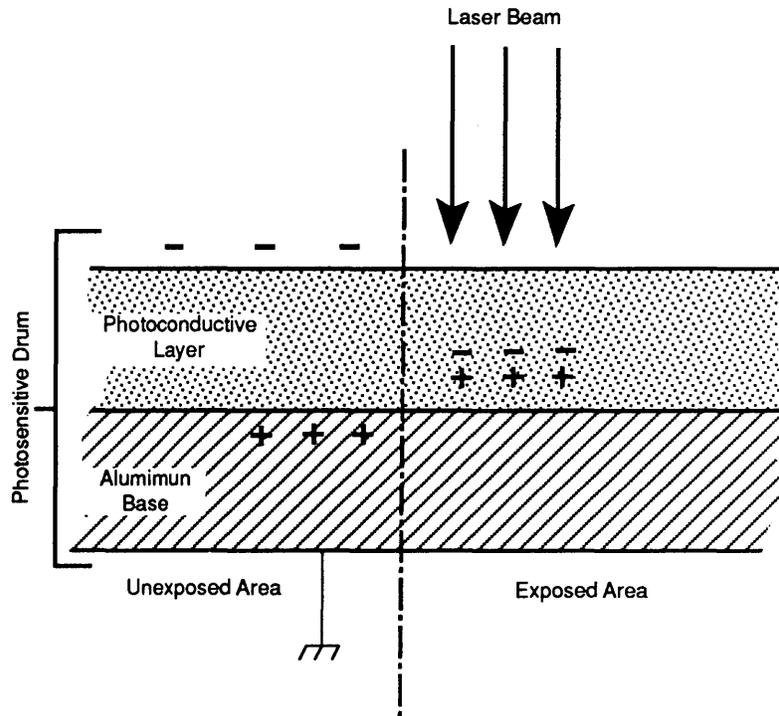
Figure 1-19 Scanning Exposure

Stage Two:
Development

In the one-step **development stage (Figure 1-20)**, the electrostatic latent image on the drum surface is developed into a visible image composed of toner particles.

The developing assembly consists of a developing cylinder rotating around a fixed internal magnet and a blade. The cylinder attracts the toner because of the magnet, and the blade skims the toner particles on the cylinder into a thin, uniform layer.

The areas on the photosensitive drum that were exposed to the laser beam have a higher potential than the negatively charged toner on the developing cylinder. This difference of potential causes the toner particles to move from the cylinder to areas of the drum surface exposed to the beam. The result is the conversion of the electrostatic latent image into a visible toner image. (Placement of toner on the drum is called *toner projection development.*)
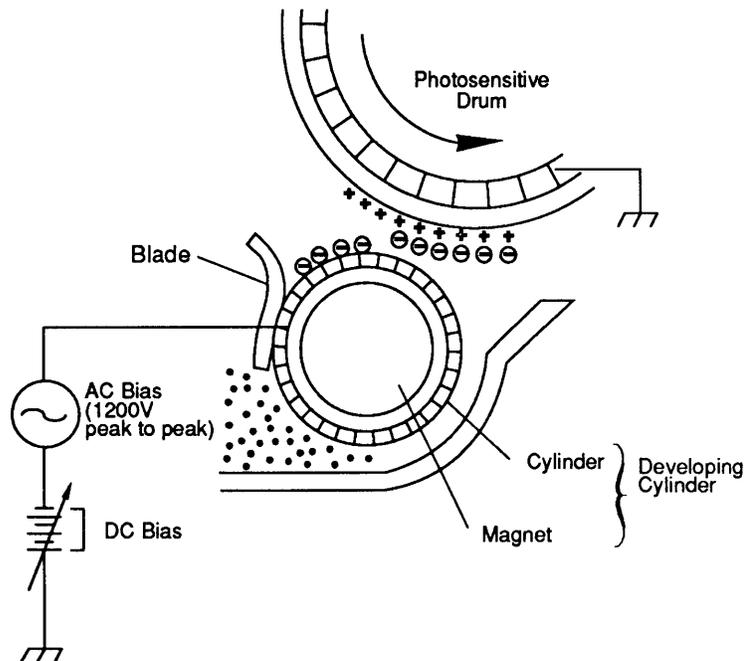
Figure 1-20 Development Stage

Stage Three:
Transfer

The third stage of the image processing system is called the **transfer stage (Figure 1-21)**. In this two-step stage, the toner image on the drum surface transfers onto the paper.

1. As the paper passes between the drum and the transfer roller, the transfer roller applies a positive charge to the back of the paper. The charge attracts the negatively charged toner particles to the paper.

Photosensitive
Drum

Transfer
Roller

Paper

Figure 1-21 Transfer Stage

2. The stiffness of the paper separates the paper from the drum, with an assist from a negative voltage produced by a static charge eliminator. The static charge eliminator weakens the attractive force between the paper and the drum. Without such assistance, thin paper might wrap around the drum.

Stage Four:
Fixing

The one-step **fixing stage** permanently fuses the transferred toner to the paper **(Figure 1-22)**.

After the toner image transfers onto the paper, it adheres by electrostatic attraction and a slight physical adhesion, so that even a light touch will smear the image. By applying heat and pressure to the paper, the fixing assembly fuses the toner particles onto the paper to make a permanent image.

The surface of the upper roller of the fuser assembly is coated with nonsticking PTFE resin (Teflon). The resin surface keeps the paper from sticking to the roller and prevents offsetting (adhesion of toner from one print to the roller and subsequent transfer of that toner to another print).
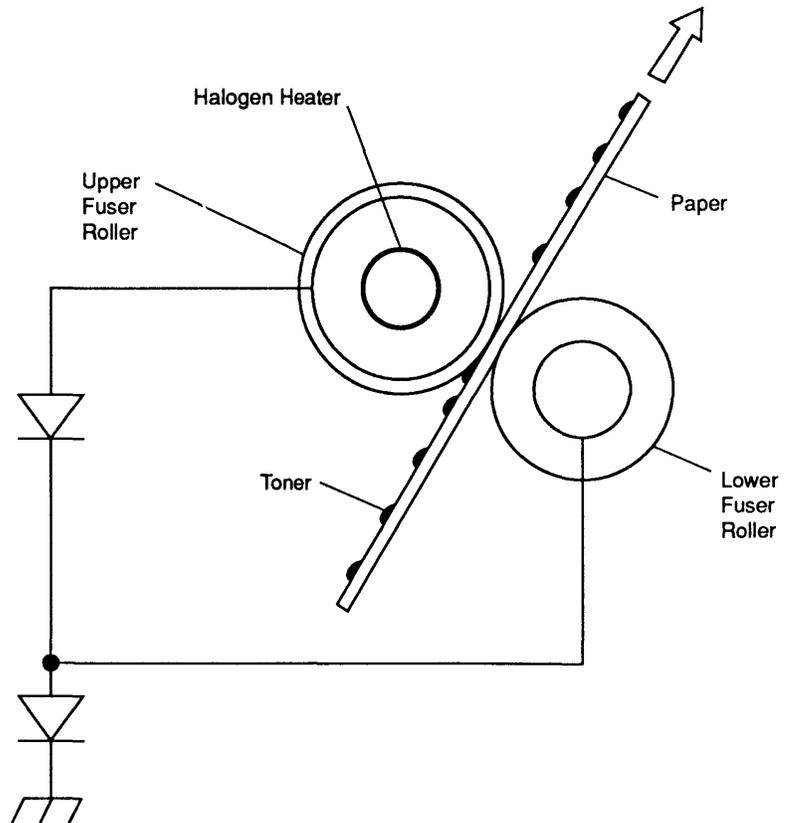
Figure 1-22 Fixing Stage

Stage Five:
Drum Cleaning

In the **drum-cleaning stage (Figure 1-23)**, any residual toner is cleaned off the photosensitive drum so that the next print image is clear and distinct.

In stage three, the transfer stage, not all the toner was transferred to the paper; some remained on the photosensitive drum. The cleaning blade removes the remaining toner from the drum surface. Then the sweeper strip collects the scraped-off toner and pushes it away from the drum.

If the image on the photosensitive drum does not transfer completely to the paper (due to a paper jam, etc.), toner may remain on the transfer roller. The printer removes the excess toner in the following manner: during wait, initial rotation, and last rotation, the DC voltage on the transfer roller has a negative potential and the charge on the photosensitive drum is 0V. These settings attract the negatively charged toner to the drum, where the toner is removed by the normal drum-cleaning sequence.
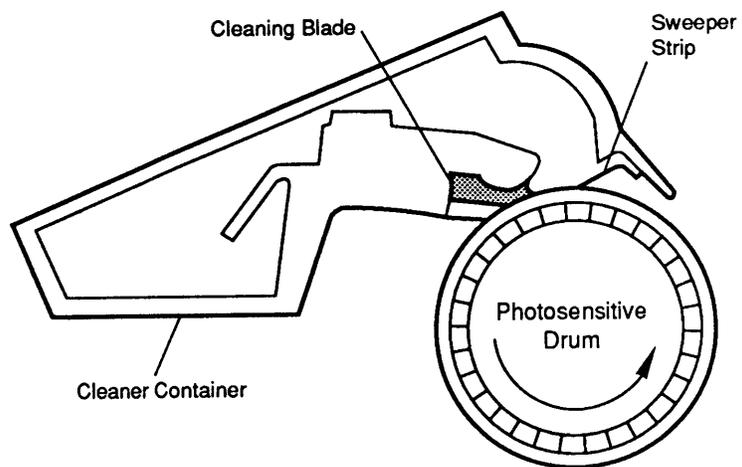
Figure 1-23 Drum-Cleaning Stage

Power Distribution System

The power distribution system (**Figure 1-24**) supplies AC power to the low-voltage DC power supply through a circuit breaker (CB101) on the AC controller PCB. The DC power supply generates the +5, +12, and +24 volts DC required by the different systems in the printer.
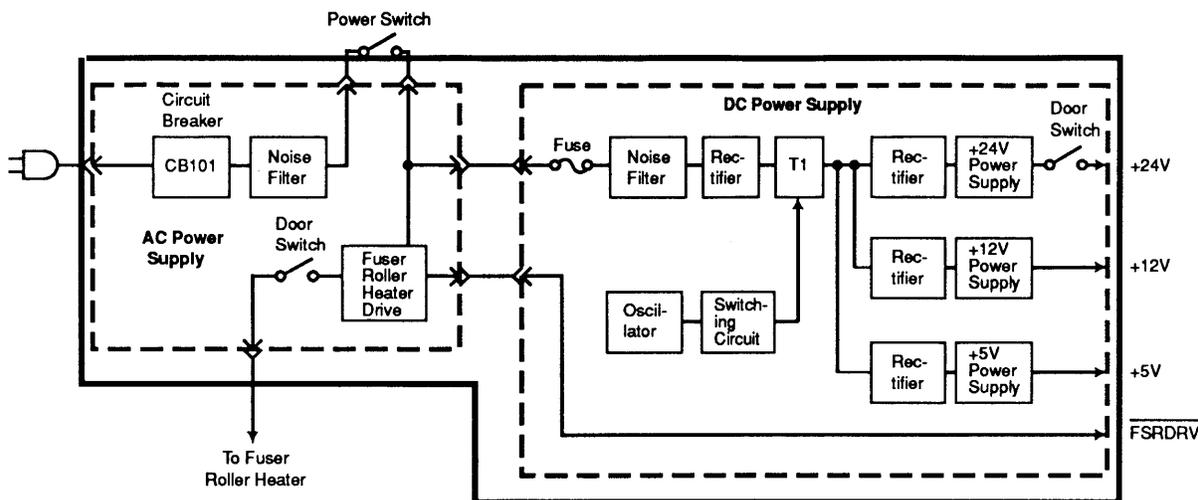
Figure 1-24 Power Supply Unit

Protection Circuitry

Should a short circuit or other fault cause excessive current draw from any of the DC power supplies, a protection circuit automatically turns off the output voltage to protect the power supply.

To reset the power supply after the protection circuit triggers, turn off the printer and locate and repair the fault. When you switch the printer on again, the power supplies will operate normally.

A circuit breaker (CB101) protects the power supply and fuser assembly from damage in the event of excess current draw by the heater bulb. The circuit breaker is located on the AC controller PCB.

Figure 1-25 Paper Feed and Delivery System
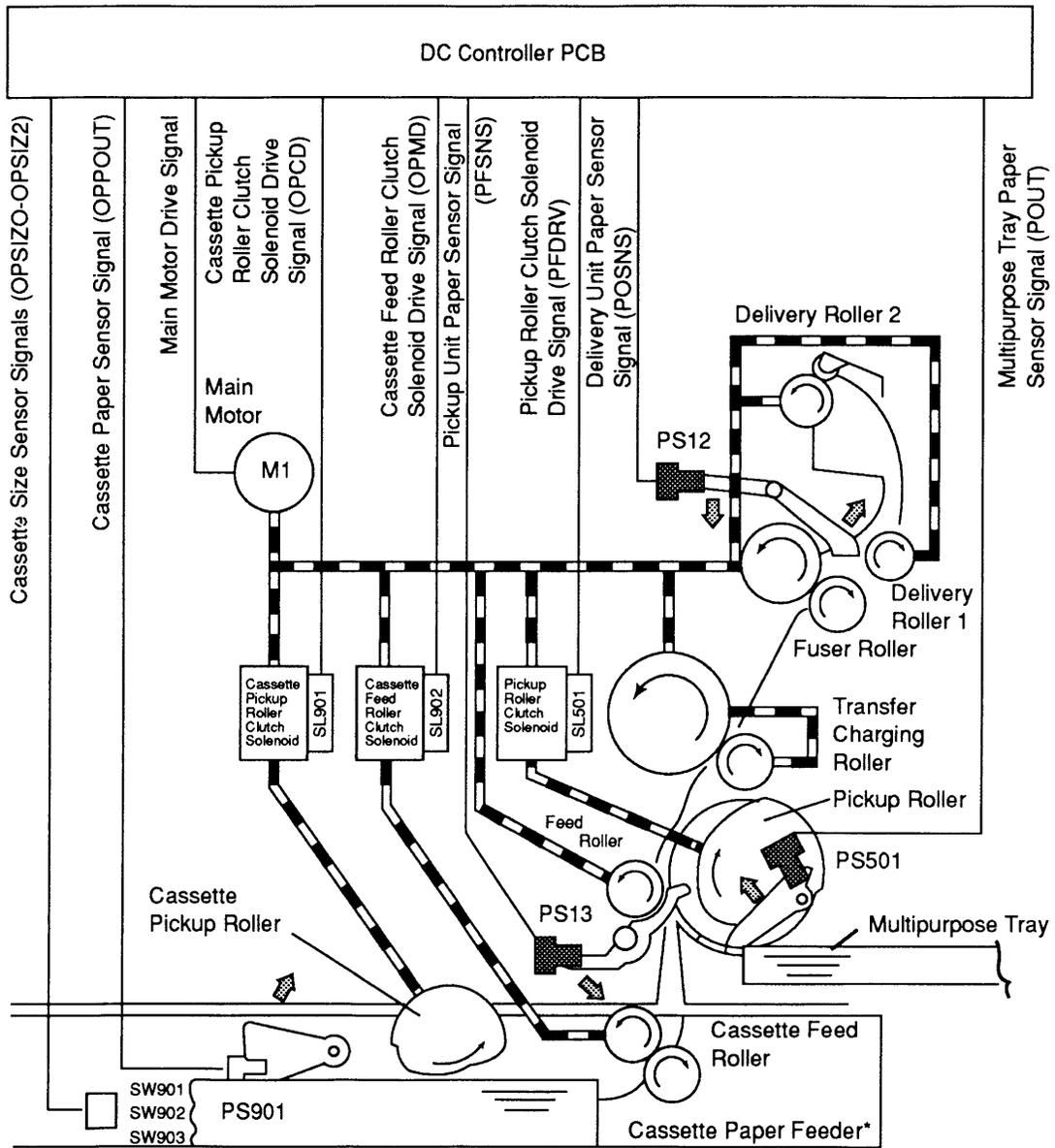
*Cassette paper feeder is optional on the LaserWriter NTR, LS, and LS/L .

**Pickup/Feed
System**

The pickup/feed system **(Figure 1-25)** controls the pickup of paper from the cassette or the multipurpose tray, the feeding of paper through the Apple Personal LaserWriter, and the delivery of paper to either the face-up or face-down output tray.

Cassette Feed

About two seconds after the main motor starts at the beginning of a print cycle, a command activates the cassette pickup roller clutch solenoid (SL901) for one second. About 2.9 seconds after the /PRNT signal, the cassette feed roller clutch solenoid (SL902) activates, the cassette feed rollers rotate, and the paper feeds toward the photosensitive drum.

Because the cassette feed rollers are not turning when the paper reaches them, the paper arches and aligns itself *along* the rollers. Solenoid SL902, the cassette feed roller clutch solenoid, activates for about .95 second and causes the clutch to engage and turn the paper pickup roller, which feeds a sheet of paper to the cassette feed rollers from the paper cassette. The action synchronizes so that the leading edge of the paper aligns with the leading edge of the image on the photosensitive drum. After transfer, separation, and fusing, the printed paper arrives in the print tray.

Manual Feed

The timing of manual paper feed is identical to the timing for cassette paper feed although the feeds use a different paper sensor. Multipurpose tray sensor PS501 senses that paper is installed and available for use on the multipurpose paper tray. If you select Manual Feed, the Personal LaserWriter automatically takes paper from the loaded manual feed tray.

*Paper Jam
Detection*

The paper delivery sensors PS12 and PS13 detect whether paper is feeding normally. At specific check times stored in memory, the DC controller PCB determines whether paper is jammed by the presence of paper in the paper path. If the DC controller PCB detects a paper jam, the PCB immediately turns the main motor off. The Personal LaserWriter SC and NT illuminate the paper jam status light on the status panel. If the Personal LaserWriter LS is connected to a Macintosh computer that is using the LS driver, the printer illuminates the paper jam status light and displays an error message on the monitor screen.

A paper jam is detected under the following conditions. Refer to **Figure 1-26** for the location of the paper sensors.

- **Pickup Unit Delay Jam:** When paper does not reach the pickup unit paper sensor (PS13) within the required time after the fuser roller reaches the specified temperature

- **Pickup Unit Stationary Jam:** When paper does not clear the pickup unit paper sensor (PS13) within the required time

- **Delivery Unit Delay Jam:** When the pickup unit paper sensor (PS13) has detected the leading edge of the paper but the paper does not reach the delivery unit sensor (PS12) within the required time

- **Delivery Unit Stationary Jam:** When paper has cleared the pickup unit paper sensor (PS13) but has not cleared the delivery unit paper sensor (PS12) within the required time
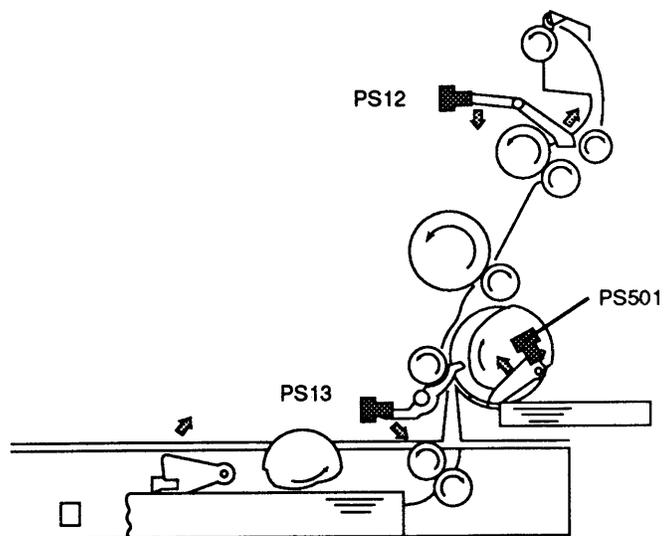
Figure 1-26 Paper Sensors

Signals and Operation

This section describes the kinds of interface signals exchanged between the printer and the I/O board. The section also provides information concerning the sequence of operations that use the interface signals (**Figure 1-27**).
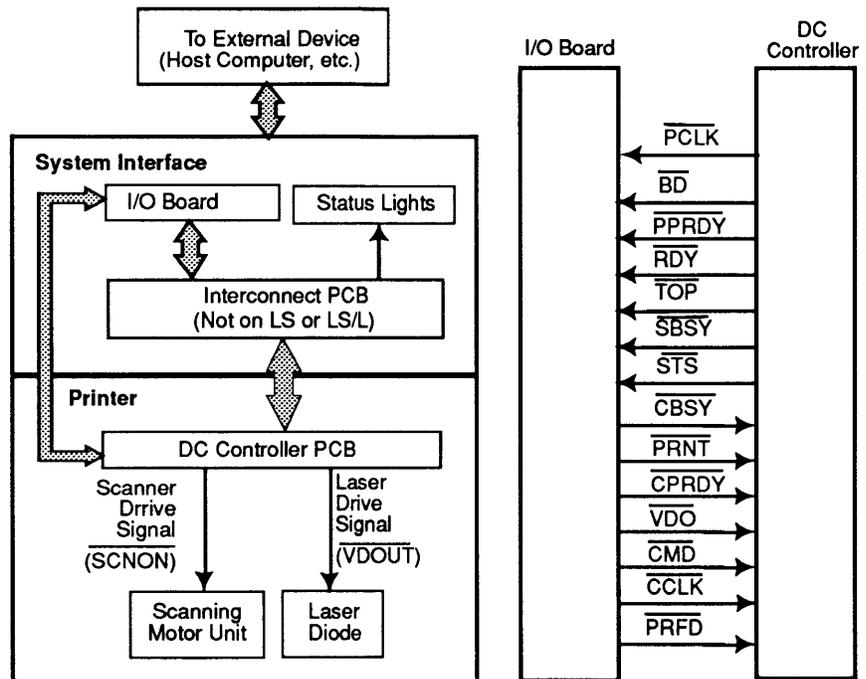
Figure 1-27 Signal Flowchart

After you switch on the printer, a wait state occurs. When the printer is ready for operation, a ready signal (/RDY) from the DC controller PCB goes to the I/O board and indicates the printer is ready to print.

When the /RDY signal is true and the page data is prepared, the I/O board sends the print signal (/PRNT) to the DC controller PCB. After the DC controller PCB receives the /PRNT signal, it starts the operation of the initial rotation (INTR) period. At the end of the INTR period, the DC controller PCB sends the vertical sync signal (/TOP) to indicate Top Of Page.

After the I/O board receives the horizontal sync signal (BD) from the DC controller PCB, the I/O board sends a video signal (/VDO) synchronized with the BD and TOP signals to the DC controller PCB. In response to the /VDO signal, the DC controller PCB generates the laser drive signal (/VDOUT), which actually switches the laser diode of the laser driver. The scanning mirror scans the resultant laser beam repeatedly across the photosensitive drum to form an electrostatic copy of the original image.

While a page is being printed, the DC controller PCB looks for another /PRNT signal from the I/O board. If none has arrived by the end of the print period, the DC controller PCB starts operation of the last rotation period (LSTR). At the end of the LSTR period, the printer enters a standby (STBY) state and awaits another data stream and /PRNT signal. However, if another /PRNT signal arrives during printing, the print period will continue until no further /PRNT signals arrive.

❏ THEORY OF OPERATION – SC I/O BOARD

Introduction

The SC I/O board slides into a card slot in the top of the Apple Personal LaserWriter print engine. The SC I/O board connects to the print engine's control electronics—specifically the DC controller board—through a 32-pin right-angle socket connector.

Overview

The SC I/O board is an electronic circuit board that provides a Small Computer System Interface (SCSI) connection between the Personal LaserWriter print engine and host computer. Standard Apple SCSI cables attach the I/O controller board to the Macintosh computer.
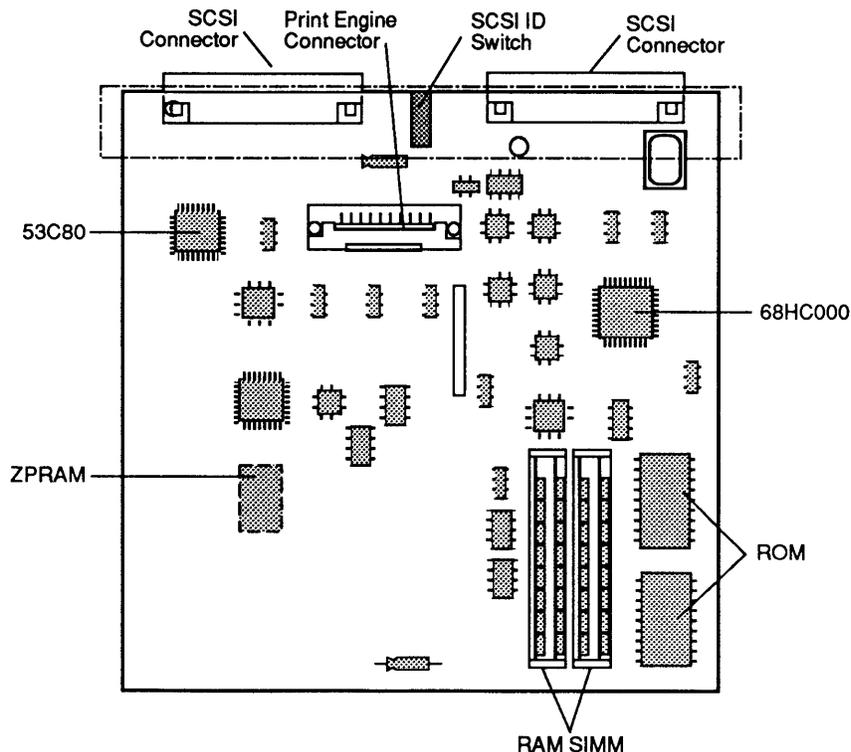
Figure 1-28 Personal LaserWriter SC I/O Board

The I/O board controls the printing process as follows: QuickDraw creates a bit-mapped image of the page in the Macintosh computer. The printing manager uses the SC driver to send portions of the bit-mapped page image over the SCSI bus to the RAM. The data transmits

until the SC controller reconstructs the entire bit-mapped image of the page in RAM. At that point, the print signal moves to the DC controller and the printing cycle starts.

The SC I/O board receives the bit-mapped images over the SCSI bus by means of SCSI commands sent from the host. The SC I/O board uses high-speed circuitry to load blocks of data (up to 512 bytes) into a first-in, first-out (FIFO) register. The SC I/O board CPU takes the data out of the FIFO and puts the data into the frame buffer RAM at the location specified by the SCSI command. The SCSI command also specifies whether the data should be OR'd, XOR'd, COPY'd, or CLEAR'd into the frame buffer, depending on the combination of text and graphics that makes up the page image. This process continues until the entire bit-mapped image of the page is in the frame buffer. When the page image is complete, the CPU takes the first scan line out of RAM and puts it back into the FIFO (approximately 300 bytes for each 8-inch scan line). When the SC I/O controller board knows the print engine is ready, the video control circuit loads the scan line, one byte at a time, into the shift register and sends the scan line to the print engine. When the last byte of the scan line departs for the print engine, the CPU loads the FIFO with the next scan line.

CPU

The CPU is an 68HC000 32-bit microprocessor running at 7.275 MHz with no wait states. It provides the necessary processing functions for the SC I/O controller board.

ROM

The SCSI control routines, printer diagnostics, error-reporting routines, and laser print engine control routines are contained in 32K of 200 ns read-only memory (ROM).

SRAM

Unlike the LaserWriter II I/O boards, the Personal LaserWriter I/O boards have no static random-access memory (SRAM) option. This option may be offered in later versions. All functions previously performed by SRAM in the LaserWriter II are done in DRAM in the Personal LaserWriter I/O controller boards.

DRAM

The Personal LaserWriter SC has one megabyte of 120 ns dynamic random-access memory (DRAM) in four 256K SIMMs (single in-line memory modules). The DRAM functions as a frame buffer for constructing the bit-mapped page image.

VIA

The 6522 versatile interface adapter (VIA) provides 14 parallel I/O lines for the handshaking signals, status panel LEDs, and other miscellaneous functions.

53C80 SCSI Controller

The SC I/O board communicates with the host computer over the SCSI bus. The bus signals and their timing are controlled by the 58C30 according to the SCSI ANSI standard. The SCSI controller, in conjunction with the CPU and ROM firmware, implements the SCSI command set to drive the print engine.

To achieve peak data transfer rates of up to 558K per second, the SC I/O controller uses high-speed transfers from the SCSI I/O controller directly to a 512-byte FIFO with full SCSI handshaking. The high-speed circuit is loaded with the number of bytes to move. The circuit then automatically transfers that number of bytes from the SCSI chip to the FIFO. The CPU and the SCSI DMA share the same bus; therefore, if the processor is using the bus, the actual DMA transfer will slow by about half—to about 250K per second.

❏ THEORY OF OPERATION – NT I/O BOARD

Introduction

The Personal LaserWriter NT I/O board slides into a card slot in the rear of the print engine. The I/O board connects to the print engine's control electronics, specifically the DC controller PCB, through a 32-pin right-angle socket connector.

Overview

The Personal LaserWriter NT I/O board interfaces between the Personal LaserWriter print engine and compatible computers over an AppleTalk network or through an RS-232/422 serial interface. Standard LocalTalk or serial interface cables attach the NT I/O board to the host computer or AppleTalk network.

Before the printing process begins, the Macintosh computer creates a bit-mapped image of the page. The printing manager uses the LaserWriter driver to convert the image on the computer screen into a PostScript file that the NT I/O board can process. Then, the Macintosh computer sends this PostScript file to the LaserWriter over the AppleTalk network. The serial connection can also be used.

The NT I/O board receives the PostScript program data or ASCII control data (when in an emulation mode) from the host computer over the LocalTalk or RS-232 serial port.

All serial data that the NT I/O board receives through the serial port is under the control of the printer interface controller (PIC). The PIC is an application-specific integrated circuit (ASIC) that controls all communication with the host computer over the serial (RS-232) and AppleTalk (RS-422) ports. After the program data is in the AppleTalk buffer, the PIC can begin to execute the PostScript program. The PIC then creates the page image in the NT I/O board RAM according to the commands in the PostScript program. This process continues until the entire bit-mapped image of the page is created in the frame buffer.

When the page image is fully constructed, the CPU takes the image data out of RAM and places it into a first-in, first-out (FIFO) buffer. When the DC controller PCB notifies the versatile interface adapter (VIA) that the printer is ready, the video control circuit

loads the data for the first scan line from the FIFO, one byte at a time, into the video shift register and sends the data to the DC controller PCB.

The DC controller PCB receives the data as digital bits in the form of serial signals that correspond to black or white dots of the image. The DC controller then generates the print signals to start and control the printing cycle, as explained in the print engine section.

**LaserWriter NT
I/O Board**

An overview of the Personal LaserWriter NT I/O board follows (**Figure 1-29**):

Print Engine Mode RS-232 RS-422
Connector Switch Serial Connector
Connector AppleTalk

RAM SIMM

53C80

PIC ROM

PIC ROM

ROM

68HC000

ROM SIMM
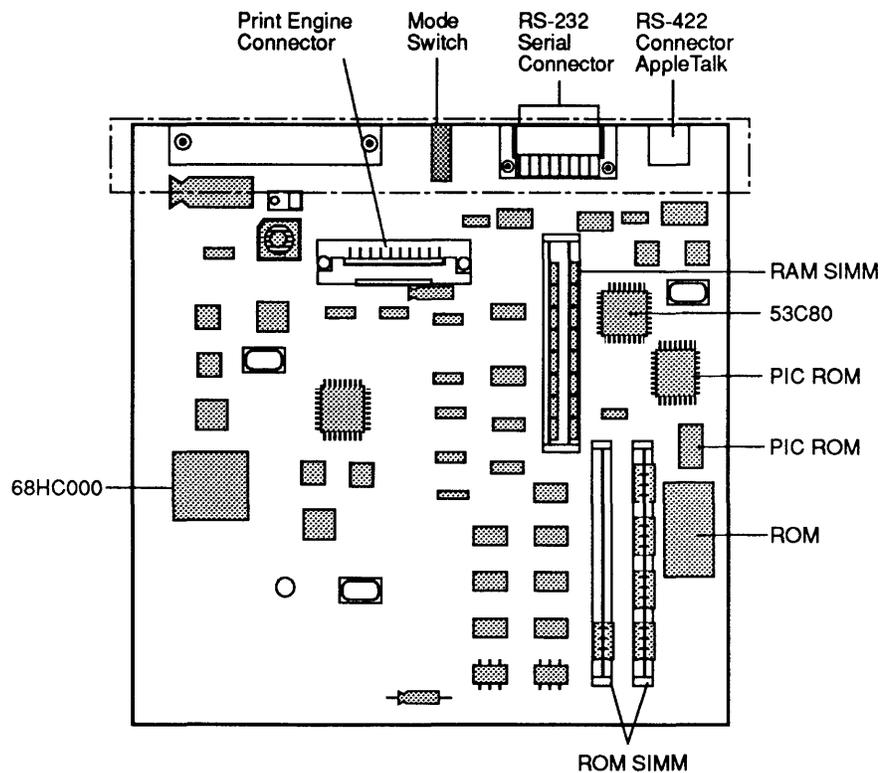
Figure 1-29 Personal LaserWriter NT I/O Board

CPU

The central processing unit (CPU) on the Personal LaserWriter NT I/O board is a Motorola 68HC000 32-bit microprocessor operating at 12 MHz with no wait states. The CPU provides all the central processing functions for the Personal LaserWriter NT I/O board.

ROM

The Personal LaserWriter NT has 2 MB of ROM, using 1-Mbit parts. This firmware contains printer control routines, the Adobe® Systems PostScript interpreter, printer diagnostic routines, AppleTalk routines, LaserWriter Plus fonts, and error-reporting routines.

DRAM

The Personal LaserWriter NT I/O controller board contains 2 MB of dynamic random-access memory (DRAM). This memory is used as a frame buffer for constructing the bit-mapped page image and is contained in two 1 MB, 30-pin SIMMs (single in-line memory modules). This frame buffer is expandable to 8 MB by removing the 1 MB SIMMs and replacing them with 4 MB SIMMs.

SRAM

Unlike the LaserWriter II I/O boards, the Personal LaserWriter I/O boards have no static random-access memory (SRAM) option. This option may be offered in later versions. All functions previously performed by SRAM in the LaserWriter II are done in DRAM in the Personal LaserWriter I/O controller boards.

VIA

The 6522 versatile interface adapter (VIA) provides 14 bidirectional I/O lines for all the handshaking and communications signals between the I/O controller and the print engine.

Application-Specific Integrated Circuit (ASIC)

The printer interface controller (PIC) is an application-specific integrated circuit (ASIC) that controls all communication with the host computer over the serial (RS-232) and AppleTalk (RS-422) ports. Using an ASIC allows the use of the slower 68000 processor and DRAM by off-loading AppleTalk packet processing from the printer CPU while maximizing network access and simplifying printer firmware. The PIC is configurable (by an external rotary switch) to support AppleTalk and serial communications, but not at the same time. The PIC module contains its own static RAM as well as a dedicated 32K erasable, programmable read-only memory (EPROM).

The serial interface is connected to a host computer through a subminiature DB-25 connector or an 8-pin mini DIN-8 connector. The AppleTalk connection is through the mini DIN-8 connector.

❑ THEORY OF OPERATION – NTR I/O BOARD

Introduction

The Personal LaserWriter NTR I/O board slides into a card slot in the rear of the print engine. The I/O board connects to the print engine's control electronics, specifically the DC controller PCB, through a 32-pin right-angle socket connector.

Overview

The Personal LaserWriter NTR I/O board interfaces between the Personal LaserWriter print engine and compatible computers over an AppleTalk network or through an RS-232/422 serial interface. In addition, the NTR I/O board provides a 35-pin Centronics-type parallel port for connecting to computers that use a parallel interface. The port arbitration capabilities of the Personal NTR I/O board allows for simultaneous communication through all three ports.

Before the printing process begins, the Macintosh computer creates a bit-mapped image of the page. The printing manager uses the LaserWriter driver to convert the image on the computer screen into a PostScript file that the NTR I/O board can process. Then, the Macintosh computer sends this PostScript file to the LaserWriter over the AppleTalk network. The serial connection can also be used.

The NTR I/O board receives the PostScript program data or ASCII control data (when in an emulation mode) from the host computer over the LocalTalk, RS-232 serial, or Centronics-type parallel port.

All of the serial data that the NTR I/O board receives through the serial port is under the control of the serial communications controler (SCC). When the internal buffer in the SCC is filled, the SCC generates an interrupt to the CPU. This interrupt causes the CPU to take the data out of the SCC internal buffer, and to place it in a larger AppleTalk buffer in RAM. After the program data is in the AppleTalk buffer, the CPU can begin to execute the PostScript program. The CPU then creates the page image in RAM according to the commands in the PostScript program. This process continues until the entire bit-mapped image of the page is created in the frame buffer.

When the page image is fully constructed, the CPU takes the image data out of RAM and places it into a first-in, first-out (FIFO) buffer. When the DC controller PCB notifies the versatile interface adapter (VIA) that the printer is ready, the video control circuit loads the data for the first scan line from the FIFO, one byte at a time, into the video shift register and sends the data to the DC controller PCB.

The DC controller PCB receives the data as digital bits in the form of serial signals that correspond to black or white dots of the image. The DC controller then generates the print signals to start and control the printing cycle, as explained in the print engine section.

LaserWriter NTR I/O Board

A overview of the Personal LaserWriter NTR I/O board follows **(Figure 1-30)**:
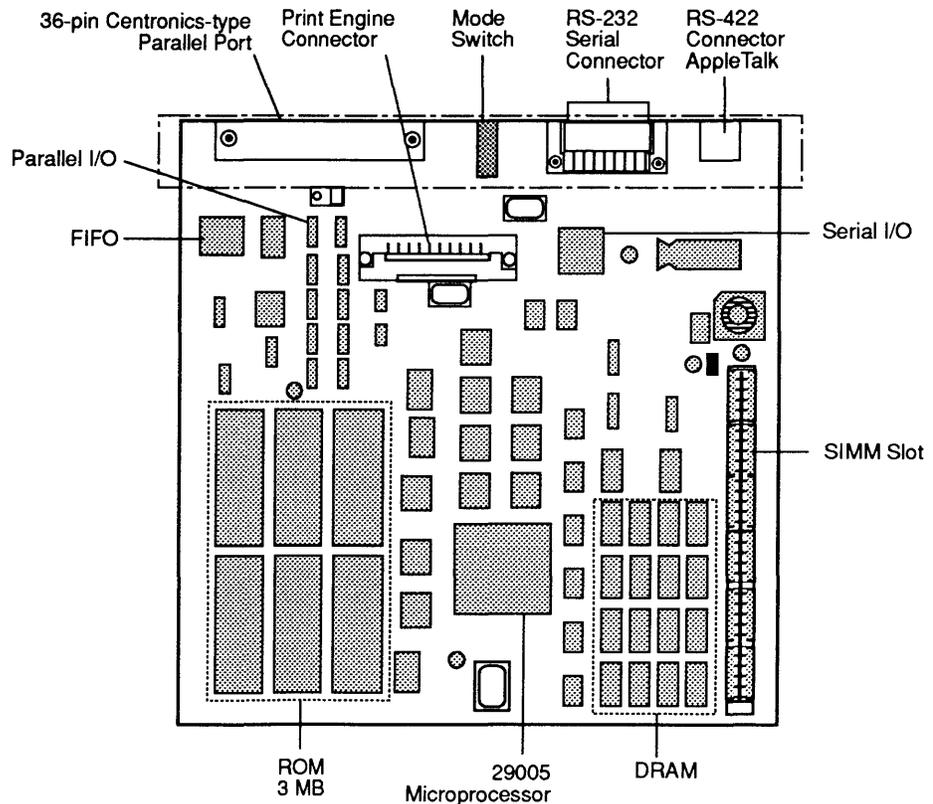
Figure 1-30 Personal LaserWriter NTR I/O Board

CPU   The central processing unit (CPU) on the Personal
                              LaserWriter NTR I/O board is an AMD 29005 32-bit
                              Reduced Instruction Set Computing (RISC)
                              microprocessor that operates at 16 MHz with no wait
                              states. The CPU is a true RISC microprocessor that
                              enables the LaserWriter NTR to process jobs 3 to 5
                              times faster than the LaserWriter NT.

ROM   The Personal LaserWriter NTR uses 3 MB of read-only
                              memory (ROM) in six 265K x 16-bit devices. The ROM
                              firmware contains printer control routines, the Adobe®
                              Systems PostScript Level 2 interpreter, printer
                              diagnostic routines, and error-reporting routines.

DRAM   The Personal LaserWriter NTR I/O controller board
                              ships with 2 MB of dynamic random-access memory
                              (DRAM) soldered to the board and a 1 MB single in-line
                              memory module (SIMM) installed in the 72-pin SIMM
                              socket. This memory is expandable to 4 or 6 MB by
                              removing the 1 MB SIMM and installing a 2 or 4 MB
                              SIMM. The DRAM is an input data buffer, a font-cache
                              for caching character bit-maps, a frame buffer for
                              constructing the bit-mapped page image, and a display
                              list buffer for storing compiled PostScript instructions.

FIFO   The first-in, first-out (FIFO) memory is a data buffer for
                              printing. The CPU loads video data from the DRAM into
                              the FIFO buffer, and the video control logic unloads the
                              data into the Shift Register.

VIA   The 6522 versatile interface adapter (VIA) provides 14
                              bidirectional I/O lines for all the handshaking and
                              communications signals between the I/O controller board and
                              the print engine.

EEPROM   The electrically erasable programmable read-only
                              memory (EEPROM) stores the serial port configuration,
                              printer name, current page count, and many other
                              parameters. You can change the serial port
                              configuration information by sending PostScript control
                              operators to the CPU, or by changing the pushwheel

switch setting. Whenever you change the pushwheel switch setting, the configuration in the EEPROM updates to match the new setting. If the switch setting changes while printer power is off, the EEPROM configuration data updates when the switch is read at power-on.

Serial I/O (SCC)

The serial communications controller has two independent ports for serial communication. The 25-pin RS-232 serial port is for non-LocalTalk serial connections. The DIN-8 RS-422 LocalTalk port is for connecting to a LocalTalk cable system. Each port can be programmed for asynchronous, synchronous, or AppleTalk protocols.

The serial interface connects to the host computer through a subminiature DB-24 RS-232 connector or an 8-pin MINI DIN-8 connector.

Parallel I/O

The LaserWriter NTR I/O board has one unidirectional Centronics-type parallel port for connecting to any IBM PC or compatible computer. The parallel interface connects to a host computer through a standard 36-pin parellel interface cable.

❏ THEORY OF OPERATION – LS I/O BOARD AND LS/L SERIAL CONTROLLER

Introduction

The Personal LaserWriter LS and the Personal LaserWriter LS/L are both single-user QuickDraw printers that connect to any Macintosh (except the Macintosh 512K) computer. Although both printers are versions of the same print engine and function similarly, there are differences in design. The Personal LaserWriter LS has a separate I/O board and DC controller PCB, but the Personal LaserWriter LS/L combines the I/O board and the DC controller PCB into one module—the serial controller.

The Personal LaserWriter LS ships with the I/O board in place. The I/O board connects to the print engine's control electronics, specifically the DC controller PCB, through a 20-pin connector and to a host computer through the standard Apple System/Peripheral—8 Cable.

The Personal LaserWriter LS/L ships with the serial controller installed and connects to a host computer using the standard Apple System/Peripheral—8 Cable.

Overview

The I/O board interfaces between the Personal LaserWriter print engine and the host computer over a special high-speed (909K baud) serial interface. This serial link connects the host computer to the printer via a standard mini-DIN 8 connector on the I/O board.

Before the printing process begins, the host must image the information. The print manager in the host computer uses the Personal LaserWriter LS driver to convert QuickDraw objects into a 300 DPI bitmap. (For the purpose of this discussion, QuickDraw objects include all text and graphics on a page). The driver then compresses this 300 DPI bitmap and feeds the bitmap into the printer via the serial link. The host then sends the I/O board an appropriate command that causes the image to be printed. During printing, the I/O board expands the compressed data and sends it to the print engine, where it is applied to the paper.

Putting all of the controller intelligence into an application-specific integrated circuit (ASIC) makes the I/O board cost-effective. The I/O board also contains a

serial interface circuit, an LED interface circuit, the print
engine interface, and 512K or 1 MB of dynamic random-
access memory (DRAM).

ASIC

The application-specific integrated circuit (ASIC) contains
all the intelligence for the Personal LaserWriter LS and
LS/L. The ASIC accepts commands and data from the host,
stores the image data in a 512K or 1 MB FIFO (first-
in/first-out) buffer, decompresses the image data as
necessary, and prints the image on the paper.

The ASIC accepts serial data that have been converted
from RS-422 into a digital data stream. The ASIC
interprets this digital data stream to determine whether
it is a command or data for the ASIC to process.

The ASIC coverts the serial image data into a byte and
writes the byte into the FIFO buffer. The ASIC reads the
image data from the FIFO during the printing process and
decompresses the data in real time.

The ASIC converts the decompressed data into a serial
video data stream. This serial data then moves to the
print engine interface, along with other appropriate
control signals.

The print engine interface also permits bidirectional
communications between the print engine and the host.
Through this interface, the host may send print engine
commands. These commands can determine print engine
status and can also set print engine parameters. A sample
print engine status command might be to inquire whether
the print engine is jammed. An example of a print engine
parameter command might be to change from the paper
tray to the cassette.

The ASIC interfaces to four or eight 256K x 4 DRAMs.
These DRAMs serve as a FIFO memory. The ASIC handles
all aspects of control for the DRAMs, including refresh
and access arbitration.

The ASIC has three outputs that drive the front panel
LEDs. These outputs are externally buffered by a 7438
open-collector driver IC.

LaserWriter LS
I/O Board

An overview of the Personal LaserWriter LS I/O board follows **(Figure 1-31)**.

```
                512K On-Board DRAM   Oscillator        ASIC      Memory Jumper
```
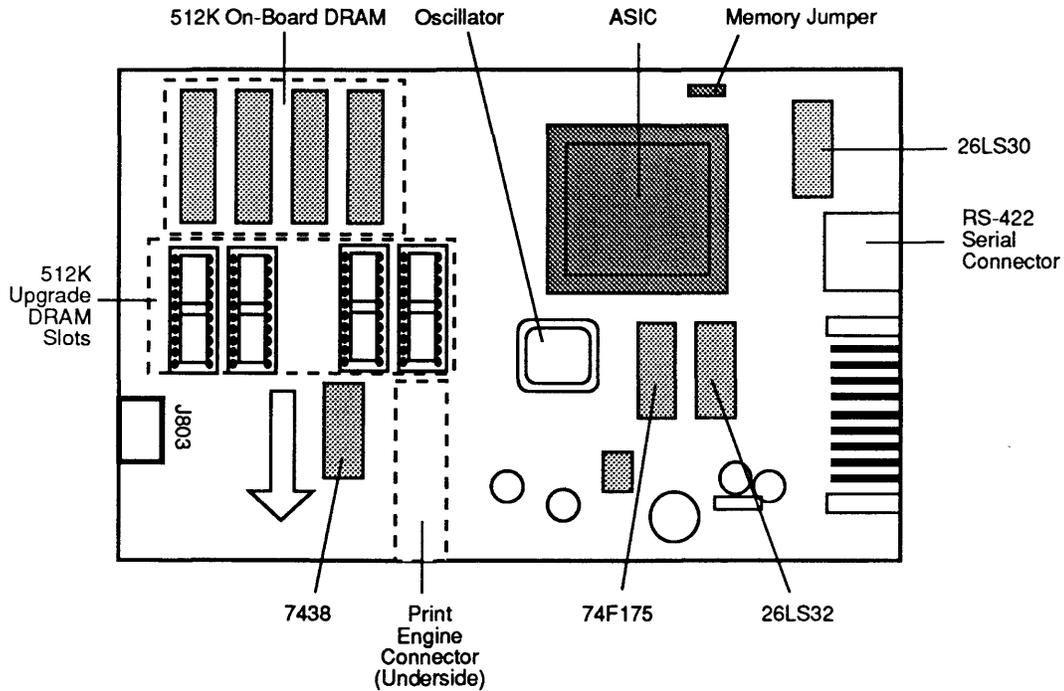
Figure 1-31   Personal LaserWriter LS I/O Board

DRAM

The Personal LaserWriter LS I/O board accepts a wide variety of 256K x 4-bit DRAMs. These DRAMs must operate at 150 ns or faster and must support CAS-before-RAS refresh. The devices are organized into a 512K x 8-bit FIFO buffer or 1 MB x 8-bit FIFO buffer. This FIFO buffer stores all image data. Since the image data is usually compressed, the FIFO buffer can sometimes hold multiple pages. However, some images do not compress well, and may require the full 1 MB of memory.

26LS30/26LS32

The 26LS30 and 26LS32 driver/receiver ICs perform the RS-422-to-digital-data conversion. As with all Apple products, the serial interface has an EMI filter on the analog input side. This filter limits the EMI emissions of the serial interface and provides input noise immunity.

7438

The 7438 is an open-collector NAND gate that provides a high-current drive source for the LEDs on the front panel. Each output connects through a resistor to the LED connector on the I/O board. The 7430 also acts as an input buffer to the ASIC to minimize the possibility of static damaging the ASIC.

Oscillator

The 29.1019 MHz oscillator provides the fundamental frequency of operation for the I/O board. The output is divided by two and fed into the ASIC. The ASIC further divides this clock to provide all system functions.

74F175

The 74F175 is a quad D register. This device is very important to the operation of the I/O board because it performs the following three functions:

- Divides the 29.1019 MHz clock by two, thus providing the ASIC with a 14.5509 MHz clock source

- Double-rank synchronizes the print engine Beam Detect (/BD) signal

- Single-rank synchronizes the print engine Top Of Page (/TOP) signal

**LaserWriter LS/L
Serial Controller**

An overview of the Personal LaserWriter LS/L serial controller board follows **(Figure 1-32).**
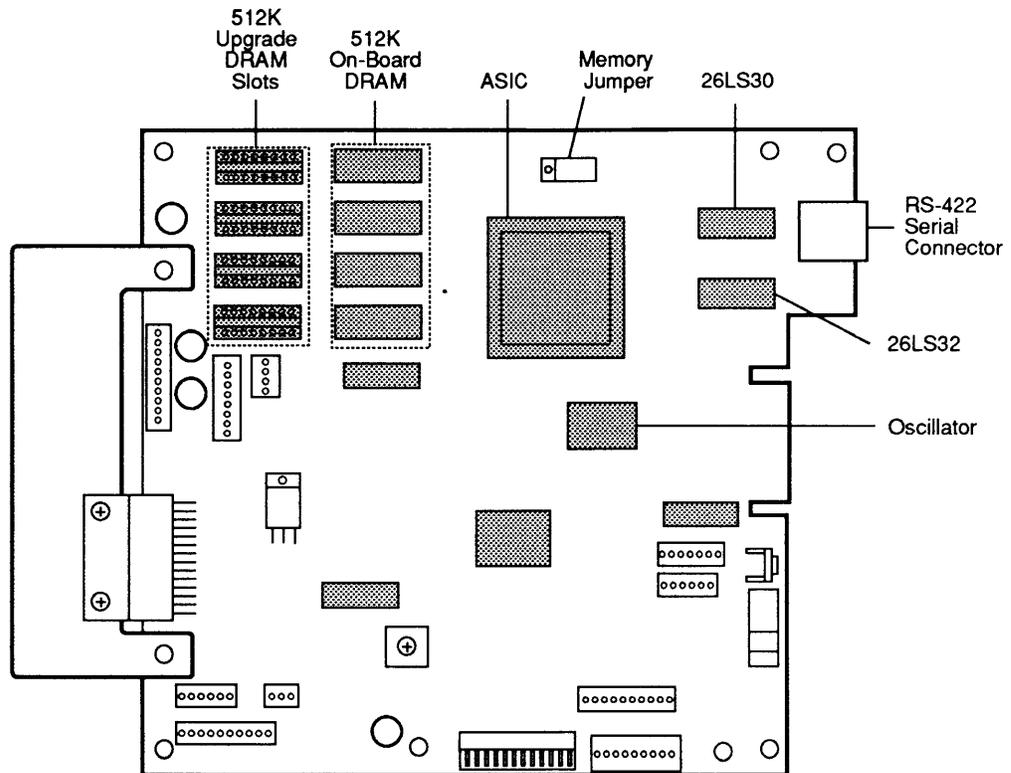
Figure 1-32 LaserWriter LS/L Serial Controller

DRAM

The Personal LaserWriter LS/L serial controller ships with 512 MB of dynamic random-access memory (DRAM). These DRAMs must operate at 150 ns or faster and must support CAS-before-RAS refresh. The devices are organized into a 512K x 8-bit FIFO buffer or 1 MB x 8-bit FIFO buffer. This FIFO buffer stores all image data. Since the image data is usually compressed, the FIFO buffer can sometimes hold multiple pages. However, some images do not compress well, and may require the full 1 MB of memory.

26LS30/26LS32

The 26LS30 and 26LS32 driver/receiver ICs perform the RS-422-to-digital-data conversion. As with all Apple products, the serial interface has an EMI filter on the analog input side. This filter limits the EMI emissions of the serial interface and provides input noise immunity.

7438

The 7438 is an open-collector NAND gate that provides a high-current drive source for the LEDs on the front panel. Each output connects through a resistor to the LED connector on the LS/L serial controller. The 7430 also acts as an input buffer to the ASIC to minimize the possibility of static's damaging the ASIC.

Oscillator

The 29.1019 MHz oscillator provides the fundamental frequency of operation for the I/O board. The output is divided by two and fed into the ASIC. The ASIC further divides this clock to provide all system functions.

74F175

The 74F175 is a quad D register. This device is very important to the operation of the I/O board because it performs the following three functions:

- Divides the 29.1019 MHz clock by two, thus providing the ASIC with a 14.5509 MHz clock source

- Double-rank synchronizes the print engine Beam Detect (/BD) signal

- Single-rank synchronizes the print engine Top Of Page (/TOP) signal

❏ ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

Introduction

The Apple Personal LaserWriter contains microcircuits that are sensitive to electrostatic discharge (ESD) damage. Touching a chip or brushing it with a nylon sleeve can degrade a circuit so that it never again performs to specification. Some microcircuits are sensitive to as little as 500 volts, or about one-sixth as much static electricity as you can feel.

ESD Rules

You must take preventive measures to avoid ESD damage. When you are unwrapping, installing, or replacing microcircuits, observe the following precautions:

Grounds

Before working on any device containing a printed circuit, connect yourself and your equipment to an earth or building ground.

Use a grounded conductive workbench mat and a grounding wriststrap, and ground your equipment to the mat.

Bodies

Don't touch anybody who is working on integrated circuits.

If that person is properly grounded, your "zap" may not cause damage, but to be on the safe side, keep your own body charge away from other technicians.

Bags

Use static-shielding bags for boards and chips during storage, transportation, and handling.

Before you leave your bench to take a board to a storage place, put the board in a static-shielding bag. Leave all Apple service exchange components in their ESD-safe packaging until needed.

Leads

Handle all ICs by the body, not the leads.

Do not touch PCB edge connectors, exposed circuitry, or printed circuits. Handle ICs and PCBs by the edges, or use extractors.

Synthetics

Do not wear polyester clothing or bring plastic, vinyl, or styrofoam into the work environment.

The electrostatic field around these nonconductors cannot be removed.

Metals

Never place components on a metal surface.

Use antistatic or conductive mats or foam.

Atmosphere

If possible, keep the humidity in the service area between 70% and 90%, and use an ion generator.

Charge levels are reduced (but not eliminated) in high-humidity environments and in areas where an ion generator is operating.

Apple Technical Procedures

Apple Personal LaserWriter

Section 2 – Take-Apart

□ CONTENTS

Front Access Door

Note: If a step is underlined, detailed instructions for that step can be found in elsewhere in this section.

❏ INTRODUCTION

Materials Required

#2 Phillips screwdriver, magnetized
Small needlenose pliers
Small flat-blade screwdriver
1.5 mm Allen wrench
0.2 mm thickness gauge
Jeweler's screwdriver
Small diagonal cutters

Before You Begin

Before servicing the Apple Personal LaserWriter, always remember to:

• Switch off the printer and disconnect the AC power cord.

• Prepare your workstation for electrostatic discharge (ESD) prevention.

• Remove the toner cartridge.

• Remove the paper cassette.

Safety Precautions

1. **Always** power off the printer and disconnect the AC power cord from the power outlet before servicing the printer.

2. **Never** disconnect the optical fiber cable from the DC controller PCB when the printer is powered on. The reflected laser beam, although invisible, can permanently damage your eyes.

3. Whenever the printer is plugged in and the cover is removed, be careful where you place your hands. There are dangerous voltages around the power supply unit, the power switch, the high-voltage contact assembly, and the high-voltage power supply.

4. Be sure to remove rings, wristwatches, bracelets, and other jewelry before servicing the printer.

Electrostatic Discharge Prevention

The Apple Personal LaserWriter contains parts that are electrostatic discharge (ESD) sensitive. When servicing the printer, always follow the ESD prevention information located in Section 1, Basics.

❑ TOP COVER

Remove

1. Depress the release button and open the front access cover of the printer.

2. Remove the two screws that secure the top cover to the printer **(Figure 2-1)**.

3. Lift the top cover straight up and set the cover aside **(Figure 2-1)**.

Replace

1. Lower the top cover onto the printer. Fit the tabs on the sides of the top cover over the edges of the left and right bottom covers.

2. Replace the two top cover screws.

Cassette Feeder is optional
on the LaserWriter LS
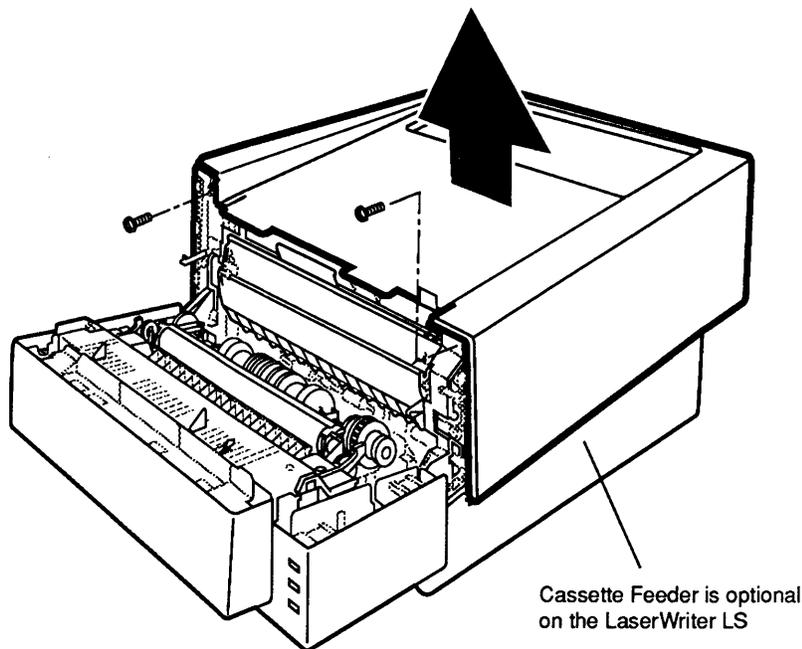
Figure 2-1 Top Cover

❏ CASSETTE FEEDER TRAY

Note: The cassette feeder is optional on the Apple LaserWriter LS. The procedures on pages 2.5 through 2.17 apply only to the cassette feeder.

Remove

1. Turn the printer upside down so that it is resting on its top **(Figure 2-2)**.

2. Remove the four screws that secure the cassette feeder tray to the printer **(Figure 2-2)**.

3. Remove the cassette feeder tray, and place the printer right-side up.

Replace

1. Turn the printer upside down so that it is resting on its top.

2. Install the cassette feeder tray into position on the base of the printer. Align the 9-pin connector with its receptacle.

3. Replace the four cassette feeder tray screws, and place the printer right-side up.

Cassette
Feeder
Tray
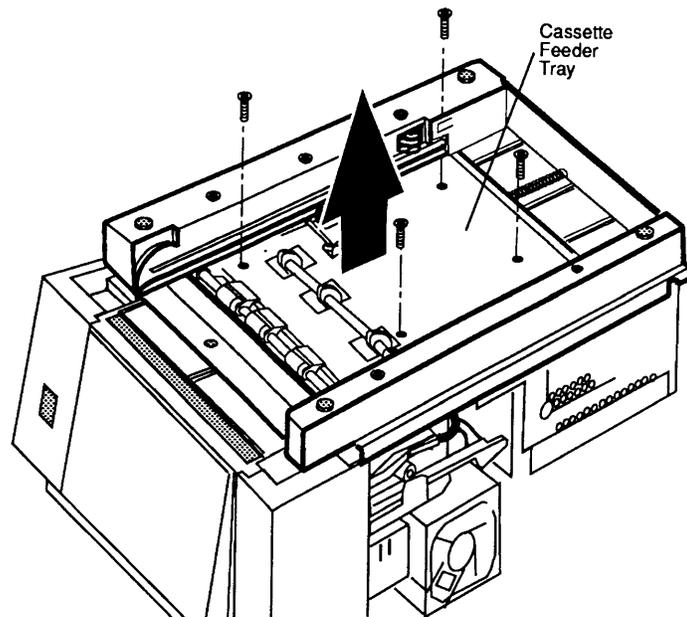
Figure 2-2 Cassette Feeder Tray

❑ CASSETTE STOP COVER

Remove

1. Remove the cassette feeder tray.

2. Unhook the cassette stop cover spring attached to the cassette feeder tray **(Figure 2-3)**.

3. Remove the cassette stop cover from the feeder tray and set it aside **(Figure 2-3)**.

Replace

1. Slide the two arms of the cassette stop cover into the grooves on the right and left bottom covers.

2. Hook the cassette stop cover spring to the cassette feeder tray.

3. Replace the cassette feeder tray.

Cassette
Stop Cover
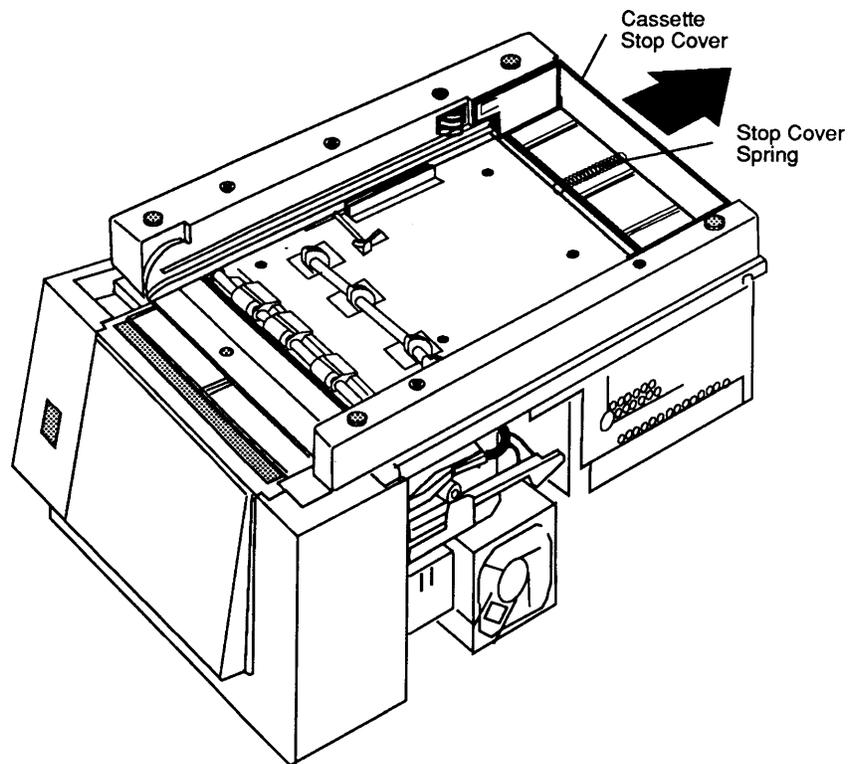
Stop Cover
Spring

Figure 2-3 Cassette Stop Cover

❑ RIGHT BOTTOM COVER

Note: The right bottom cover is attached to the cassette feeder tray, which is optional on the LaserWriter LS.

Remove

1. Remove the top cover.

2. Remove the cassette feeder tray and the cassette stop cover.

3. Remove the three screws that secure the right bottom cover to the cassette feeder tray (**Figure 2-4**).

4. While pressing in the paper cassette microswitches with your fingers, lift the right bottom cover off the cassette feeder tray (**Figure 2-4**).

CAUTION: Be careful not to twist or bend the paper cassette microswitches (SW901, SW902, SW903) when removing or replacing the right bottom cover.
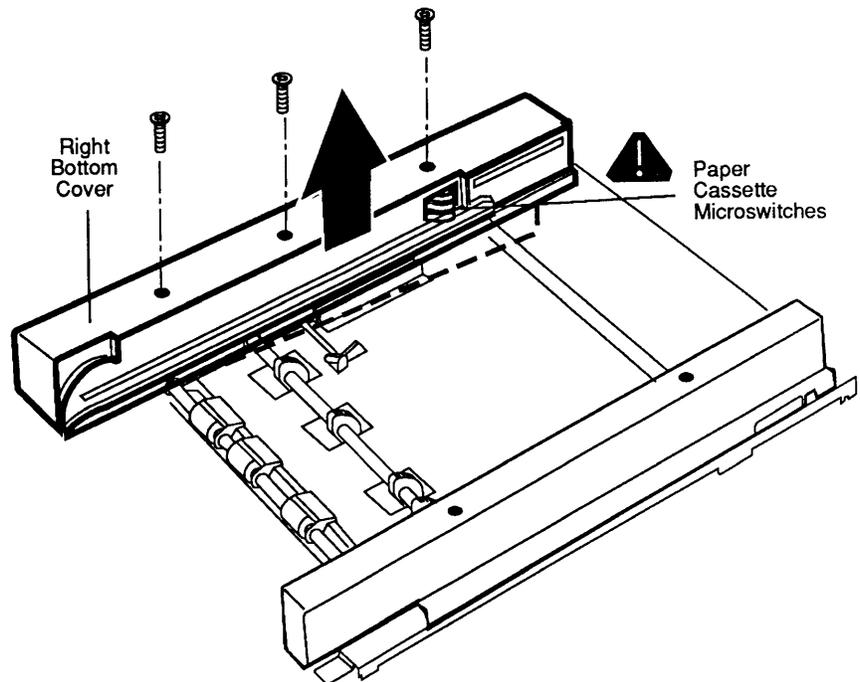
Figure 2-4 Right Bottom Cover

Replace

1. Hold the right side of the cassette feeder tray up with the 9-pin connector facing toward you **(Figure 2-5A)**.

2. Install the right bottom cover onto the tray by first inserting the rear guide pin into its slot on the tray and then inserting the front guide pin into its slot on the tray **(Figure 2-5B)**.

3. Replace the three right bottom cover screws.

4. Replace the cassette stop cover, the cassette feeder tray, and the top cover.
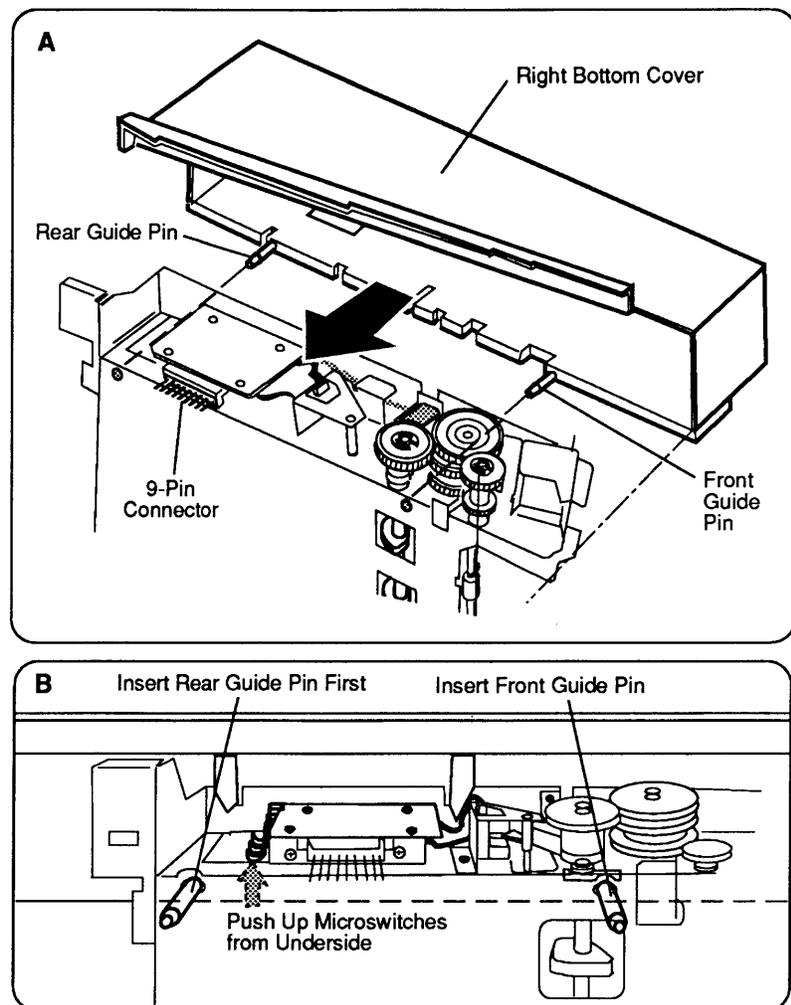
Figure 2-5 Right Bottom Cover

❏ LEFT BOTTOM COVER

Note: The left bottom cover is attached to the cassette feeder tray, which is optional on the LaserWriter LS.

Remove

1. Remove the top cover.

2. Remove the cassette feeder tray and the cassette stop cover.

3. Remove the two screws that secure the left bottom cover to the cassette feeder tray (**Figure 2-6**).

4. Lift the left bottom cover off the printer chassis and set it aside (**Figure 2-6**).

Replace

1. Place the left bottom cover in position on the cassette feeder tray.

2. Replace the two left bottom cover screws.

3. Replace the cassette stop cover, the cassette feeder tray, and the top cover.
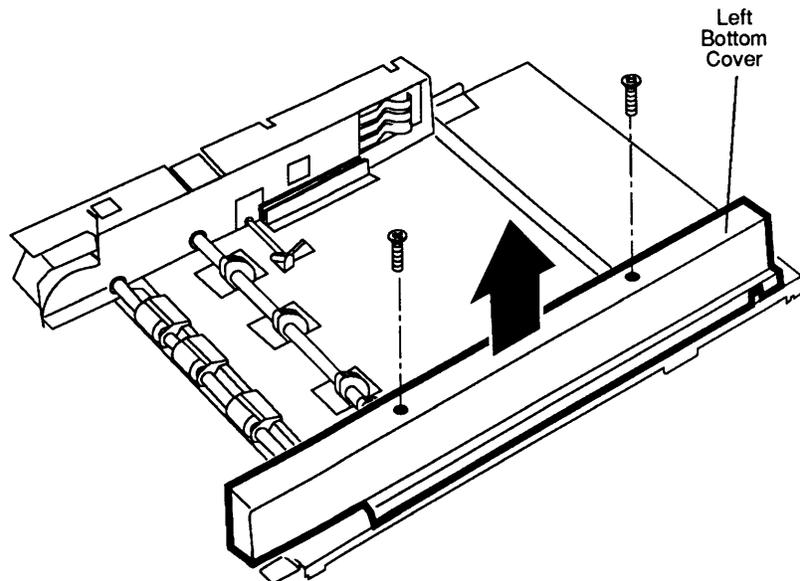
Figure 2-6 Left Bottom Cover
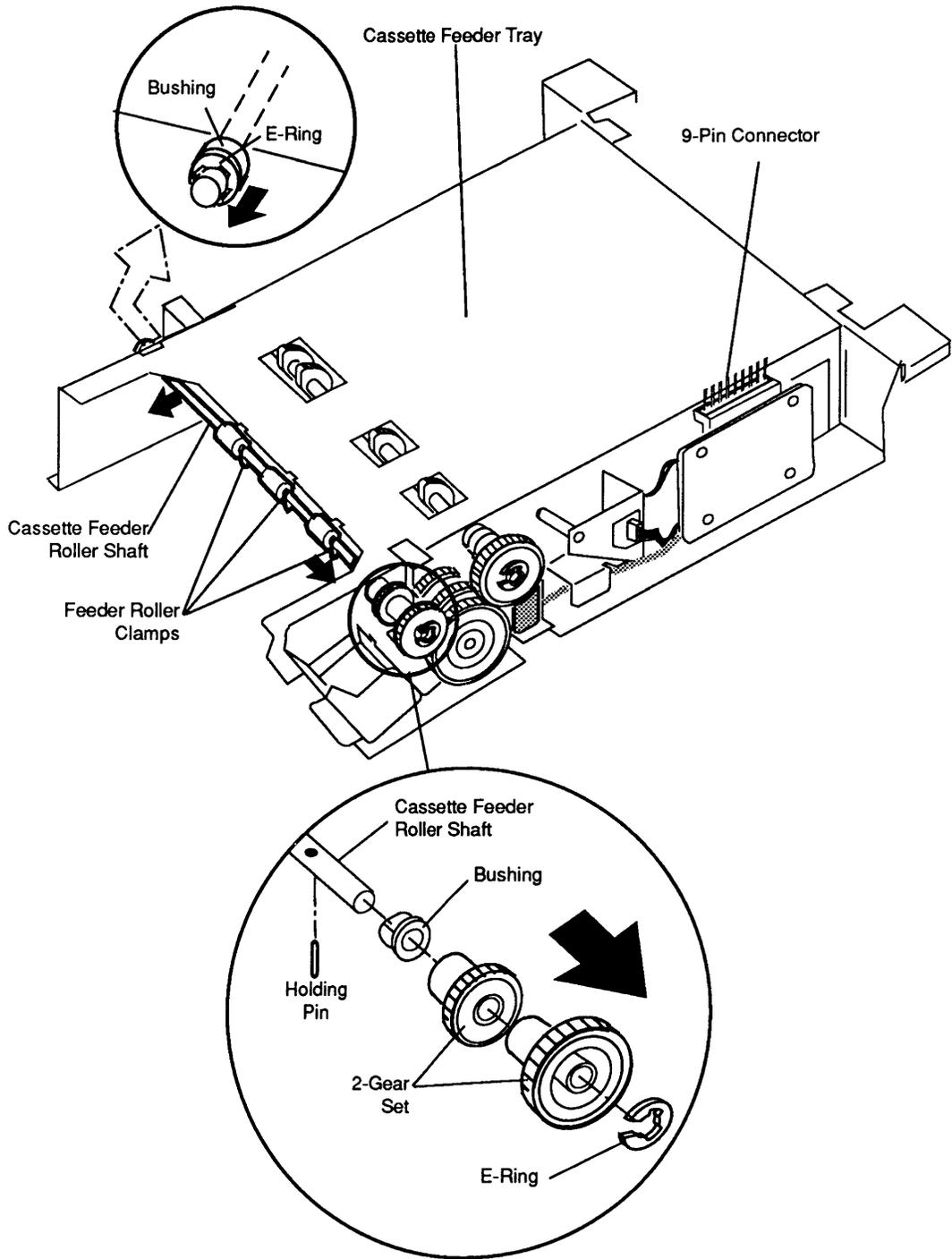
Figure 2-7 Cassette Feeder Roller Shaft

Mar 91

☐ CASSETTE FEEDER ROLLER SHAFT

Remove

1. Remove the top cover, the cassette feeder tray, and the cassette stop cover.

2. Remove the left and right bottom covers.

3. Turn the cassette feeder tray so that the 9-pin connector is facing upward. Locate the cassette feeder roller shaft (**Figure 2-7**).

4. Using a small screwdriver or grip-ring pliers, remove the E-rings at each end of the feeder roller shaft (**Figure 2-7**).

5. Slide the two white gears off the roller shaft (**Figure 2-7**).

6. Remove the small metal holding pin next to the bushing on the right side of the roller shaft (**Figure 2-7**).

7. Unhook the three plastic feeder roller clamps (**Figure 2-7**).

8. Slide the bushing off each end of the roller shaft and remove the roller shaft from the cassette feeder tray (**Figure 2-7**).

Replace

1. Place the cassette feeder roller shaft through the slots on each side of the cassette feeder tray.

2. Hook the three plastic feeder roller clamps to the cassette feeder tray (**Figure 2-7**).

3. Replace the bushings at each end of the roller shaft (**Figure 2-7**).

4. Replace the E-ring on the left side of the roller shaft (**Figure 2-7**).

5. Reinstall the small metal pin, the two white gears, and the remaining E-ring (**Figure 2-7**).

6. Replace the left and right bottom covers.

7. Replace the cassette stop cover, the cassette feeder tray, and the top cover.
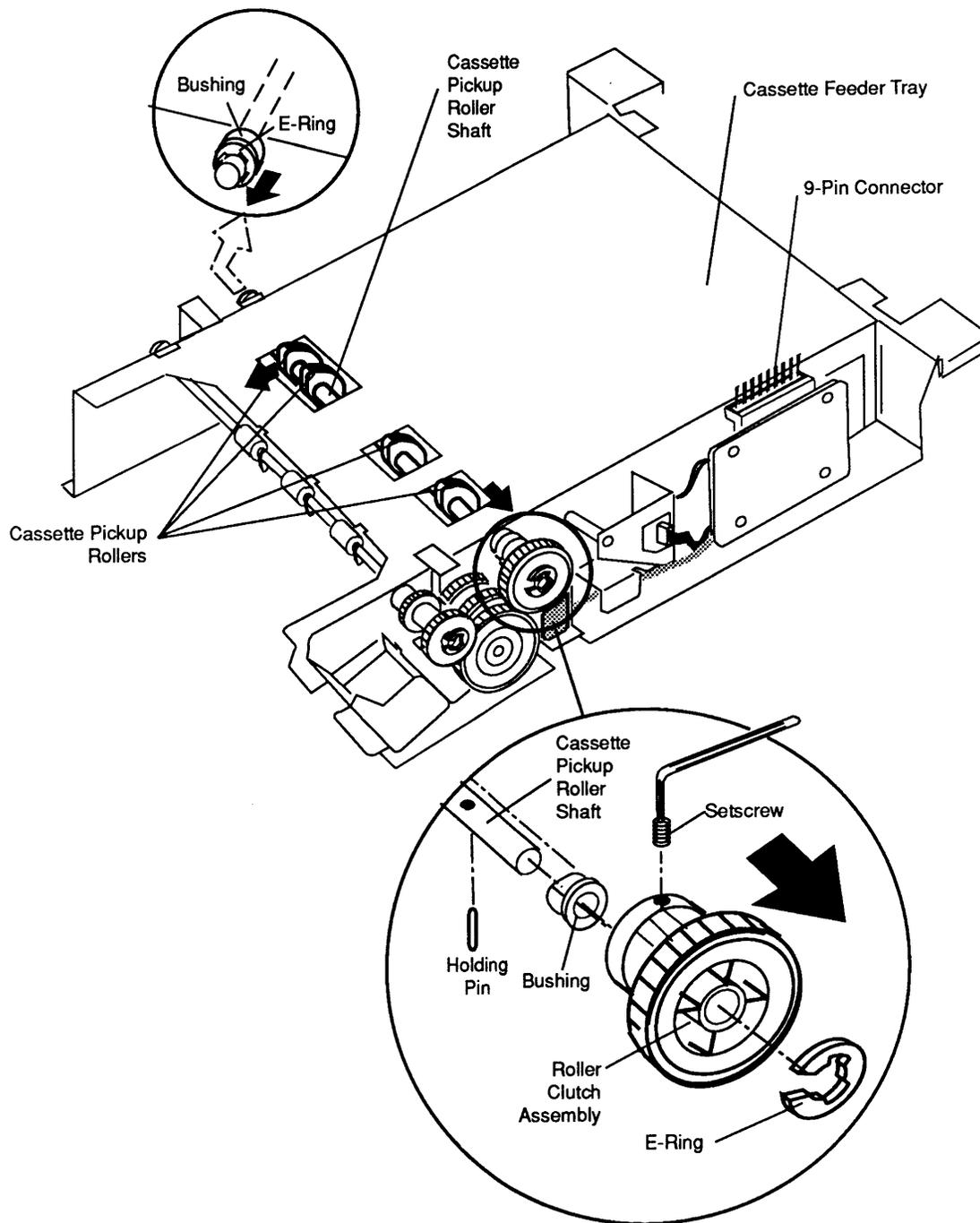
Figure 2-8 Cassette Pickup Roller Shaft

❏ CASSETTE PICKUP ROLLER SHAFT

Remove

1. Remove the top cover, the cassette feeder tray, and the cassette stop cover.

2. Remove the left and right bottom covers.

3. Turn the cassette feeder tray so that the 9-pin connector is facing upward and locate the cassette pickup roller shaft **(Figure 2-8)**.

4. Using a small flat-blade screwdriver or grip-ring pliers, remove the E-rings at each end of the pickup roller shaft **(Figure 2-8)**.

5. Using a 1.5 mm Allen wrench, loosen the setscrew that secures the pickup roller clutch drum to the pickup roller shaft **(Figure 2-8)**.

6. Remove the cassette pickup roller clutch assembly from the pickup roller shaft **(Figure 2-8)**.

   Note: When you remove the cassette pickup roller clutch assembly, the small metal pin that holds the pickup roller clutch drum in position may drop off the roller shaft. **Do not lose the holding pin.** You will need it when replacing the cassette pickup roller clutch assembly.

7. Remove the metal holding pin from the roller shaft if the pin did not drop off the roller shaft when removing the clutch assembly.

8. Slide the bushings off each end of the roller shaft and remove the cassette pickup roller shaft from the cassette feeder tray **(Figure 2-8)**.
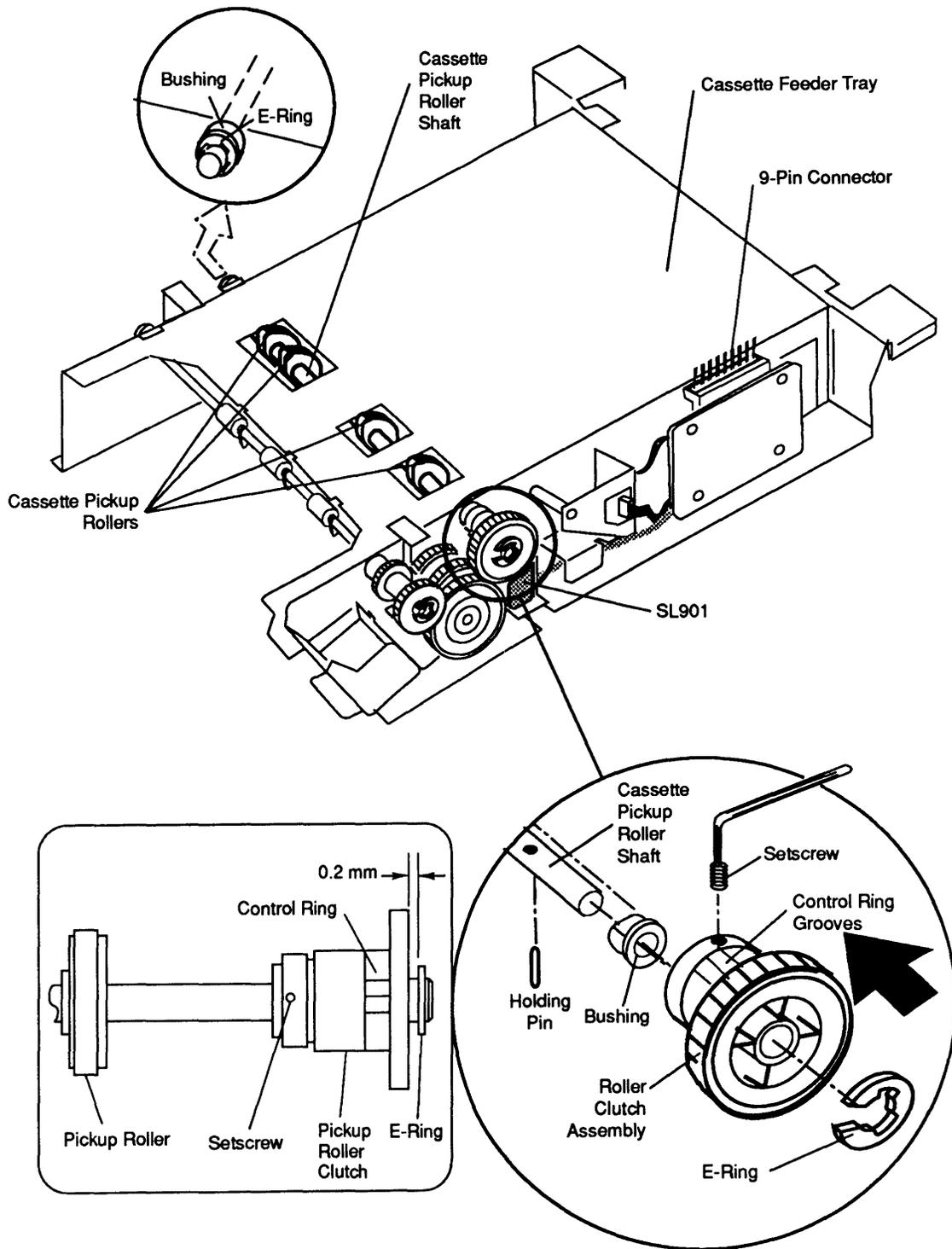
Figure 2-9 Cassette Pickup Roller Shaft

Replace

1. Place the pickup roller shaft through the slots on each side of the cassette feeder tray.

2. Install the bushing on the left side of the roller shaft and replace the E-ring (**Figure 2-9**).

3. Install the bushing on the right side of the pickup roller shaft (**Figure 2-9**).

4. Rotate the roller shaft so that the crescent-shaped pickup rollers protrude through the three cutouts on the cassette feeder tray (**Figure 2-9**).

5. Install the metal holding pin through the slot on the pickup roller shaft. Be sure the pickup rollers are still protruding through the cutouts.

6. With the three grooves on the control ring facing upward, slide the pickup roller clutch assembly onto the pickup roller shaft. Align the grooves on the pickup roller clutch assembly with the metal rod installed on the roller shaft.

   Note: As you slide the pickup roller clutch assembly onto the roller shaft, the pickup roller clutch claw may catch on the arm of the cassette pickup roller clutch solenoid SL901. Press down on SL901 to free the claw and slide the roller clutch assembly into position on the roller shaft.

7. Using the 1.5 mm Allen wrench, tighten the setscrew just enough to hold the assembly in place, and replace the E-ring on the right side of the pickup roller shaft (**Figure 2-9**).

8. Place a 0.2 mm thickness gauge between the cassette pickup roller clutch and the E-ring.

9. Adjust the setscrew so that the distance between the pickup roller clutch and the E-ring is 0.2 mm. Then tighten the setscrew into position.

10. Replace the left and right bottom covers.

11. Replace the cassette stop cover, the cassette feeder tray, and the top cover.

Cassette Feeder Tray

9-Pin Connector

Cassette
Feeder PCB
Assembly

J902 Connector
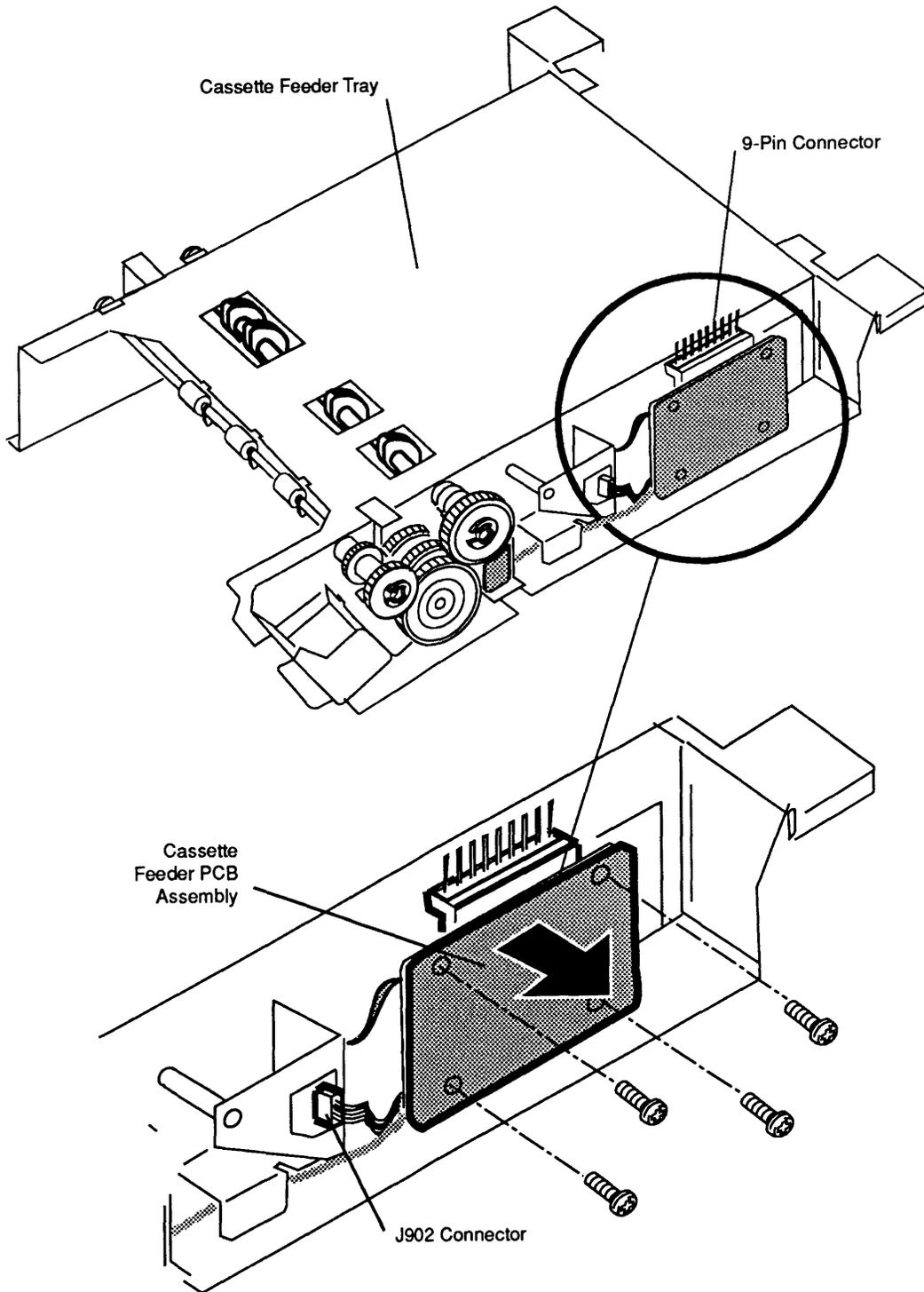
Figure 2-10 Cassette Feeder PCB Assembly

❑ CASSETTE FEEDER PCB ASSEMBLY

Remove

1. Remove the top cover, the cassette feeder tray, and the cassette stop cover.

2. Remove the right bottom cover.

3. Turn the cassette feeder tray so that the 9-pin connector is facing upward **(Figure 2-10)**.

4. Remove the four black screws that secure the PCB assembly to the cassette feeder tray **(Figure 2-10)**.

5. Disconnect connector J902 and remove the cassette feeder PCB assembly **(Figure 2-10)**.

Replace

1. Reconnect connector J902 to the cassette feeder PCB assembly **(Figure 2-10)**.

2. With the component side of the board facing the cassette feeder tray, place the cassette feeder PCB assembly into position **(Figure 2-10)**.

3. Replace the four black screws that secure the PCB assembly to the cassette feeder tray **(Figure 2-10)**.

4. Replace the right bottom cover.

5. Replace the cassette stop cover, the cassette feeder tray, and the top cover.
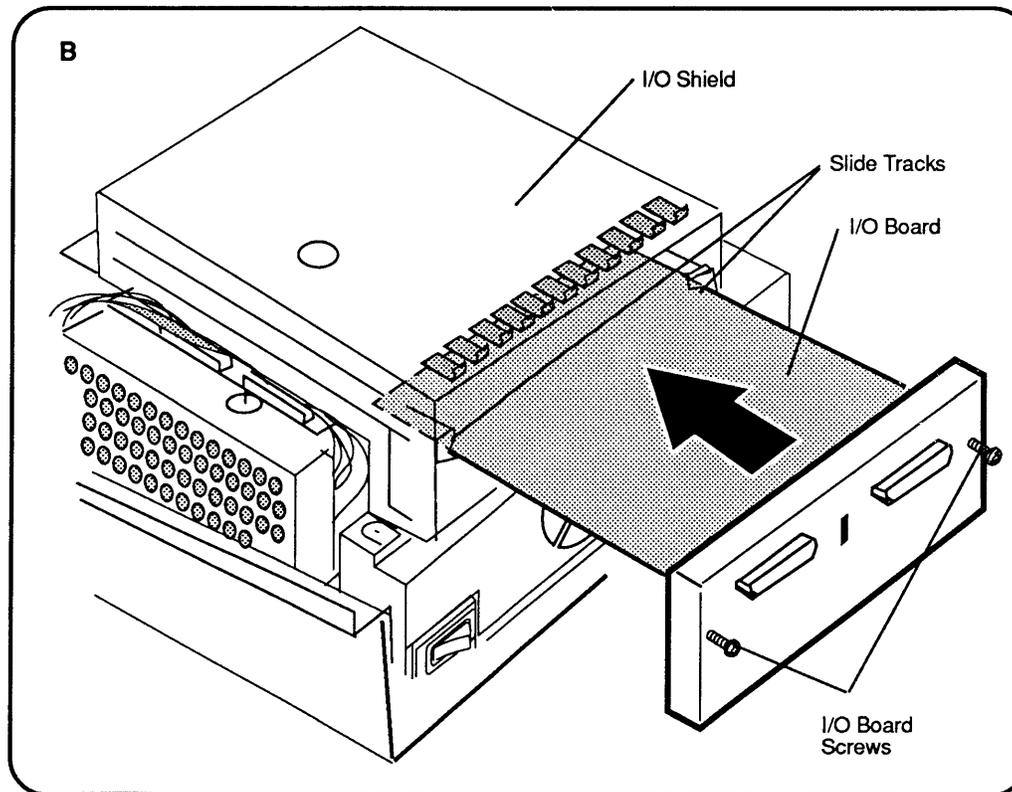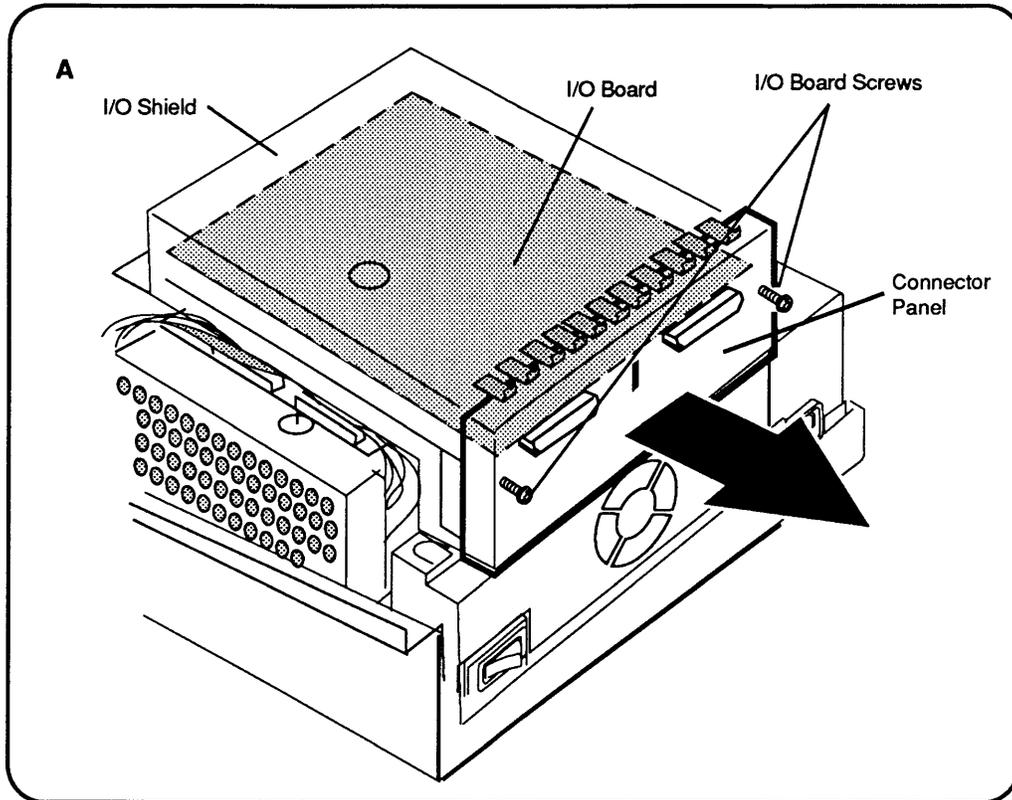
Figure 2-11 I/O Board (LaserWriter NT, SC, and NTR)

❏ I/O BOARD (LASERWRITER NT, SC, and NTR)

Remove

1. Remove the top cover.

2. Loosen the two screws that secure the I/O board to the I/O shield **(Figure 2-11A)**.

3. Carefully slide the I/O board out of the I/O shield. Handle the board only by the metal connector panel **(Figure 2-11A)**.

4. Before returning the I/O board to Apple, remove the screws that hold the metal connector panel to the I/O board.

5. Remove the metal connector panel and keep it to install on the replacement I/O board.

Replace

1. Install the metal connector panel on the I/O board and replace the screws.

2. Holding the I/O board by the metal connector panel, **turn the board so the component side is facing down (Figure 2-11B)**.

3. Carefully slide the board (component-side down) into the I/O board opening at the rear of the printer **(Figure 2-11B)**.

4. Tighten the two screws, one on each side of the I/O board connector panel **(Figure 2-11B)**.

5. Replace the top cover.

A

I/O Shield

B

I/O Board

J803
Connector
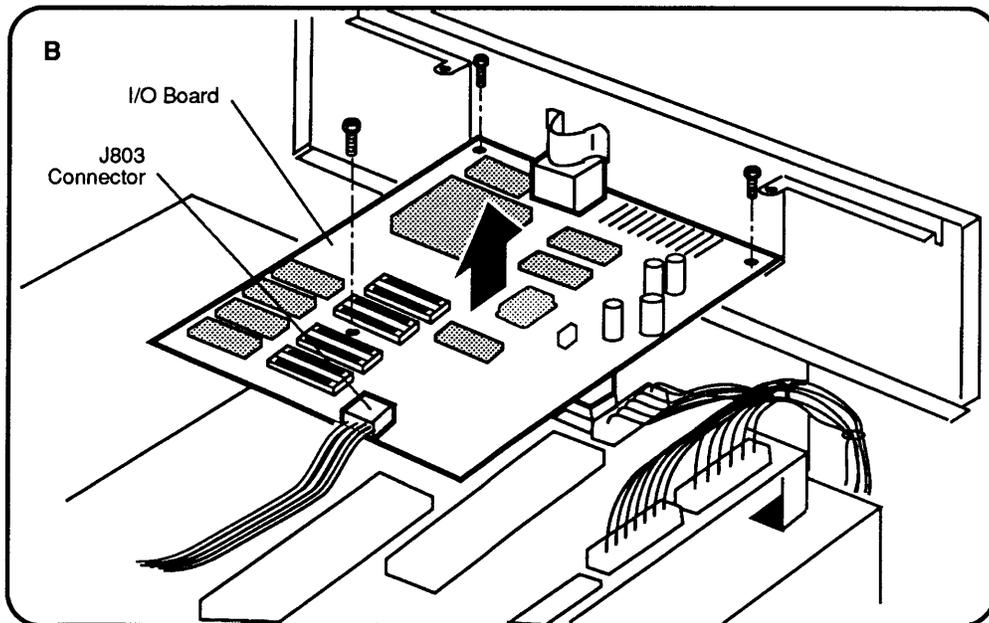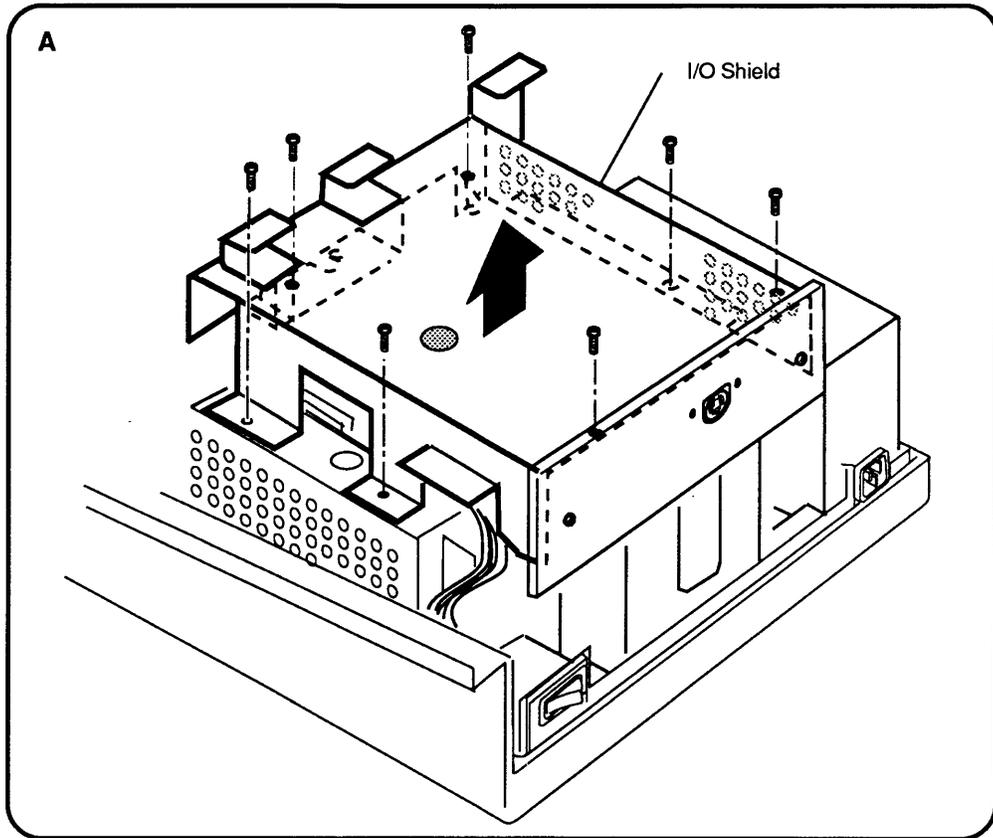
Figure 2-12 I/O Board (LaserWriter LS)

❏ I/O BOARD (LASERWRITER LS)

Remove

1. Remove the top cover.

2. Remove the seven screws that secure the I/O shield **(Figure 2-12A)**. Remove the I/O shield and set it aside.

3. Disconnect the four-wire connector from connector J803 on the I/O board **(Figure 2-12B)**.

4. Remove the three screws that secure the I/O board in place **(Figure 2-12B)**. Note that the two silver-colored screws at the rear of the I/O board have flat washers and the black screw in the middle of the board has no washer.

5. Holding the I/O board only by the edges, gently lift straight up on the I/O board to disconnect it from the controller board.

Replace

1. Holding the I/O board only by the edges, position the I/O board so that the connector on the underneath side fits into the connector on the controller board.

2. Replace the three screws that secure the I/O board in place **(Figure 2-12B)**. The two silver-colored screws at the rear of the I/O board have flat washers; the black screw in the middle of the board has no washer.

3. Connect the four-wire connector to connector J803 on the I/O board **(Figure 2-12B)**.

4. Replace the seven screws that secure the I/O shield **(Figure 2-12A)** over the I/O board.

5. Replace the top cover.

❏ I/O SHIELD (LASERWRITER NT, SC, and NTR)

Remove

1. Remove the top cover and the I/O board.

2. Remove the five screws that secure the I/O shield to the printer chassis (**Figure 2-13**).

3. Remove the I/O shield and set it aside (**Figure 2-13**).

Replace

1. Lower the I/O shield over the DC controller PCB; align the two cutouts on the shield with the positioning pins on the printer chassis.

2. Replace the five screws that secure the I/O shield to the printer chassis.

3. Replace the I/O board and the top cover.
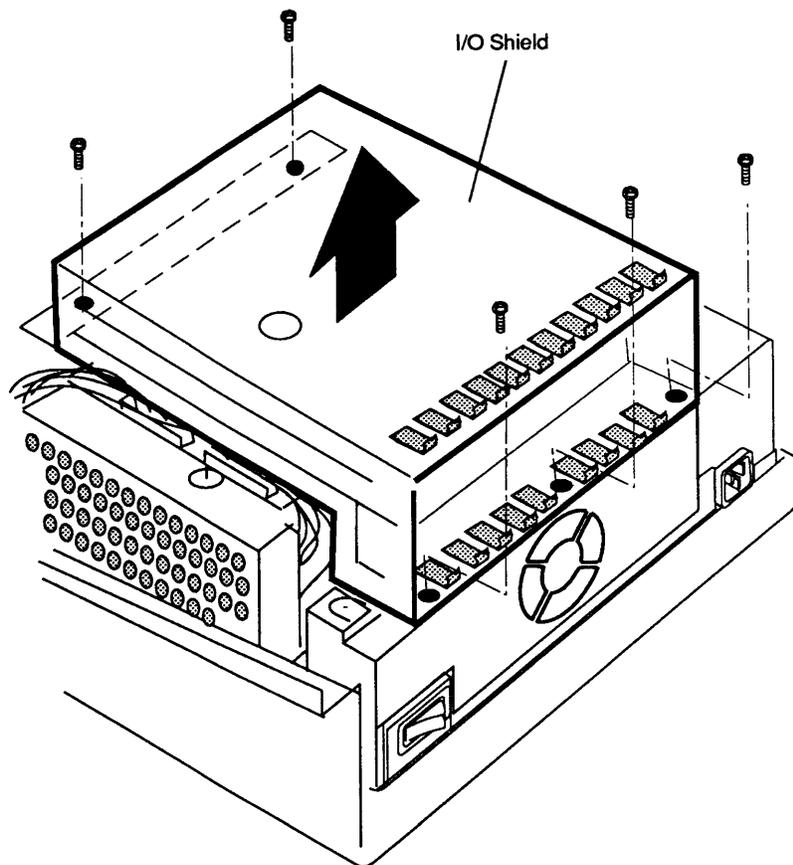
Figure 2-13 I/O Shield (LaserWriter NT, SC, and NTR)

❏ END PLATE (LASERWRITER NT, SC, AND NTR)

Remove

1. Remove the top cover, the I/O board, and the I/O shield.

2. Remove the four silver-colored screws that hold the end plate to the printer chassis **(Figure 2-14)**.

3. Lift the end plate out of the printer **(Figure 2-14)**.

Replace

1. Place the end plate into position; align the four screw holes on the plate with the screw holes on the printer chassis.

2. Replace the four silver-colored screws that hold the end plate to the printer chassis.

3. Replace the I/O shield, the I/O board, and the top cover.
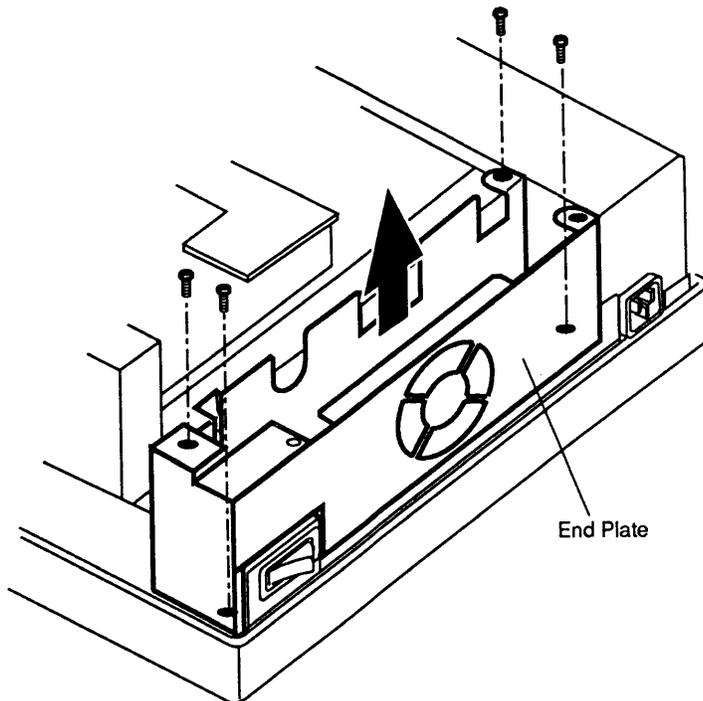
Figure 2-14 End Plate (LaserWriter NT, SC, and NTR)
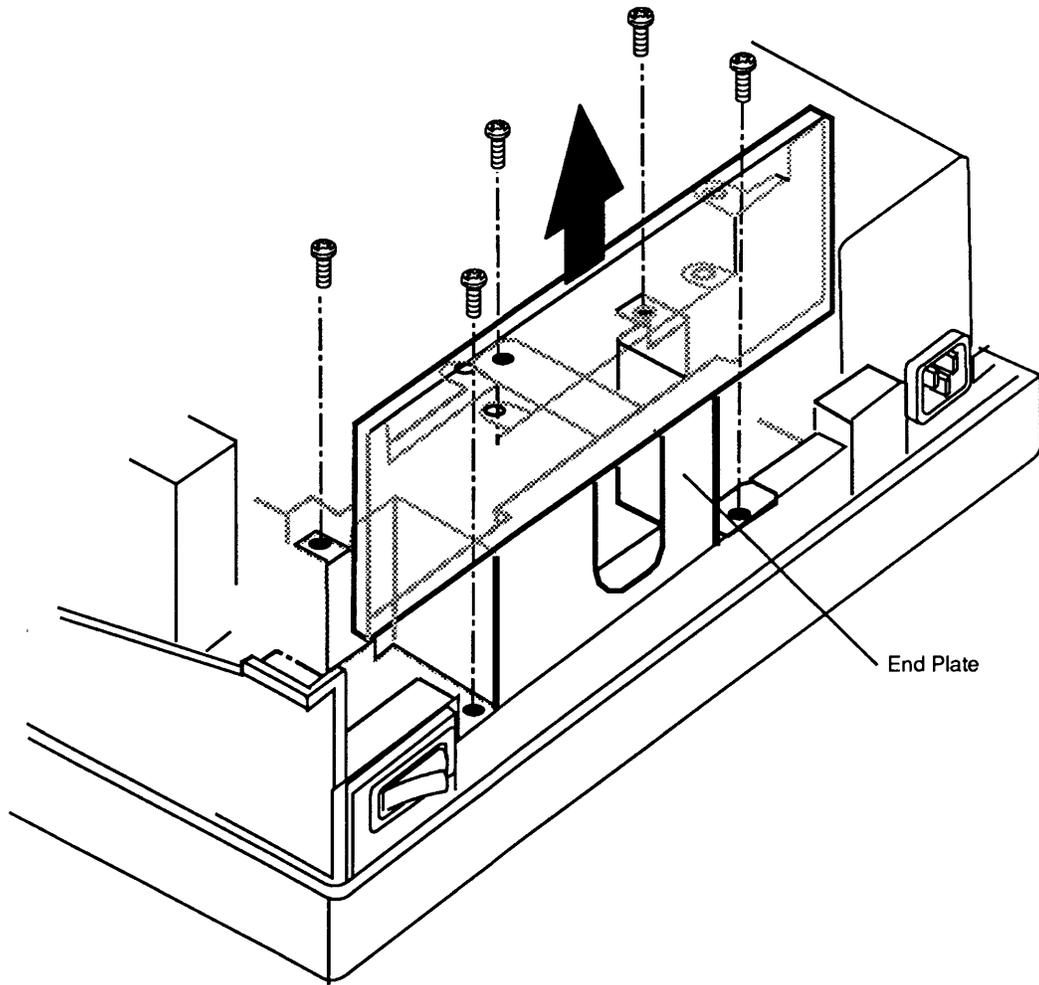
End Plate

Figure 2-15 End Plate (LaserWriter LS)

❑ END PLATE (LASERWRITER LS)

Remove

1. Remove the top cover and the I/O board.

2. Remove the five silver-colored screws that hold the end plate to the printer chassis **(Figure 2-15)**.

3. Lift the end plate out of the printer **(Figure 2-15)**.

Replace

1. Place the end plate into position. Align the five screw holes on the plate with the screw holes on the printer chassis.

2. Replace the five silver-colored screws that hold the end plate to the printer chassis.

3. Replace the I/O board and the top cover.

PCB Shield Screws

PCB
Duct
Plate
Screws

PCB
Duct
Plate

PCB
Shield
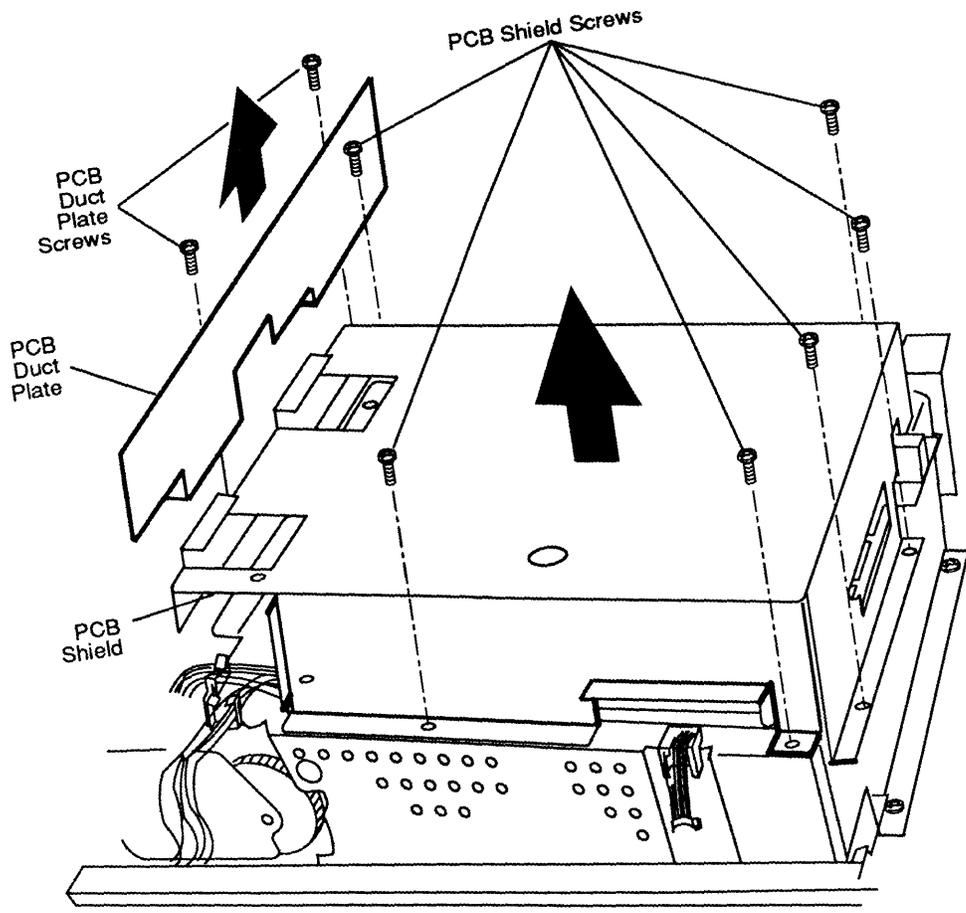
Figure 2-16 PCB Shield (LaserWriter LS/L)

❏ PCB SHIELD (LASERWRITER LS/L)

Remove

1. Remove the top cover.

2. Remove the two screws that secure the PCB duct plate **(Figure 2-16)**. Lift the PCB duct plate out of the printer.

3. Remove the six screws that secure the PCB shield to the printer chassis **(Figure 2-16)**. Lift the PCB shield out of the printer.

Replace

1. Place the PCB shield over the serial controller. Align the screw holes on the shield with the screw holes on the printer chassis.

2. Replace the six screws that secure the PCB shield to the printer chassis **(Figure 2-16)**.

3. Place the PCB duct plate into position and replace the two screws **(Figure 2-16)**.

4. Replace the top cover.

A

Density-Adjusting PCB
Assembly

J701

Fan

Tie-Wrap

B

Gold-Colored
Grounding
Plate

Fan

Left
Nut
Plate

Holding Pin
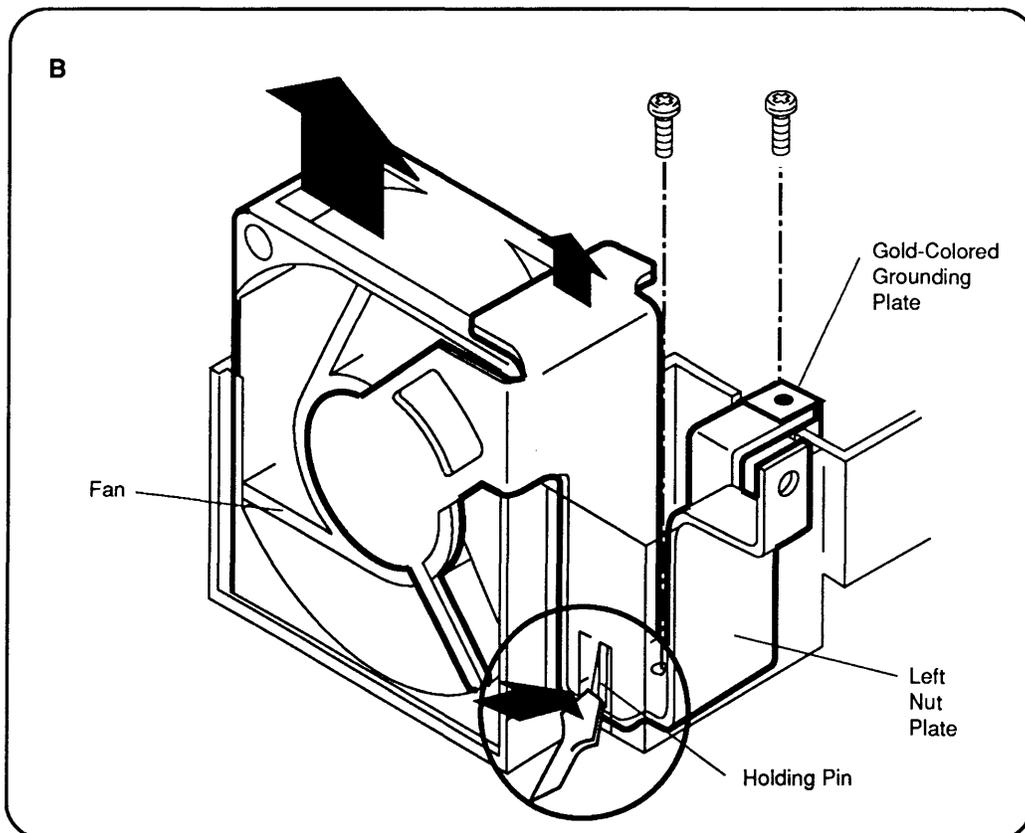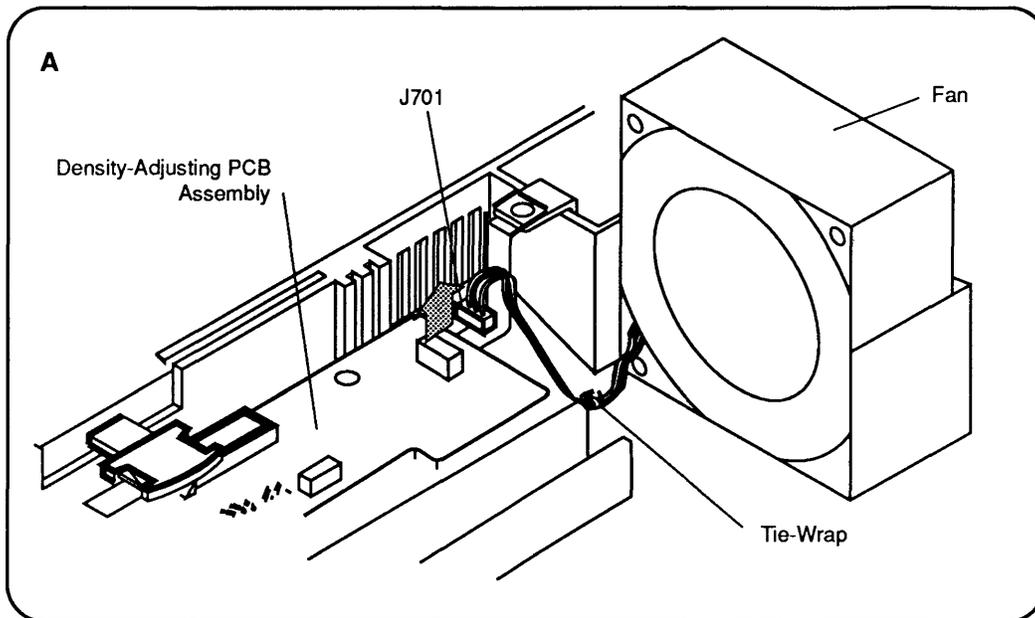
Figure 2-17 Fan

❏ FAN

Remove

1. <u>Remove the top cover.</u>

2. Locate the fan on the left side of the inner cover.

3. Remove the two screws that secure the left nut plate to the printer chassis **(Figure 2-17B)**.

4. Using small diagonal cutters, **carefully** cut the tie-wrap that secures the fan cable **(Figure 2-17A)**.

5. Disconnect connector J701 from the density-adjusting PCB **(Figure 2-17A)**.

6. Using a small flat-blade screwdriver, unlatch the holding pin that secures the left nut plate **(Figure 2-17B)**.

7. Lift the left nut plate and the fan out of the printer **(Figure 2-17B)**.

Replace

1. With the fan label facing out, slide the fan into the plastic fan holder on the inner cover.

2. Reconnect connector J701 to the density-adjusting PCB.

3. Slide the left nut plate into position **over** the fan. Be sure to place the gold-colored grounding plate over the left nut plate.

4. Replace the two screws that secure the left nut plate to the printer chassis.

5. <u>Replace the top cover.</u>

Toner Cartridge
Detection Sensor
PS11

Connector
J12

Mounting
Plate
Sensor

Paper Delivery
Sensor
PS12

Connector
J13
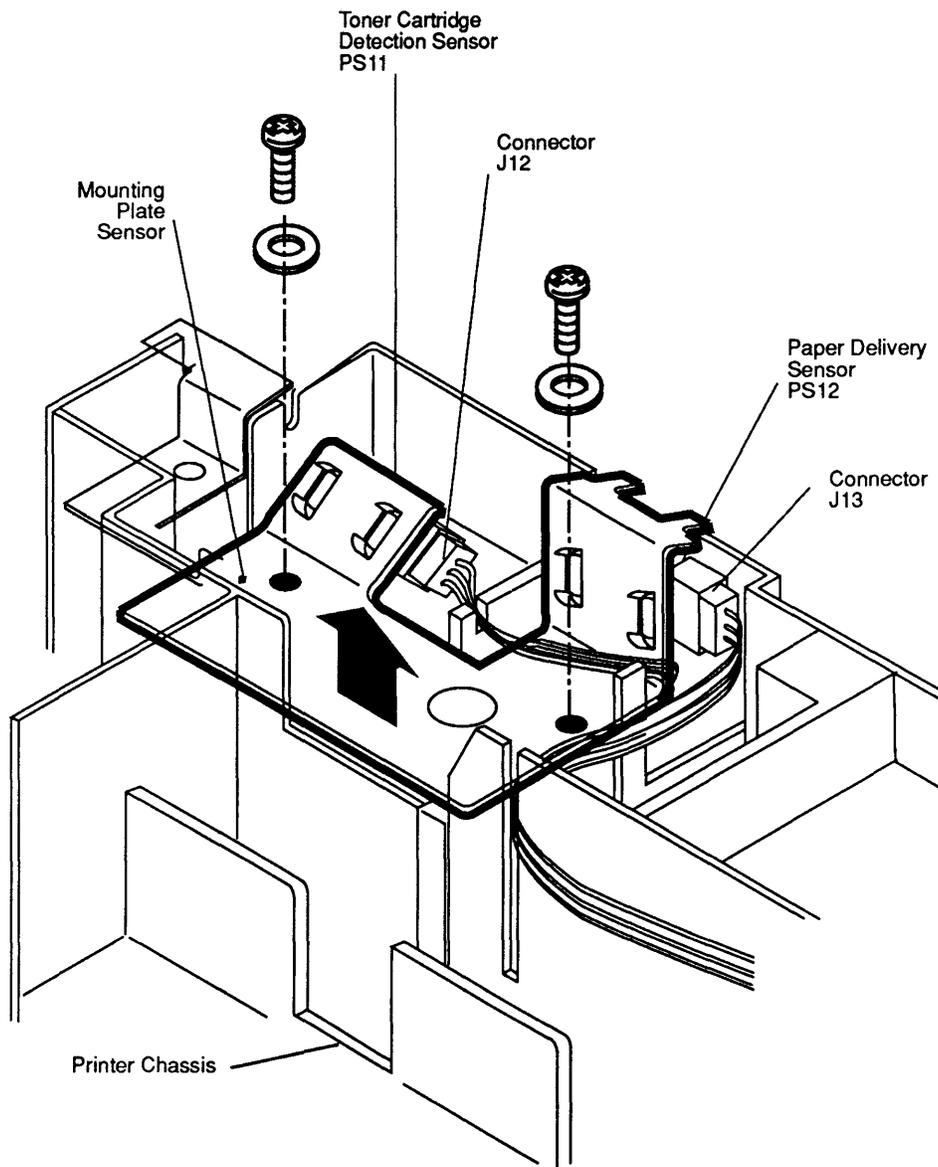
Printer Chassis

Figure 2-18 Mounting Plate Sensor

❏ MOUNTING PLATE SENSOR

Remove

1. Remove the top cover.

2. Locate the mounting plate sensor on the right side of the printer chassis.

3. Remove the two black screws and washers that secure the mounting plate sensor to the printer chassis **(Figure 2-18)**.

4. Lift the mounting plate sensor slightly **(Figure 2-18)**.

5. Disconnect connector J13 from photo-interrupter PS12, the paper delivery sensor **(Figure 2-18)**.

6. Disconnect connector J12 from photo-interrupter PS11, the toner cartridge detection sensor **(Figure 2-18)**.

7. Lift the mounting plate sensor out of the printer **(Figure 2-18)**.

Replace

1. Reconnect connector J12 (grey wires) to photo-interrupter PS11 on the mounting plate sensor **(Figure 2-18)**.

2. Reconnect connector J13 (purple wires) to photo-interrupter PS12 on the mounting plate sensor **(Figure 2-18)**.

3. Place the mounting plate sensor into position on the inner cover.

4. Replace the two black screws and washers that hold the mounting plate sensor to the printer chassis.

5. Replace the top cover.
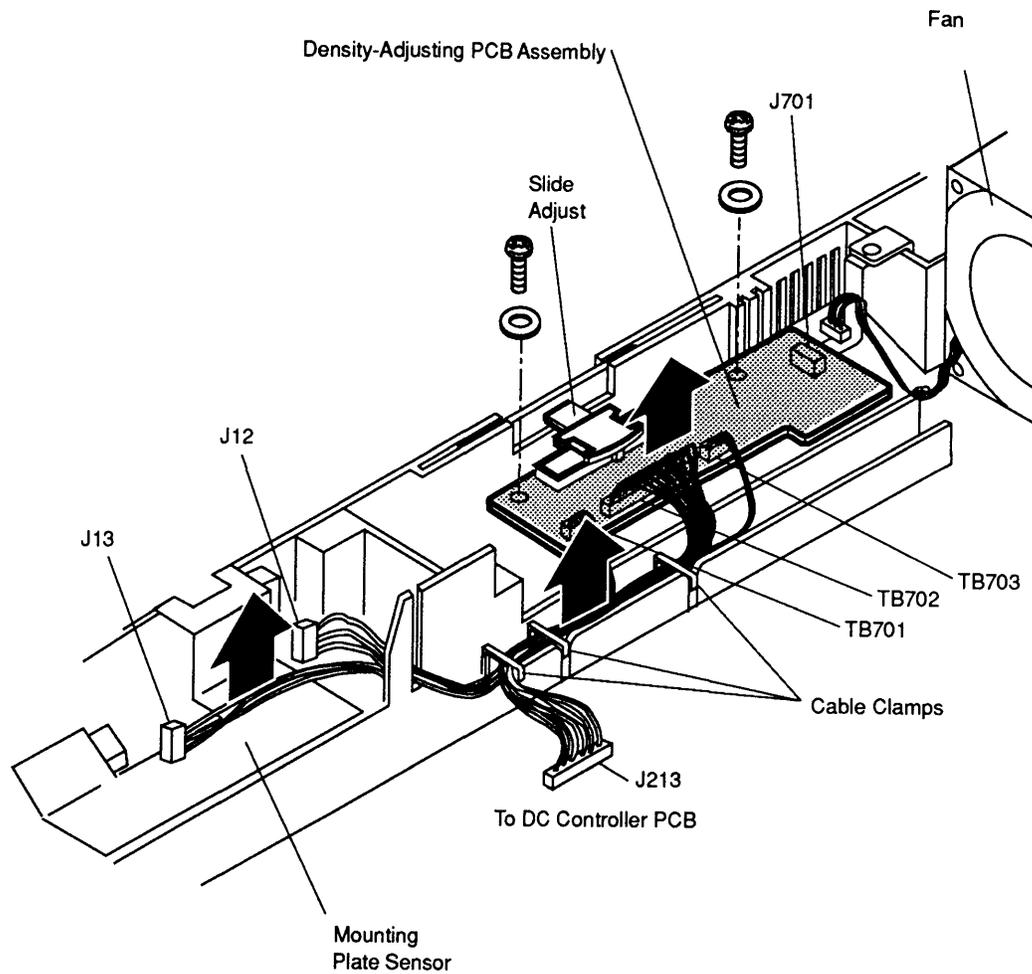
Figure 2-19 Density-Adjusting PCB Assembly

❏ DENSITY-ADJUSTING PCB ASSEMBLY

Remove

1. Remove the top cover, the I/O board, the I/O shield, and the mounting plate sensor.

2. Locate the density-adjusting PCB next to the fan **(Figure 2-19)**.

3. Disconnect the fan connector (J701) from the density-adjusting PCB **(Figure 2-19)**.

4. Disconnect connector J213 from the DC controller PCB **(Figure 2-19)**.

5. Use a small flat-blade screwdriver to open the three black cable retainers behind the density-adjusting PCB; remove the connector cables **(Figure 2-19)**.

6. Open the black cable retainer located behind connector J212 on the DC controller PCB; remove the connector cables.

7. Remove the two black screws and washers that secure the density-adjusting PCB to the printer chassis **(Figure 2-19)**.

8. Lift the density-adjusting PCB out of the printer **(Figure 2-19)**.

Replace

1. Place the density-adjusting PCB in position next to the fan.

2. Replace the two black screws and washers that hold the density-adjusting PCB to the printer chassis.

3. Reconnect the fan connector (J701) to the density-adjusting PCB.

4. Reconnect connector J213 to the DC controller PCB.

5. Replace the cables in the black cable retainers and close the retainers.

6. Replace the mounting plate sensor, I/O shield, I/O board, and top cover.
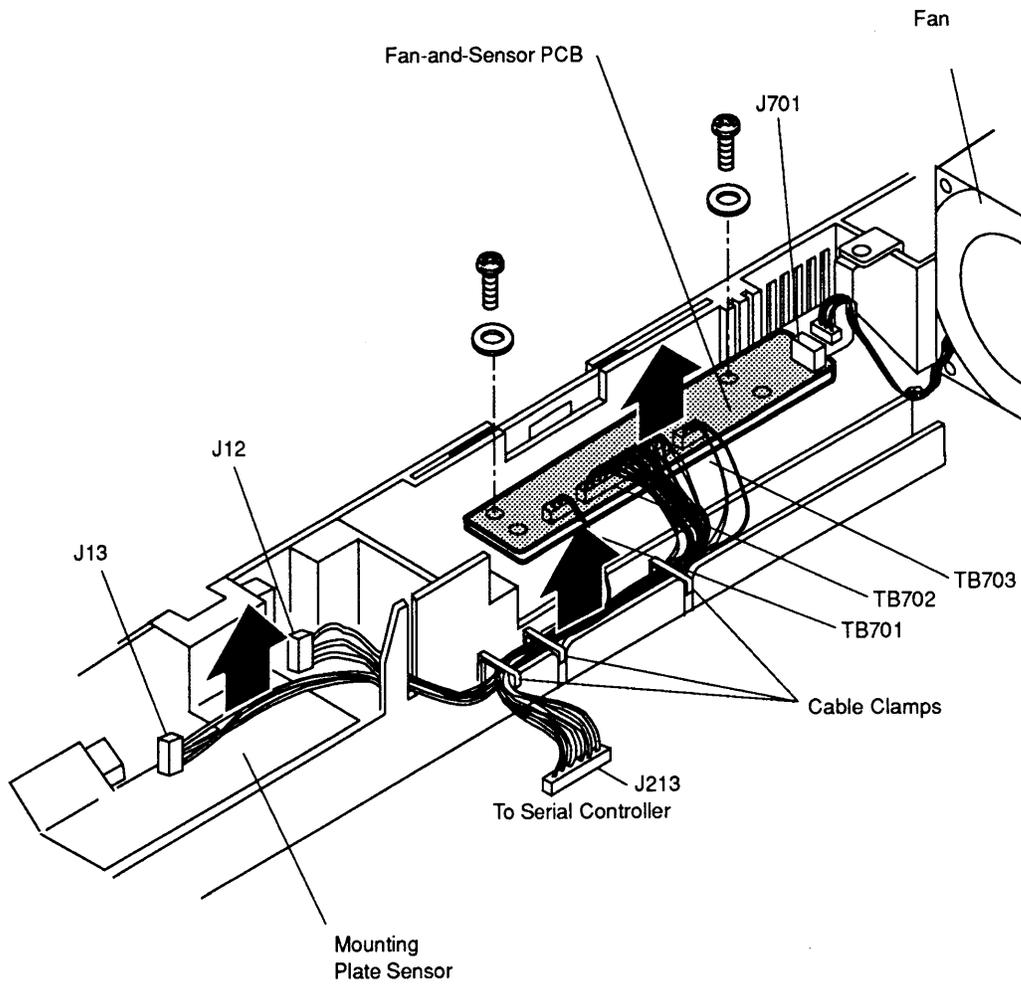
Figure 2-20 Fan-and-Sensor PCB (LaserWriter LS/L)

❏ FAN-AND-SENSOR PCB (LASERWRITER LS/L)

Remove

1. Remove the top cover, PCB shield, and mounting plate sensor.

2. Locate the fan-and-sensor PCB next to the fan **(Figure 2-20)**.

3. Disconnect the fan connector (J701) from the fan-and-sensor PCB **(Figure 2-20)**.

4. Disconnect connector J213 from the serial controller **(Figure 2-20)**.

5. Using a small flat-blade screwdriver, open the three black cable clamps behind the fan-and-sensor PCB; remove the connector cables **(Figure 2-20)**.

6. Open the black cable clamp behind connector J212 on the serial controller; remove the connector cables.

7. Remove the two black screws that secure the fan-and-sensor PCB to the printer chassis **(Figure 2-20)**.

8. Lift the fan-and-sensor PCB out of the printer **(Figure 2-20)**.

Replace

1. Place the fan-and-sensor PCB in position next to the fan.

2. Replace the two black screws that hold the fan-and-sensor PCB to the printer chassis.

3. Reconnect the fan connector (J701) to the fan-and-sensor PCB.

4. Reconnect connector J213 to the serial controller.

5. Replace the cables in the black cable clamps and close the cable clamps.

6. Replace the mounting plate sensor, PCB shield, and top cover.

A

Power
Supply
Unit

Cable
Retainer

AC Power
Switch (SW11)

B

DC Controller
PCB

Interconnect PCB

J302

Power
Supply
Unit

J212

Cable Retainers

J101
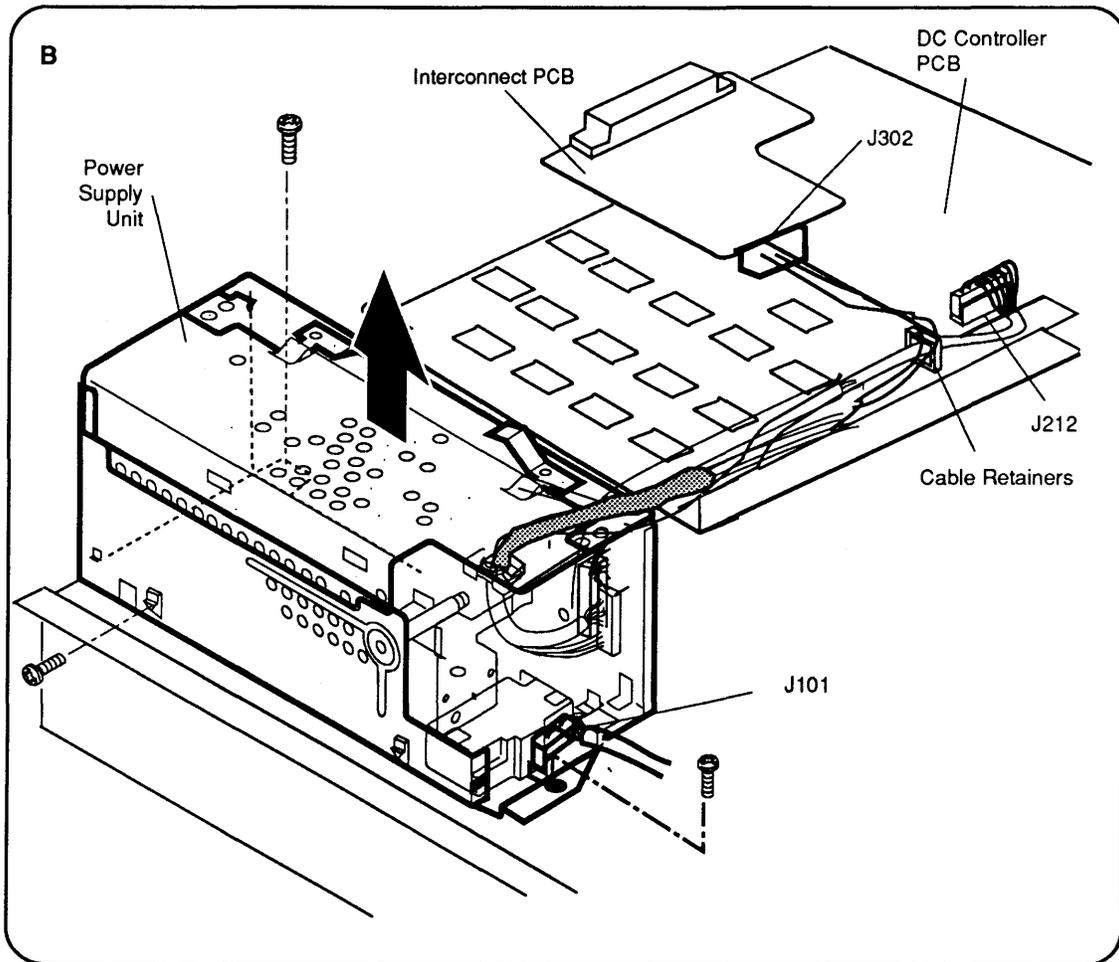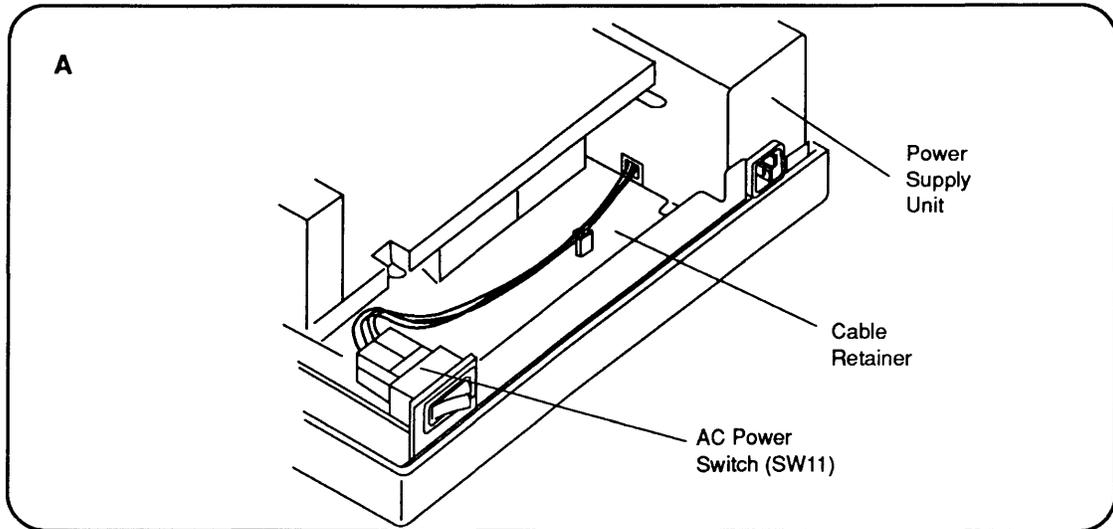
Figure 2-21 Power Supply Unit (LaserWriter NTR, NT and SC)

❏ POWER SUPPLY UNIT (LASERWRITER NT, SC AND NTR)

Remove

1. Remove the top cover, the I/O board, the I/O shield, and the end plate.

2. Open the front access door.

3. Disconnect the connector from SW11, the AC power switch **(Figure 2-21A)**.

4. Remove the power cable from the black cable retainer **(Figure 2-21A)**.

5. Disconnect connector J101 from the power supply unit **(Figure 2-21B)**.

6. Disconnect connector J212 from the DC controller PCB **(Figure 2-21B)**.

7. Disconnect connector J302 from the interconnect PCB **(Figure 2-21B)**.

8. Remove the three silver-colored screws securing the power supply unit to the printer chassis **(Figure 2-21B)**.

9. Lift the power supply unit out of the printer.

Replace

1. Install the power supply unit inside the printer.

2. Replace the three screws that secure the power supply unit to the printer chassis.

3. Replace the power cable inside the black cable clamp and close the clamp.

4. Reconnect the connector to SW11, the AC power switch.

5. Reconnect J101 to the power supply unit.

6. Reconnect J212 to the DC controller PCB.

7. Reconnect J302 to the interconnect PCB.

8. Replace the end plate, the I/O shield, the I/O board, and the top cover.
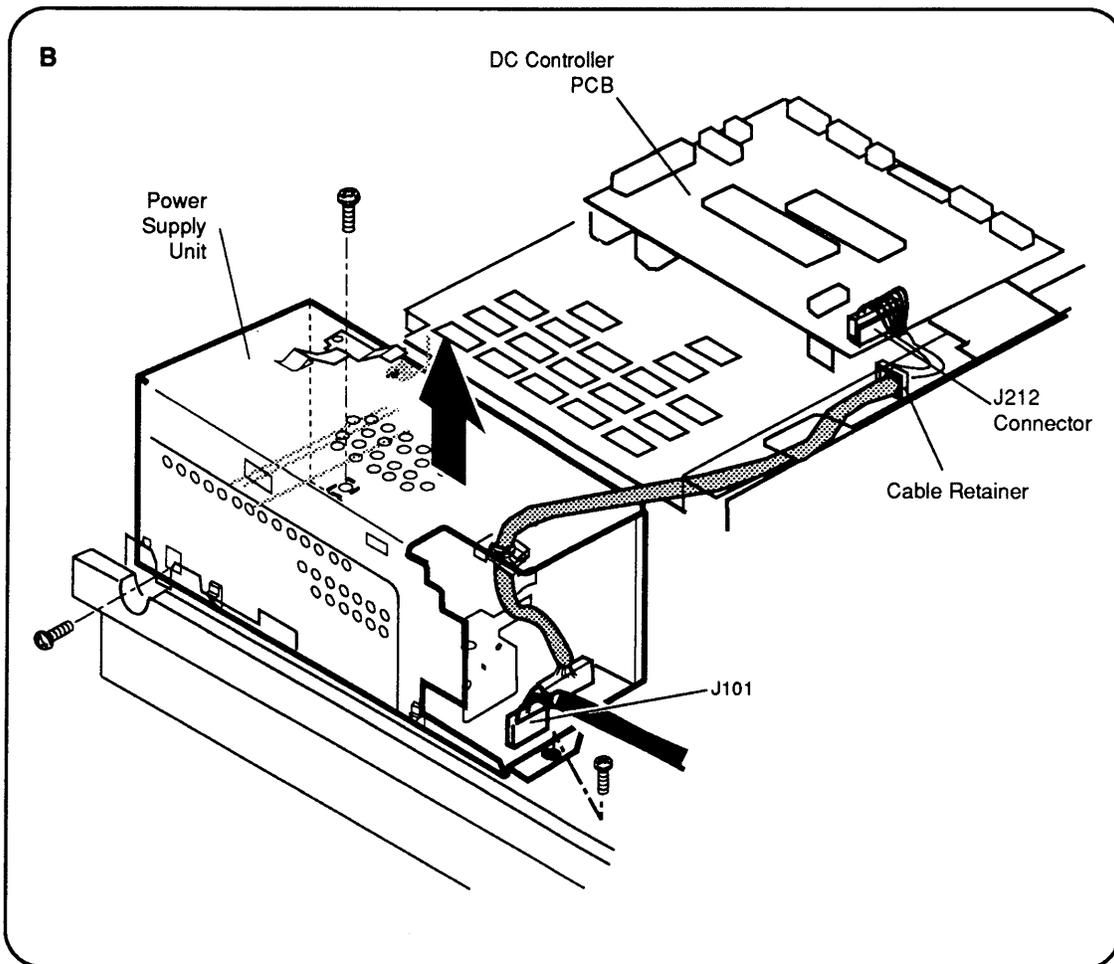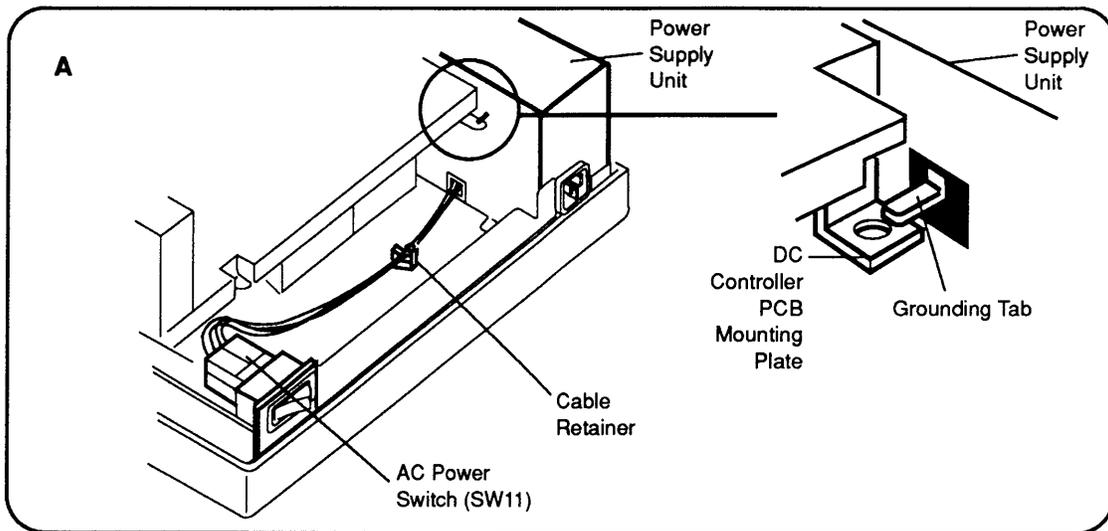
Figure 2-22 Power Supply Unit (LaserWriter LS)

❏ POWER SUPPLY UNIT (LASERWRITER LS)

Remove

1. Remove the top cover, I/O board, and end plate.

2. Disconnect the connector from SW11 (the AC power switch) and remove the AC power cable from the black cable retainer on the base of the printer **(Figure 2-22A)**.

3. Disconnect connector J212 from the DC controller PCB, and remove the cable from the black cable retainer near J212 **(Figure 2-22B)**.

4. Disconnect connector J101 from the power supply **(Figure 2-22B)**.

5. Remove the three silver-colored screws securing the power supply unit to the printer chassis **(Figure 2-22B)** and lift the power supply out of the printer.

Replace

1. Install the power supply inside the printer.

2. Replace the three screws that secure the power supply to the printer chassis.

3. Replace the power cable inside the black cable retainer near connector J212 on the DC controller PCB. Close the retainer.

4. Reconnect J212 to the DC controller PCB.

5. Reconnect J101 to the power supply.

6. Place the AC power cable into the cable retainer on the base of the printer, and reconnect the AC connector to SW11 (the AC power switch).

7. Replace the end plate.

   Note: The small protruding grounding tab on the upper-left side of the power supply must be positioned between the DC controller PCB mounting plate and the end plate **(Figure 2-22A)**.

8. Replace the I/O board and top cover.

Serial Controller

Power
Supply
Unit

J212
Connector

Cable Retainer

J101
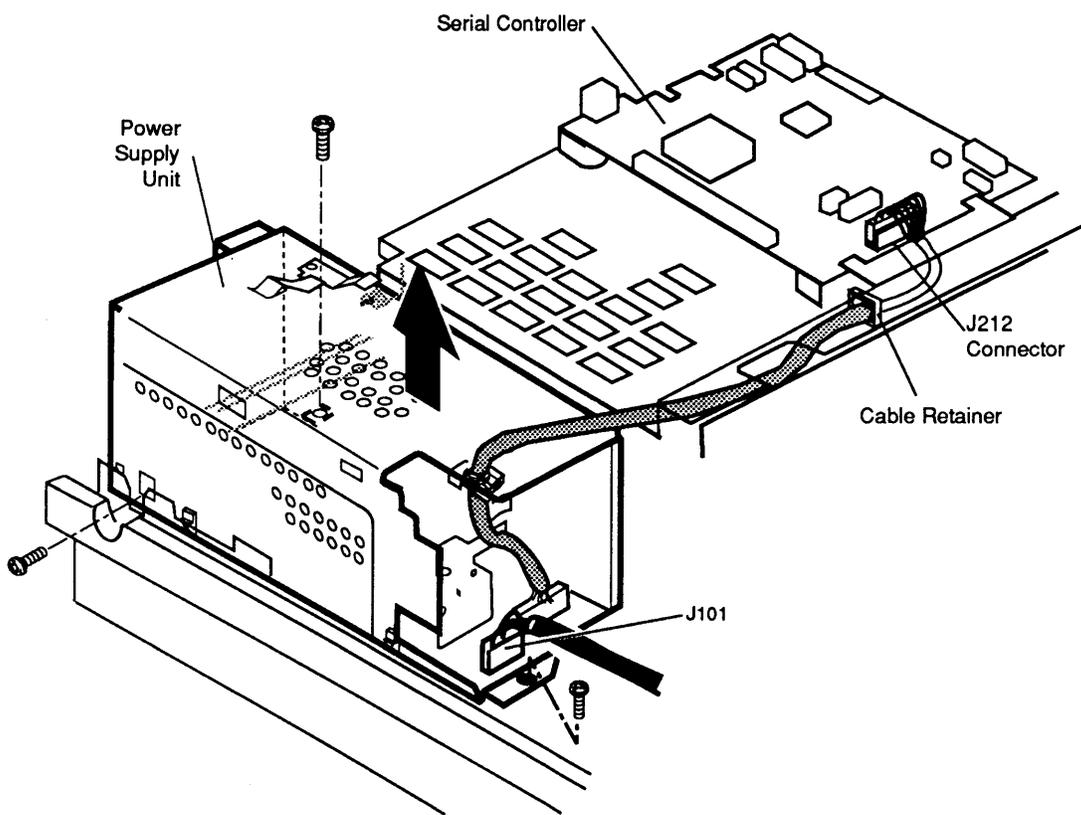
Figure 2-23 Power Supply Unit (LaserWriter LS/L)

❏ POWER SUPPLY UNIT (LASERWRITER LS/L)

Remove

1. Remove the top cover and PCB shield.

2. Disconnect connector J212 from the serial controller, and remove the cable from the black cable retainer near J212 **(Figure 2-23)**.

3. Disconnect connector J101 from the power supply unit **(Figure 2-23)**.

4. Remove the three silver-colored screws that secure the power supply unit to the printer chassis **(Figure 2-23)**.

5. Lift the power supply out of the printer.

Replace

1. Install the power supply unit inside the printer.

2. Replace the three screws that secure the power supply unit to the printer chassis.

3. Replace the power cable inside the black cable retainer near connector J212 on the serial controller. Close the retainer.

4. Reconnect J212 to the serial controller.

5. Reconnect J101 to the power supply unit.

6. Replace the PCB shield and the top cover.

High-Voltage Power Supply

J601 Connector

J602 Connector

High-Voltage
Cable Connector
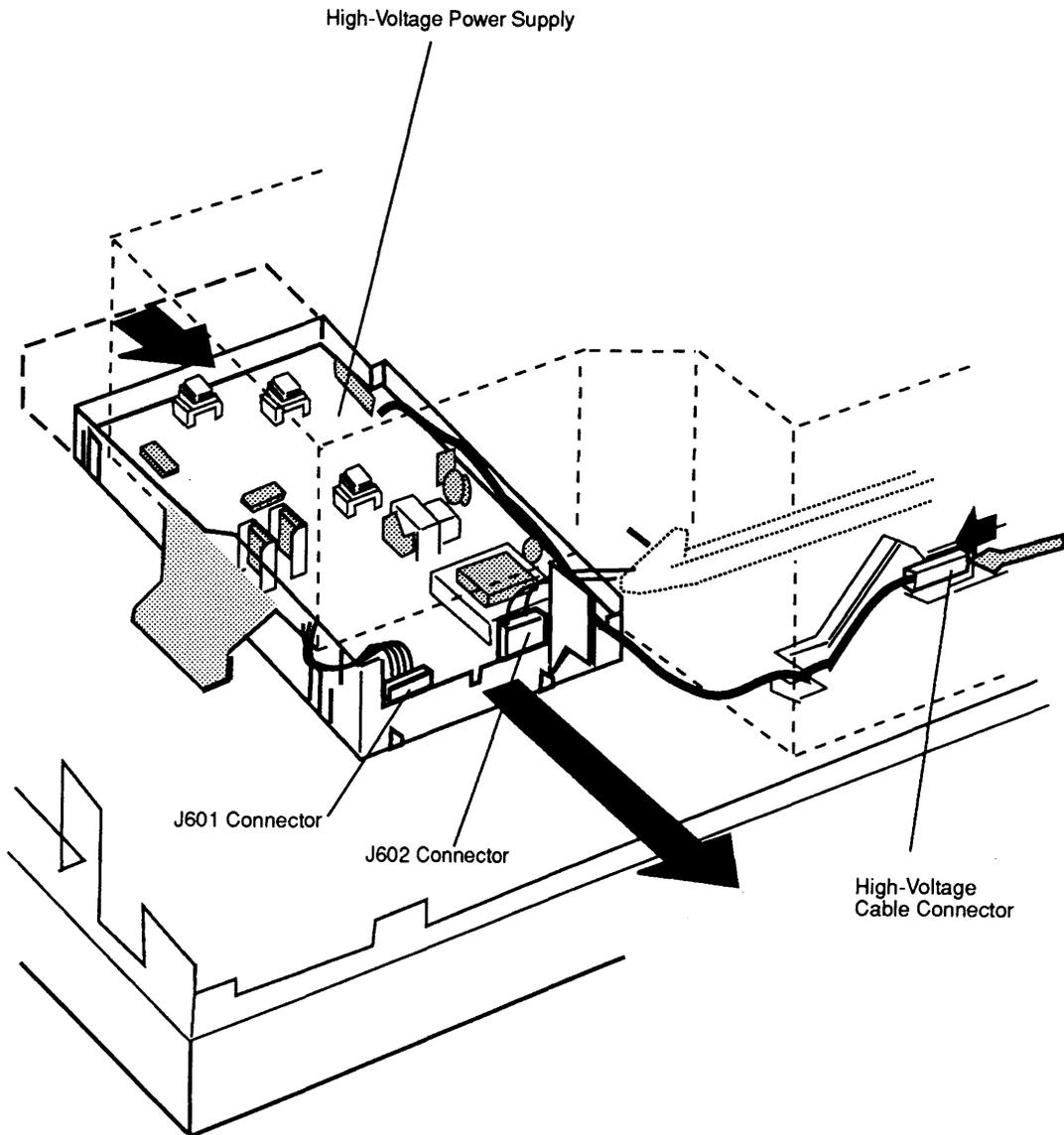
Figure 2-24 High-Voltage Power Supply

❑ HIGH-VOLTAGE POWER SUPPLY

Remove

1. On the LaserWriter NT, SC, LS, and NTR, remove the top cover, the I/O board, the I/O shield, and the end plate.

2. On the LaserWriter LS/L, remove the top cover and the PCB shield.

3. Remove the power supply unit.

4. Pull the plastic tray containing the high-voltage power supply from under the scanner assembly **(Figure 2-24)**.

5. Disconnect connectors J601 and J602 from the high-voltage power supply **(Figure 2-24)**.

6. Disconnect the black, high-voltage cable connector from the high-voltage contact assembly **(Figure 2-24)**.

7. Slide the high-voltage power supply from under the scanner assembly and lift the high-voltage power supply from the printer.

Replace

1. Slide the high-voltage power supply tray halfway under the scanner assembly.

2. Reconnect the black, high-voltage cable connector to the high-voltage contact assembly **(Figure 2-24)**.

3. Reconnect connectors J601 and J602 to the high-voltage power supply **(Figure 2-24)**.

4. Push the high-voltage power supply tray all the way under the scanner assembly. Make sure that the notches on the bottom of the tray fit into the slots on the printer base plate.

5. Replace the power supply unit.

6. On the LaserWriter LS/L replace the PCB shield and the top cover.

7. On the LaserWriter NT, SC, LS, and NTR, replace the end plate, the I/O shield, the I/O board, and the top cover.

J302

J303

DC Controller
PCB

Interconnect
PCB

DC Controller
Interconnect
Mount
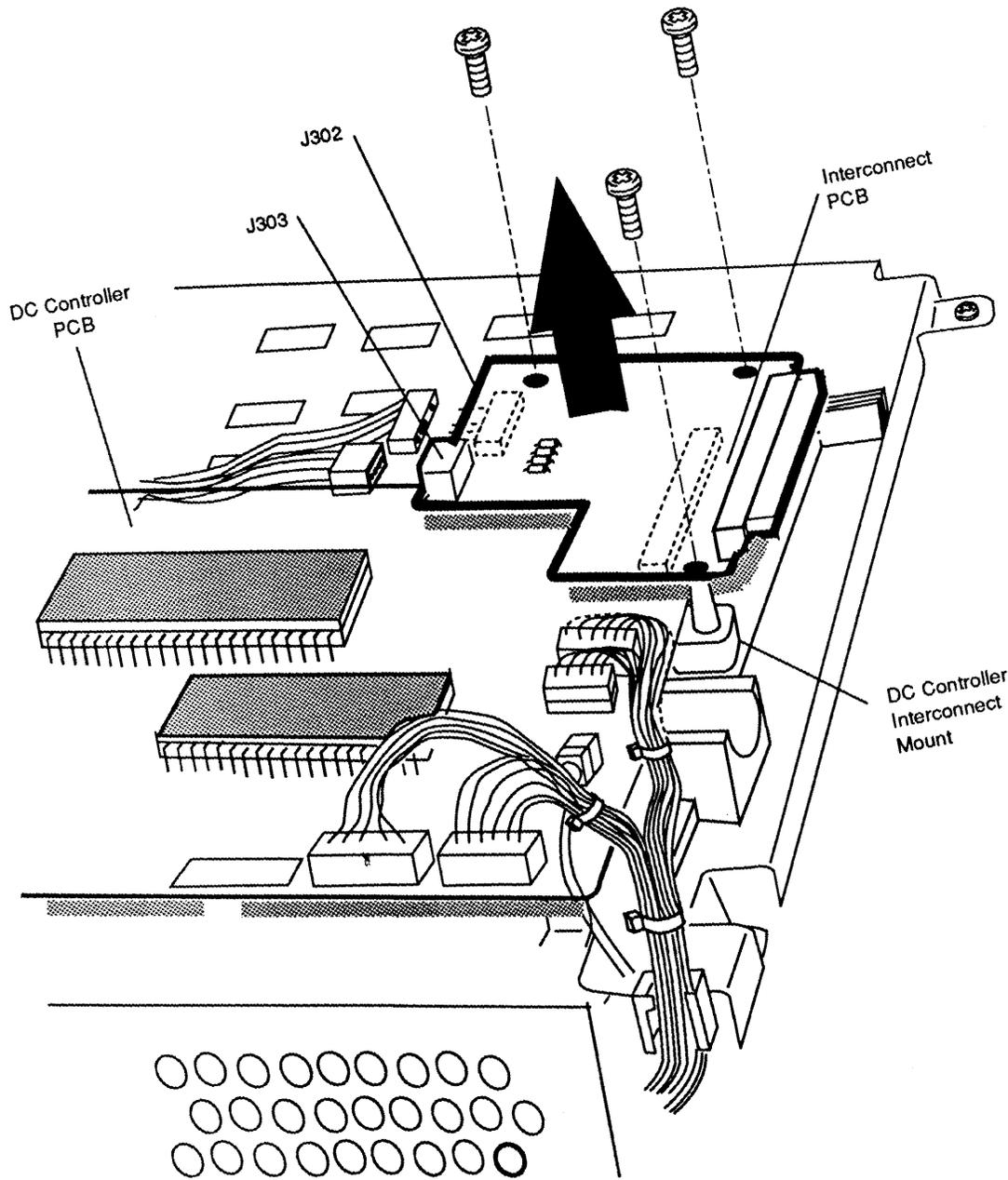
Figure 2-25 Interconnect PCB (LaserWriter NTR, NT and SC)

Apple Personal LaserWriter

rev. Apr 92

❑ INTERCONNECT PCB (LASERWRITER NT, SC, AND NTR)

Remove

1. Remove the top cover, the I/O board, and the I/O shield.

2. Carefully disconnect connectors J302 and J303 from the interconnect PCB **(Figure 2-25)**.

   Note: Be careful not to bend any of the components on the DC controller PCB when disconnecting J302 and J303 from the interconnect PCB.

3. Remove the three black screws that hold the interconnect PCB to the DC controller interconnect mount **(Figure 2-25)**.

4. Lift the interconnect PCB out of the printer **(Figure 2-25)**.

Replace

1. Place the interconnect PCB into position on the DC controller interconnect mount.

2. Replace the three black interconnect PCB screws.

3. Reconnect connectors J302 and J303 to the interconnect PCB.

4. Replace the I/O shield, the I/O board, and the top cover.

A

J212 DC Power Supply PCB Cable

J213 Density-Adjusting PCB Cable

DC Controller PCB

J202 Laser Assembly PCB Cable

J203 Scanner Motor PCB Cable

J204 Optical Fiber Cable

Screws

Cable Retainer

J210 Main Motor Cable

J209 Fuser Assembly Cable

J208 Paper Pickup Sensor Cable

J206 High-Voltage Power Supply Cable

J205 Cassette Feeder PCB Cable

B
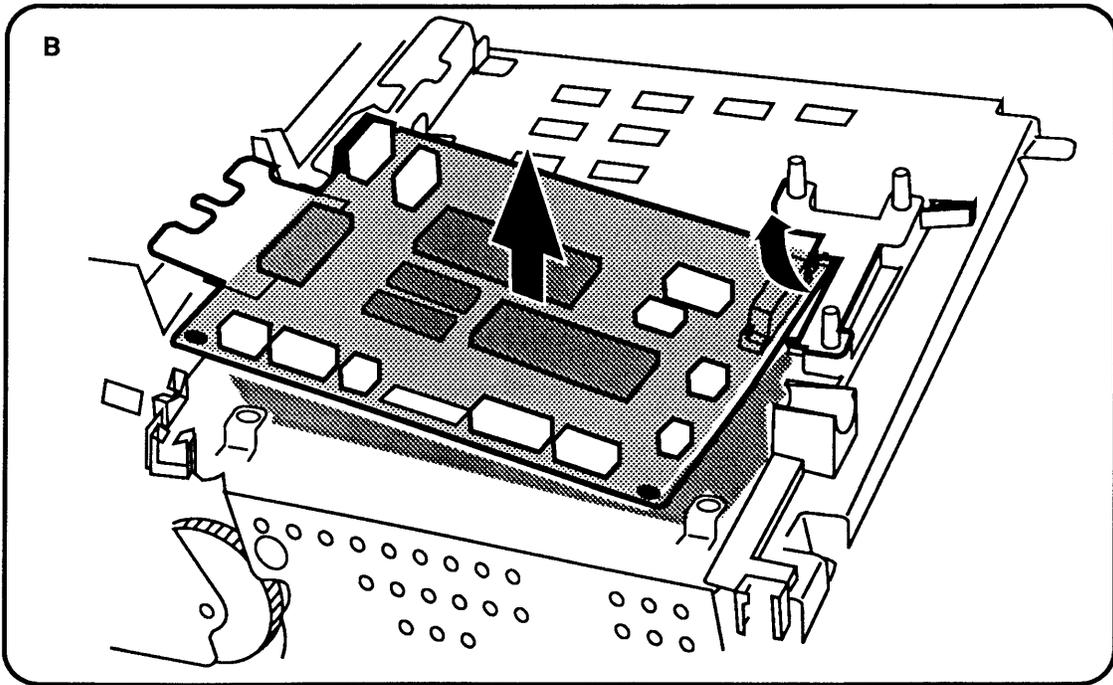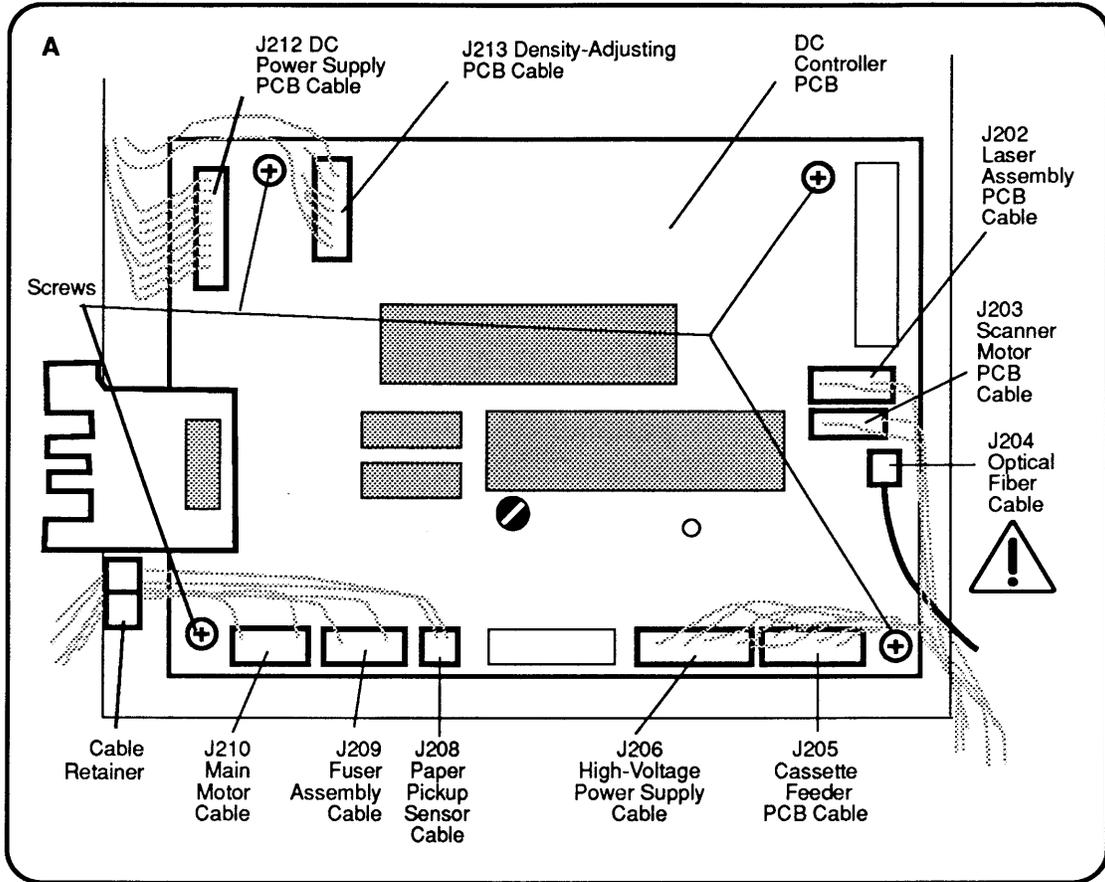
Figure 2-26 DC Controller PCB

❏ DC CONTROLLER PCB

Remove

1. Remove the top cover, the I/O board, and the I/O shield.

2. On the LaserWriter NT, SC, and NTR, remove the interconnect PCB.

3. Disconnect the following connectors from the DC controller PCB **(Figure 2-26A)**:

   • J202, laser assembly PCB cable

   • J203, scanner motor PCB cable

WARNING: *Do not disconnect J204, the optical fiber cable, from the DC controller PCB when the printer is powered on. The reflected laser beam, though invisible, can damage your eyes.*

   • J204, optical fiber cable

   • J205, cassette feeder PCB cable

   • J206, high-voltage power supply cable

   • J208, paper pickup sensor cable

   • J209, fuser assembly cable

   • J210, main motor cable

   • J212, DC power supply PCB cable

   • J213, density-adjusting PCB cable

4. Remove the connector cables from the black cable retainer on the DC controller PCB **(Figure 2-26A)**.

5. Remove the four silver-colored screws that secure the DC controller PCB to the DC controller PCB mounting plate **(Figure 2-26A)**.

6. Carefully lift the DC controller PCB out of the printer **(Figure 2-26B)**.

A

B

J212 DC
Power Supply
PCB Cable

J213 Density-Adjusting
PCB Cable

DC
Controller
PCB

J202
Laser
Assembly
PCB
Cable

Screws

J203
Scanner
Motor
PCB
Cable

J204
Optical
Fiber
Cable

Cable
Retainer

J210
Main
Motor
Cable

J209
Fuser
Assembly
Cable

J208
Paper
Pickup
Sensor
Cable

J206
High-Voltage
Power Supply
Cable

J205
Cassette
Feeder
PCB Cable
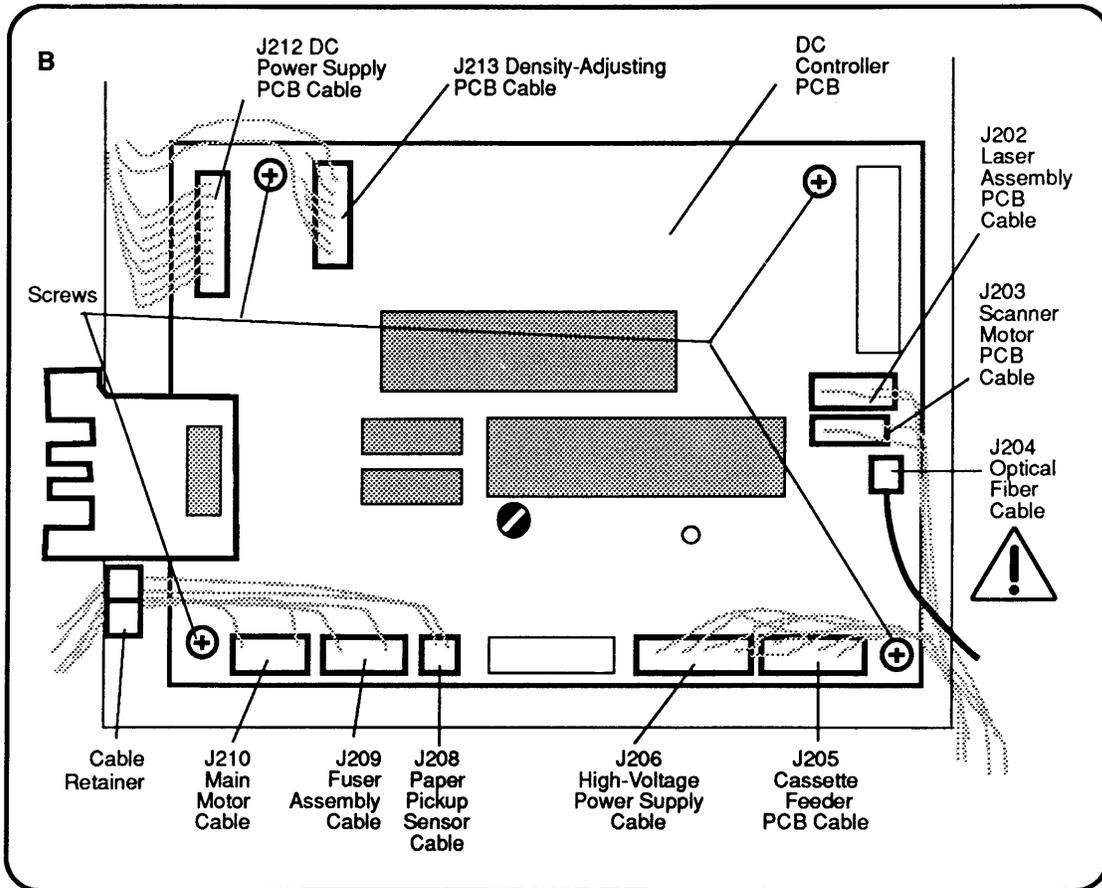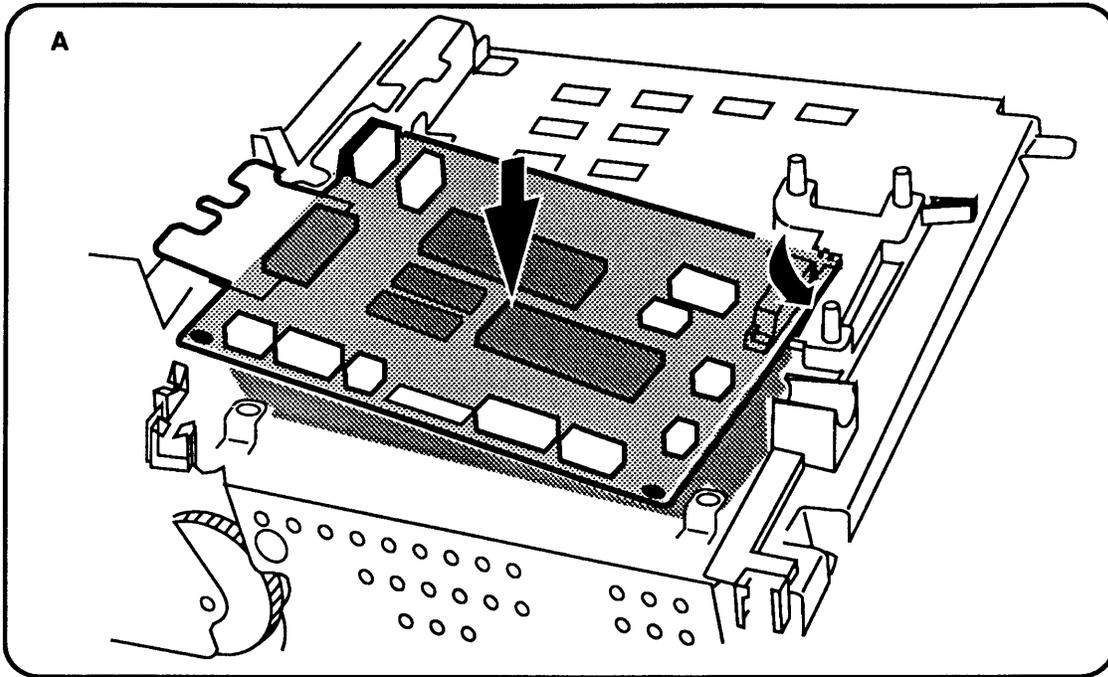
Figure 2-27 DC Controller PCB

Replace

1. Place the DC controller PCB into position on the DC controller PCB mounting plate and replace the four corner screws **(Figure 2-27A and B)**.

2. Reconnect the following connectors to the DC controller PCB **(Figure 2-27B)**:

   • J202, laser assembly PCB cable

   • J203, scanner motor PCB cable

   • J204, optical fiber cable

   • J205, cassette feeder PCB cable

   • J206, high-voltage power supply cable

   • J208, paper pickup sensor cable

   • J209, fuser assembly cable

   • J210, main motor cable

   • J212, DC power supply PCB cable

   • J213, density-adjusting PCB cable

3. Replace the connector cables inside the black cable retainer **(Figure 2-27B)**.

4. On the LaserWriter NT, SC, and NTR, replace the interconnect PCB.

5. Replace the I/O shield, the I/O board, and the top cover.

A

J212 DC Power Supply PCB Cable

J213 Density-Adjusting PCB Cable

DC Controller PCB

J202 Laser Assembly PCB Cable

J203 Scanner Motor PCB Cable

J204 Optical Fiber Cable

Cable Retainer

J210 Main Motor Cable

J209 Fuser Assembly Cable

J208 Paper Pickup Sensor Cable

J206 High-Voltage Power Supply Cable

J205 Cassette Feeder PCB Cable

B

Retainer Clip

J303

J302

DC Controller PCB Mounting Plate

Interconnect PCB (not on LS or LS/L)

Retainer Clips

Retainer Clip

Cable Guide

Figure 2-28 DC Controller PCB Mounting Plate

❏ DC CONTROLLER PCB MOUNTING PLATE

Remove

1. Remove the top cover, the I/O board, the I/O shield, and the end plate.

2. Disconnect the following connectors from the DC controller PCB **(Figure 2-28A)**:

   • J202, laser assembly PCB cable

   • J203, scanner motor PCB cable

WARNING: *Do not disconnect J204, the optical fiber cable, from the DC controller PCB when the printer is powered on. The reflected laser beam, though invisible, can damage your eyes.*

   • J204, optical fiber cable

   • J205, cassette feeder PCB cable

   • J206, high-voltage power supply cable

   • J208, paper pickup sensor cable

   • J209, fuser assembly cable

   • J210, main motor cable

   • J212, DC power supply PCB cable

   • J213, density-adjusting PCB cable

3. On the LaserWriter NT, SC, and NTR, disconnect connectors J302 and J303 from the interconnect PCB **(Figure 2-28B)**.

4. Remove the cables from the three black cable retainer clips **(Figure 2-28B)**.

5. Remove the four screws that secure the DC controller PCB mounting plate to the printer chassis **(Figure 2-28B)**.

6. Lift the DC controller PCB mounting plate off the printer and set it aside **(Figure 2-28B)**.

A

Retainer Clip

J302 J303

DC Controller PCB Mounting Plate

Interconnect PCB (not on LS or LS/L)

Retainer Clips

Retainer Clip

Cable Guide

B

J212 DC Power Supply PCB Cable

J213 Density- Adjusting PCB Cable

DC Controller PCB

J202 Laser Assembly PCB Cable

J203 Scanner Motor PCB Cable

J204 Optical Fiber Cable

Cable Retainer

J210 Main Motor Cable

J209 Fuser Assembly Cable

J208 Paper Pickup Sensor Cable

J206 High-Voltage Power Supply Cable

J205 Cassette Feeder PCB Cable

Figure 2-29 DC Controller PCB Mounting Plate

Replace

1. Set the DC controller PCB mounting plate in place (**Figure 2-29A**).

2. Replace the four screws that secure the DC controller PCB mounting plate to the printer chassis (**Figure 2-29A**).

3. On the LaserWriter NT, SC, and NTR, reconnect connectors J302 and J303 to the interconnect PCB.

4. Reconnect the following cables to the DC controller PCB (**Figure 2-29B**):

   - J202, laser assembly PCB cable

   - J203, scanner motor PCB cable

   - J204, optical fiber cable

   - J205, cassette feeder PCB cable

   - J206, high-voltage power supply cable

   - J208, paper pickup sensor cable

   - J209, fuser assembly cable

   - J210, main motor cable

   - J212, DC power supply PCB cable

   - J213, density-adjusting PCB cable

5. Replace the connector cables in the cable retainer clips (**Figure 2-29A and B**).

6. Replace the end plate, the I/O shield, the I/O board, and the top cover.

A

J215
Status
LED Cable

J213 Fan-and-Sensor
PCB Cable

Screws

Serial
Controller

Cable
Retainer

J212 DC
Power Supply
PCB Cable

J202
Laser
Assembly
PCB
Cable

J204
Optical
Fiber
Cable

J210
Main
Motor
Cable

Cable
Retainer

J209
Fuser
Assembly
Cable

J208
Paper
Pickup
Sensor
Cable

J205 Cassette
Feeder Cable

J206
High-Voltage
Power Supply
Cable

J203
Scanner
Motor
PCB
Cable

B

Serial
Controller

PCB Controller
Mount

Serial
Controller

Figure 2-30 Serial Controller (LaserWriter LS/L)

□ SERIAL CONTROLLER (LASERWRITER LS/L)

Remove

1. Remove the top cover and the PCB shield.

2. Disconnect the following connectors from the serial controller **(Figure 2-30A)**:

    *   J202, laser assembly PCB cable

    *   J203, scanner motor PCB cable

WARNING: *Do not disconnect J204, the optical fiber cable, from the serial controller when the printer is powered on. The reflected laser beam, though invisible, can damage your eyes.*

---

*   J204, optical fiber cable

*   J205, cassette feeder PCB cable

*   J206, high-voltage power supply cable

*   J208, paper pickup sensor cable

*   J209, fuser assembly cable

*   J210, main motor cable

*   J212, DC power supply PCB cable

*   J213, fan-and-sensor PCB cable

*   J215, status light cable

3. Remove the connector cables from the black cable retainer near J212 **(Figure 2-30A)**.

4. Remove the four silver-colored screws that secure the serial controller to the PCB mounting plate **(Figure 2-30A)**.

5. Carefully lift the serial controller out of the printer **(Figure 2-30B)**. Make sure that the PCB controller mount remains on the PCB mounting plate.
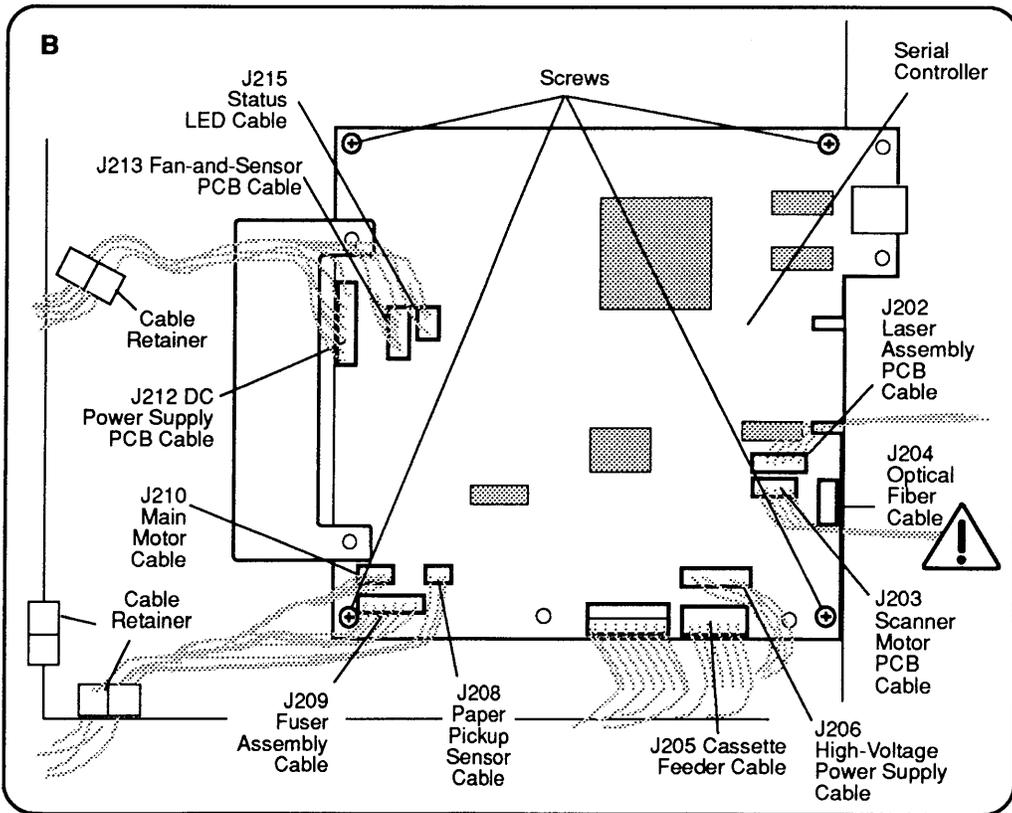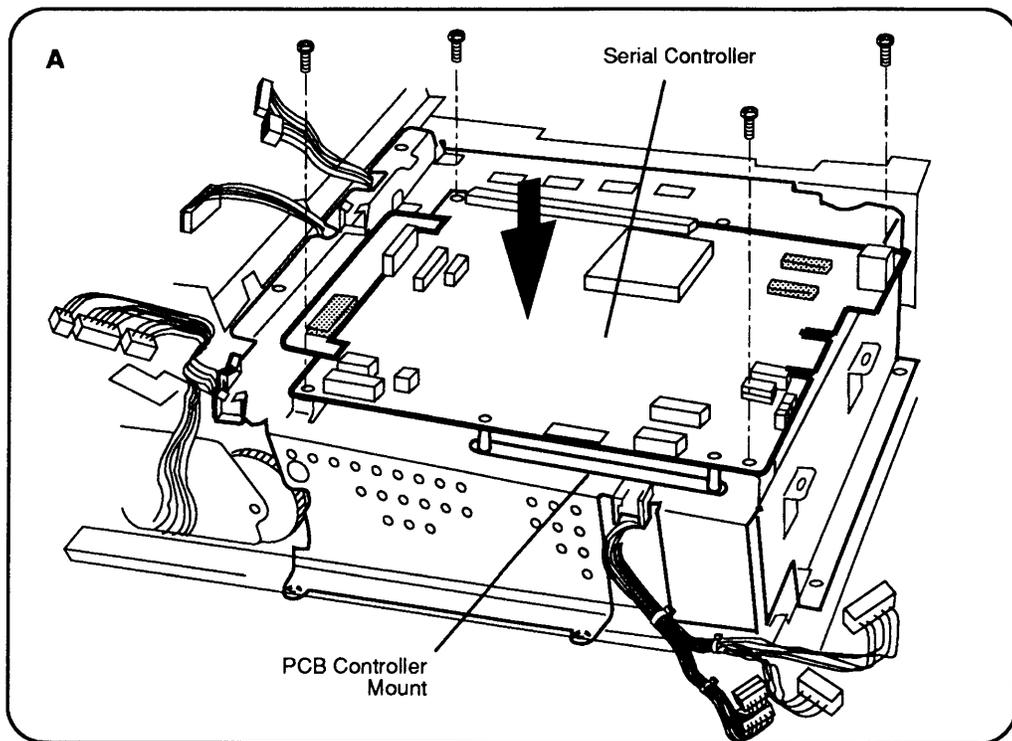
Figure 2-31 Serial Controller (LaserWriter LS/L)

Replace

1. Place the serial controller into position on the PCB mounting plate and the PCB controller mount **(Figure 2-31A)**.

2. Replace the four corner screws that secure the serial controller to the PCB mounting plate **(Figure 2-31A and B)**.

3. Reconnect the following connectors to the serial controller **(Figure 2-31B)**:

   • J202, laser assembly PCB cable

   • J203, scanner motor PCB cable

   • J204, optical fiber cable

   • J205, cassette feeder PCB cable

   • J206, high-voltage power supply cable

   • J208, paper pickup sensor cable

   • J209, fuser assembly cable

   • J210, main motor cable

   • J212, DC power supply PCB cable

   • J213, fan-and-sensor PCB cable

   • J215, status light cable

4. Replace the connector cables inside the black cable retainer near J212 **(Figure 2-31B)**.

5. Replace the PCB shield and the top cover.
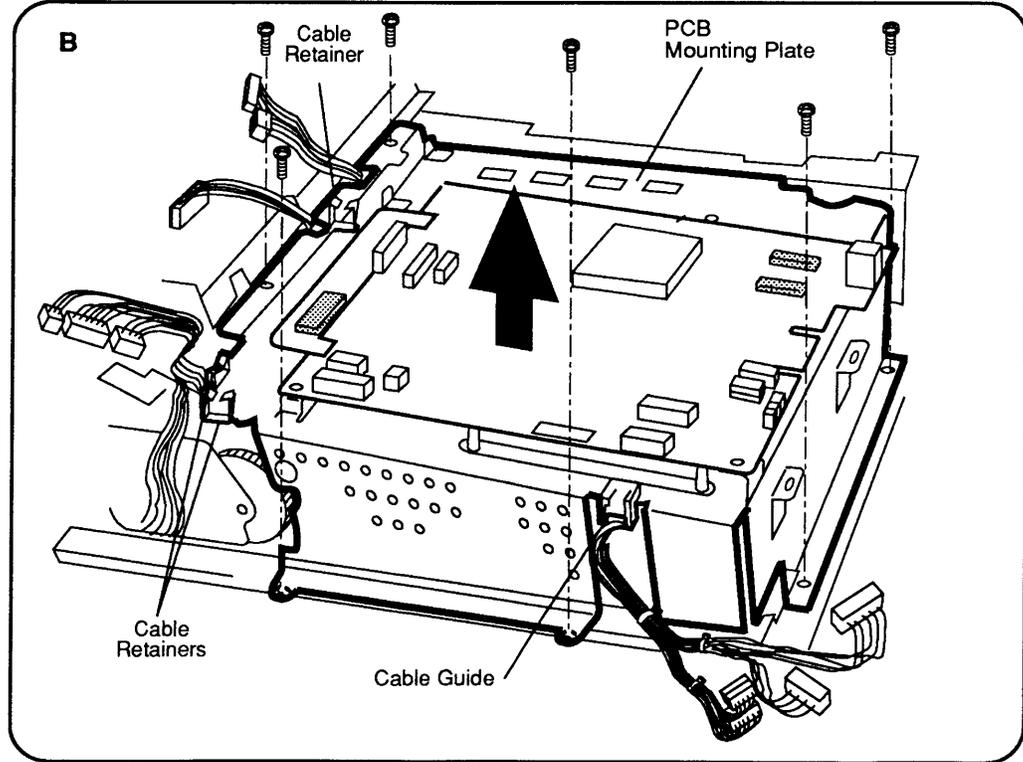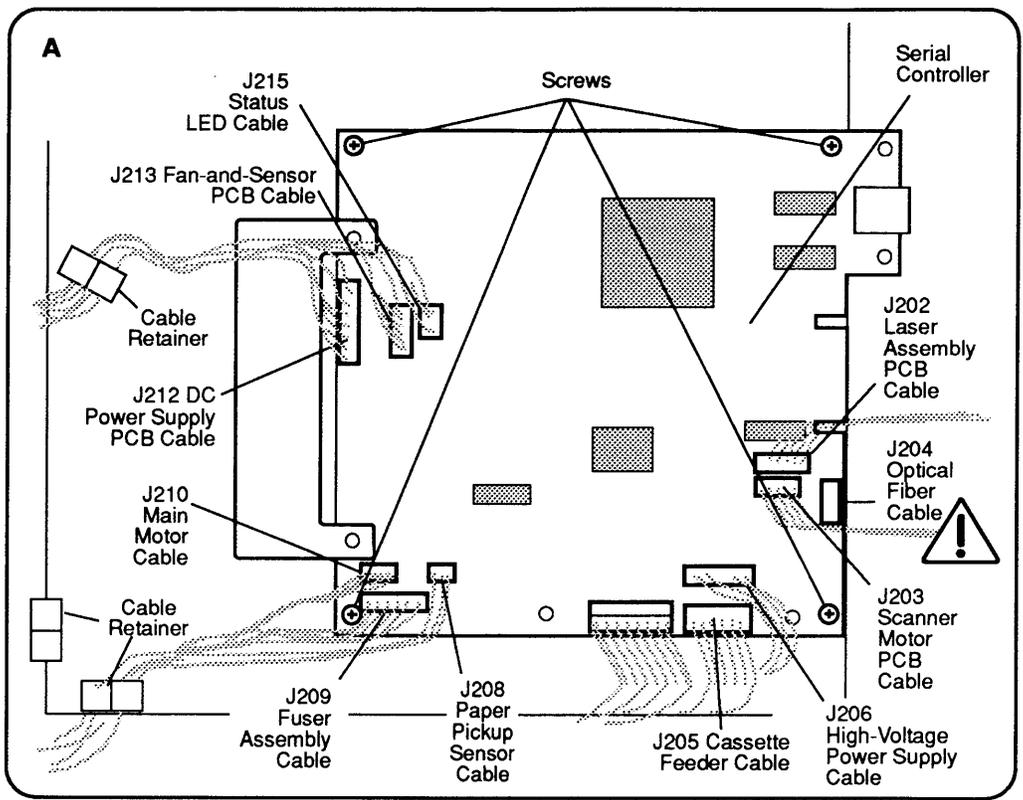
Figure 2-32 PCB Mounting Plate (LaserWriter LS/L)

❏ PCB MOUNTING PLATE (LASERWRITER LS/L)

Remove

1. Remove the top cover and the PCB shield.

2. Disconnect the following connectors from the serial controller **(Figure 2-32A)**:

   • J202, laser assembly PCB cable

   • J203, scanner motor PCB cable

WARNING: *Do not disconnect J204, the optical fiber cable, from the serial controller when the printer is powered on. The reflected laser beam, though invisible, can damage your eyes.*

   • J204, optical fiber cable

   • J205, cassette feeder PCB cable

   • J206, high-voltage power supply cable

   • J208, paper pickup sensor cable

   • J209, fuser assembly cable

   • J210, main motor cable

   • J212, DC power supply PCB cable

   • J213, fan-and-sensor PCB cable

   • J215, status light cable

3. Remove the connector cables from the black cable retainer near J212 **(Figure 2-32A)**.

4. Remove the six screws that secure the PCB mounting plate to the printer chassis **(Figure 2-32A)**.

5. Lift the PCB mounting plate off the printer **(Figure 2-32B)**.

A

Cable Retainer

PCB Mounting Plate

Cable Retainer

Cable Guide

B

J215 Status LED Cable

Screws

Serial Controller

J213 Fan-and-Sensor PCB Cable

Cable Retainer

J212 DC Power Supply PCB Cable

J210 Main Motor Cable

Cable Retainer

J209 Fuser Assembly Cable

J208 Paper Pickup Sensor Cable

J205 Cassette Feeder Cable

J206 High-Voltage Power Supply Cable

J203 Scanner Motor PCB Cable

J204 Optical Fiber Cable

J202 Laser Assembly PCB Cable

Figure 2-33 PCB Mounting Plate (LaserWriter LS/L)

Apr 92

Replace

1. Place the PCB mounting plate into position on the printer chassis. Align the screw holes on the plate with the screw holes on the chassis **(Figure 2-33A)**.

2. Replace the six screws that secure the PCB mounting plate to the printer chassis.

3. Reconnect the following connectors to the serial controller **(Figure 2-33B)**:

   • J202, laser assembly PCB cable

   • J203, scanner motor PCB cable

   • J204, optical fiber cable

   • J205, cassette feeder PCB cable

   • J206, high-voltage power supply cable

   • J208, paper pickup sensor cable

   • J209, fuser assembly cable

   • J210, main motor cable

   • J212, DC power supply PCB cable

   • J213, fan-and-sensor PCB cable

   • J215, status light cable

4. Replace the connector cables inside the black cable retainer near J212 **(Figure 2-33B)**.

5. Replace the PCB shield and the top cover.
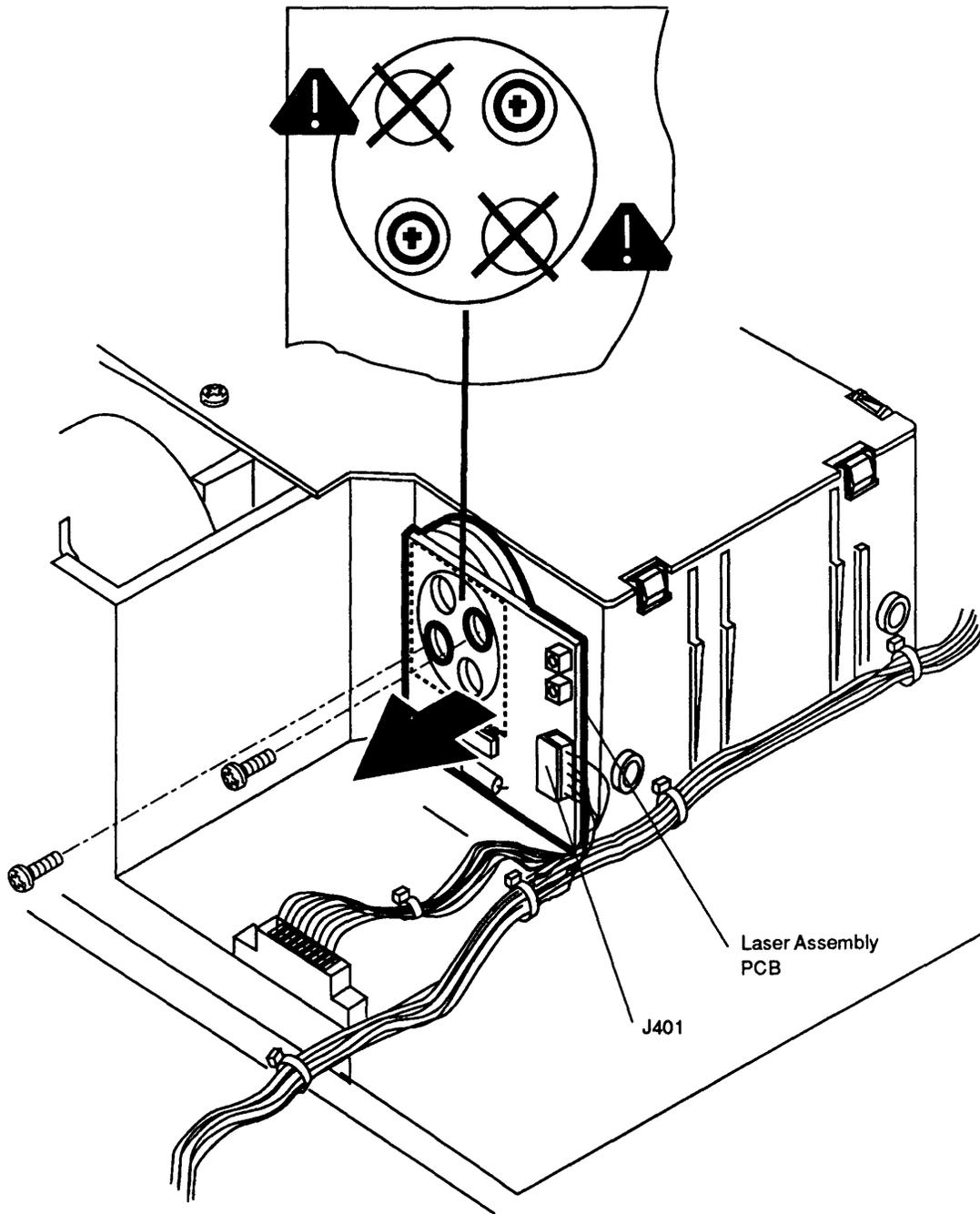
Figure 2-34 Laser Assembly

Laser Assembly
PCB

J401

❑ LASER ASSEMBLY

Remove

1. On the LaserWriter NT, SC, LS, and NTR, <u>remove the top cover, the I/O board, the I/O shield, the end plate</u>, and <u>the DC controller PCB mounting plate</u>.

2. On the LaserWriter LS/L, <u>remove the top cover, the PCB shield</u>, and <u>the PCB mounting plate</u>.

3. Disconnect connector J401 from the laser assembly PCB **(Figure 2-34)**.

4. Remove the two recessed screws (one is at one o'clock and the other is at eight o'clock) that secure the laser assembly PCB to the printer chassis **(Figure 2-34)**.

CAUTION: *Never loosen the two black screws at eleven o'clock and at five o'clock! If these screws are removed or loosened, the laser assembly loses alignment and you must replace it.*

---

5. Lift the laser assembly out of the printer.

Replace

1. Place the laser assembly into position inside the printer.

2. Replace the two laser assembly screws.

3. Reconnect connector J401 to the laser assembly PCB.

4. On the LaserWriter LS/L, <u>replace the PCB mounting plate, the PCB shield</u>, and <u>the top cover</u>.

5. On the LaserWriter NT, SC, LS, and NTR, <u>replace the DC controller PCB mounting plate, the end plate, the I/O shield, the I/O board</u>, and <u>the top cover</u>.

A

Scanner Assembly
Cover

Cover
Clamps

B

Beam
Detect
Mirror
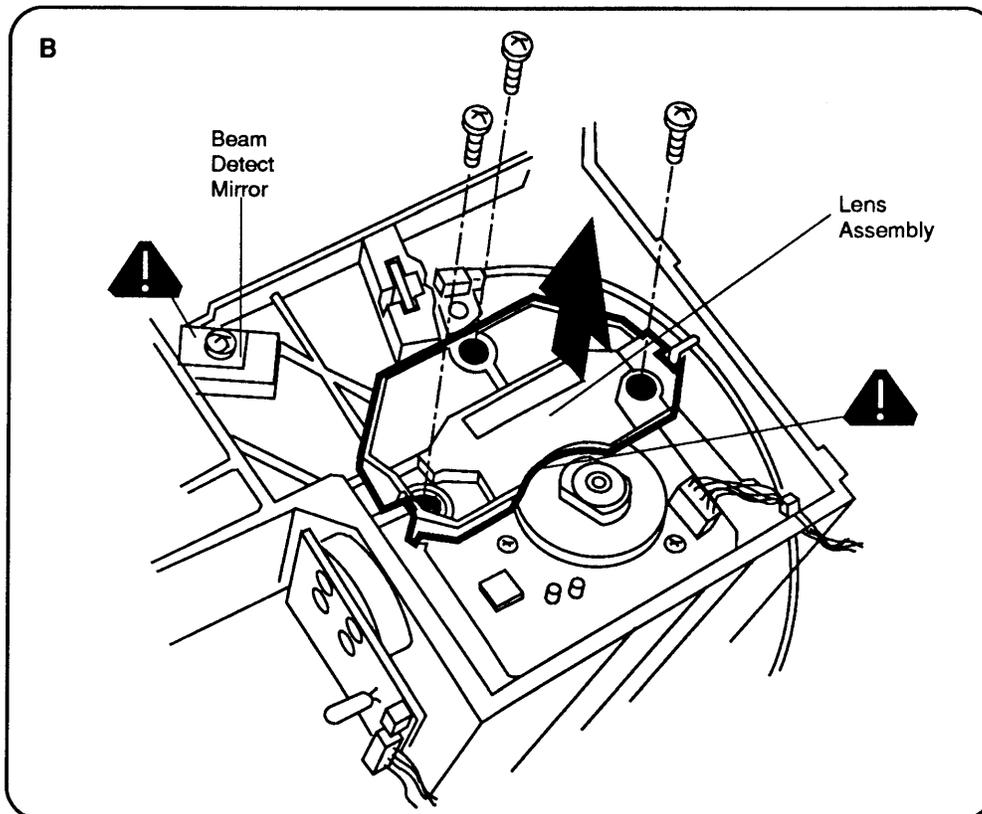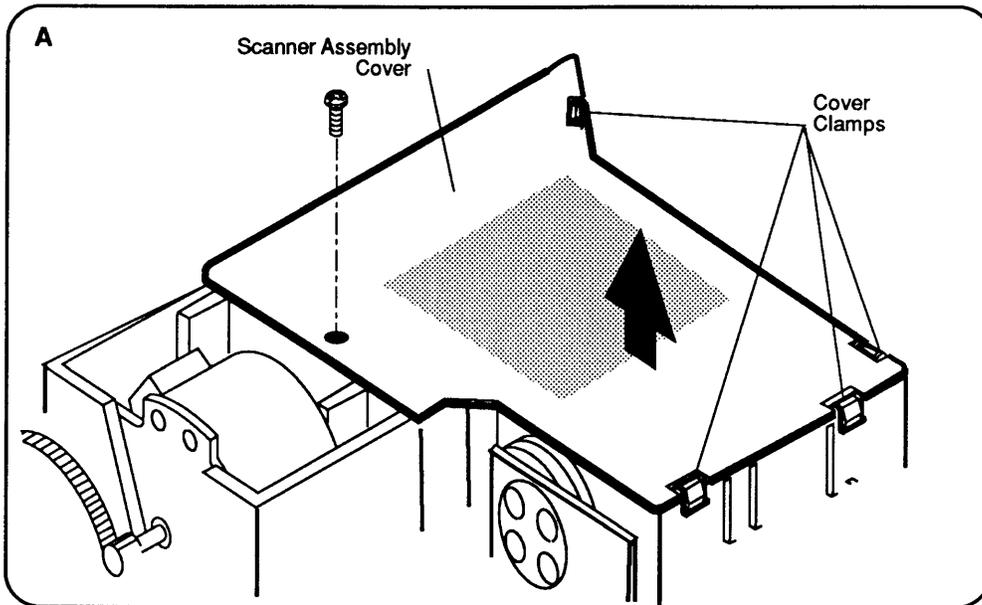
Lens
Assembly

Figure 2-35 Lens Assembly

❏ LENS ASSEMBLY

Remove

1. On the LaserWriter NT, SC, LS, and NTR, remove the top cover, the I/O board, the I/O shield, the end plate, and the DC controller PCB mounting plate.

2. On the LaserWriter LS/L, remove the top cover, the PCB shield, and the PCB mounting plate.

3. Remove the large silver-colored screw holding the scanner assembly cover in place **(Figure 2-35A)**.

4. Unclamp the four cover clamps and lift the scanner assembly cover out of the printer **(Figure 2-35A)**.

5. Locate the lens assembly and remove the three black screws holding the lens assembly to the printer chassis **(Figure 2-35B)**. Lift the lens assembly out of the printer **(Figure 2-35B)**.

Replace

1. **Carefully** lower the lens assembly into position inside the scanner assembly case and replace the three black screws.

2. Replace the scanner assembly cover, secure the four cover clamps, and replace the large silver-colored scanner cover screw.

3. On the LaserWriter LS/L, replace the PCB mounting plate, the PCB shield, and the top cover.

4. On the LaserWriter NT, SC, LS, and NTR, replace the DC controller PCB mounting plate, the end plate, the I/O shield, the I/O board, and the top cover.

Scanner
Assembly

Beam Detect Mirror

J301
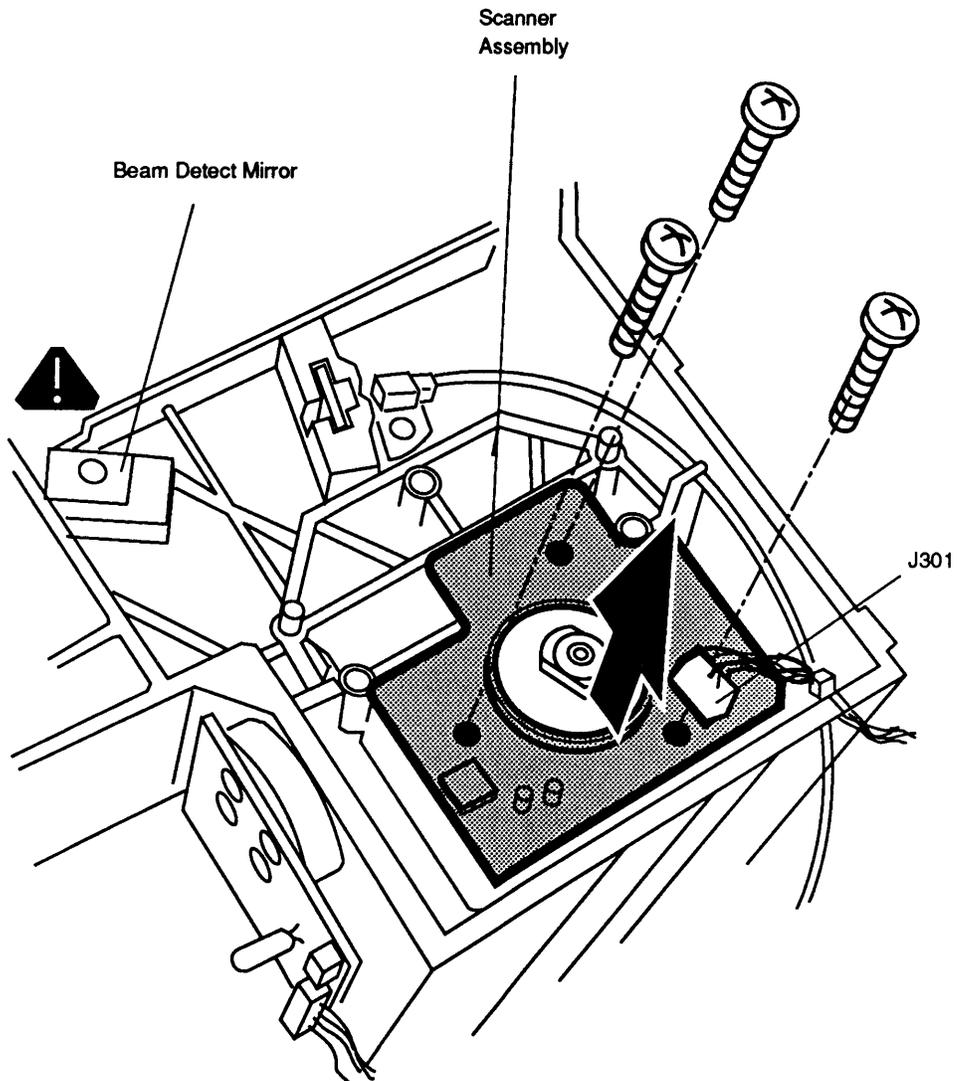
Figure 2-36 Scanner Assembly

❏ SCANNER ASSEMBLY

> **WARNING:** *Always replace the protective scanner assembly cover before you switch on the printer. The reflected laser beam can damage your eyes.*

Remove

1. On the LaserWriter NT, SC, LS, and NTR, remove the top cover, I/O board, I/O shield, end plate, DC controller PCB mounting plate, and lens assembly.

2. On the LaserWriter LS/L, remove the top cover, PCB shield, PCB mounting plate, and lens assembly.

3. Disconnect connector J301 from the scanner assembly PCB **(Figure 2-36)**.

4. Remove the three long black screws that secure the scanner assembly to the printer chassis **(Figure 2-36)**. Carefully lift the scanner assembly out of the printer **(Figure 2-36)**.

> **CAUTION:** *Do not touch the scanner assembly mirror! If you touch the mirror or it becomes dirty, you must replace the scanner assembly.*

> **CAUTION:** *Do not loosen the beam detect mirror screw! The beam detect mirror requires factory alignment. If the screw is loose, you must replace the whole printer.*

Replace

1. **Carefully** lower the scanner assembly into position inside the scanner assembly case, and replace the three long black scanner assembly screws.

2. Reconnect connector J301 to the scanner assembly PCB.

3. On the LaserWriter LS/L, replace the lens assembly, PCB mounting plate, PCB shield, and top cover.

4. On the LaserWriter NT, SC, LS, and NTR, replace the lens assembly, DC controller PCB mounting plate, end plate, I/O shield, I/O board, and top cover.

Cable
Retainer
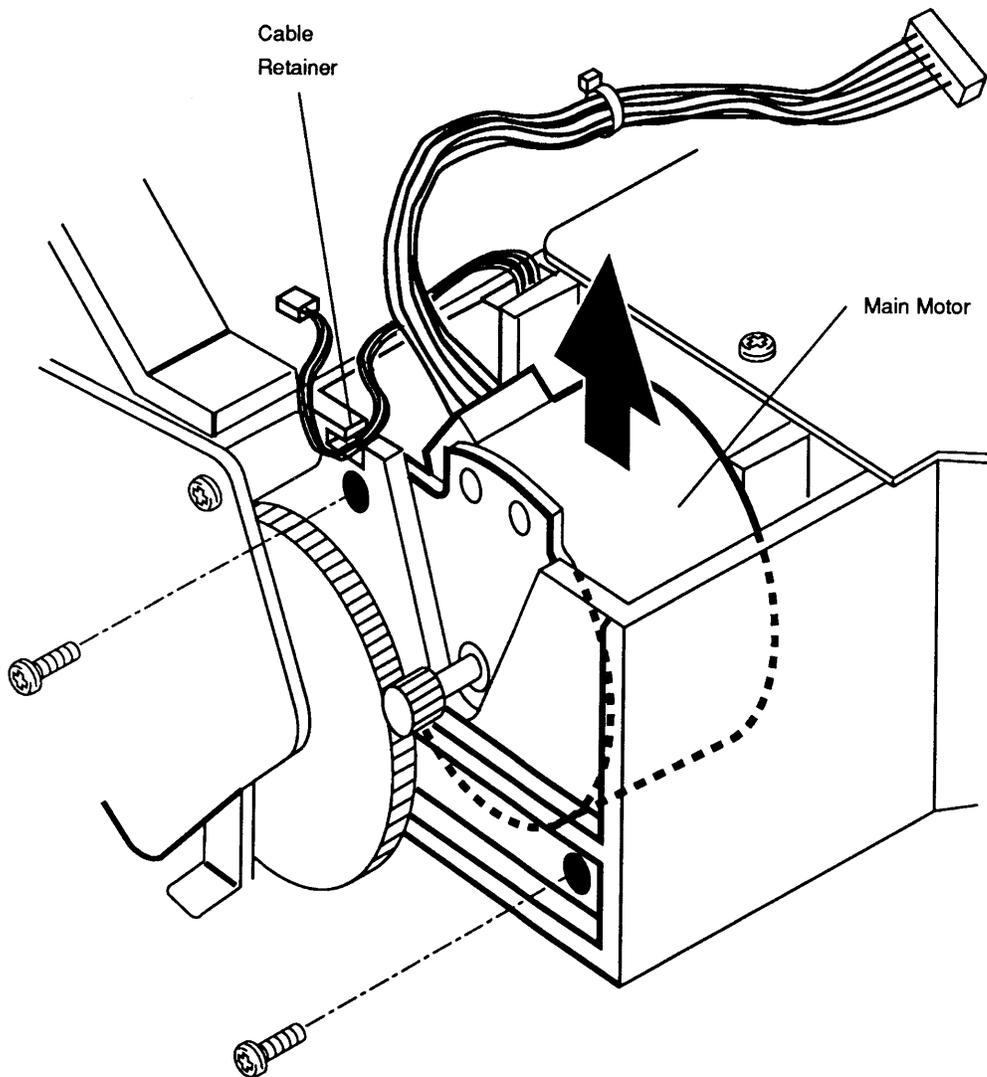
Main Motor

Figure 2-37 Main Motor

❏ MAIN MOTOR

Remove

1. On the LaserWriter NT, SC, LS, and NTR, remove the top cover, the I/O board, the I/O shield, the end plate, and the DC controller PCB mounting plate.

2. On the LaserWriter LS/L, remove the top cover, the PCB shield, and the PCB mounting plate.

3. Locate the main motor and remove the two silver-colored screws that secure the main motor to the printer chassis **(Figure 2-37)**.

4. Remove the wires from the cable retainer.

5. To remove the main motor from the printer, lift the motor straight up **(Figure 2-37)**.

Replace

1. Lower the main motor into its chamber on the printer chassis.

2. Replace the two silver-colored main motor screws.

3. Install the wires in the cable retainer.

4. On the LaserWriter LS/L, replace the PCB mounting plate, the PCB shield, and the top cover.

5. On the LaserWriter NT, SC, LS, and NTR, replace the DC controller PCB mounting plate, the end plate, the I/O shield, the I/O board, and the top cover.

Cable Clamp

Drive
Assembly

Gear Tooth

Black Cable Retainer Pin

Grounding Cable
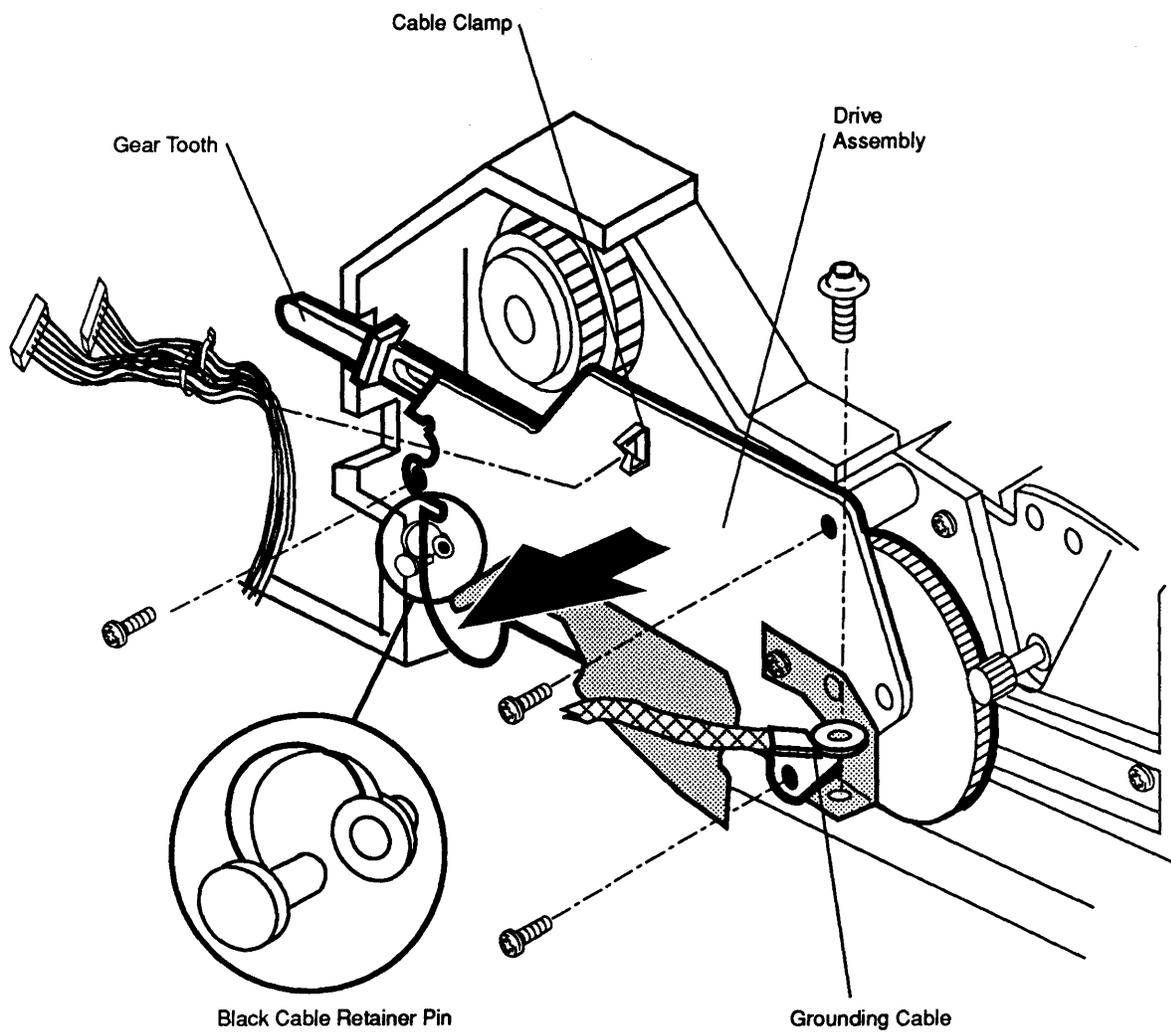
Figure 2-38 Drive Assembly

❏ DRIVE ASSEMBLY

Remove

1. Remove the cassette feeder tray (or bottom case if there is no cassette feeder tray) and the top cover.

2. Open the front access door and locate the drive assembly on the right side of the printer.

3. Using needlenose pliers, pull out the black cable retainer pin that holds the connector cables to the drive assembly **(Figure 2-38)**.

4. Remove the silver-colored screw that secures the silver-colored grounding cable to the printer chassis **(Figure 2-38)**.

5. Remove all cables from the cable clamp located on the side of the drive assembly **(Figure 2-38)**.

6. Remove the three silver-colored screws that hold the drive assembly in place, and remove the drive assembly **(Figure 2-38)**.

Replace

1. Place the drive assembly into position on the right side of the printer.

2. Push the drive assembly in toward the printer until the green gear tooth snaps into place on the white gear.

3. Replace the three drive assembly screws.

CAUTION: *Be careful not to overtighten the screws!*

---

4. Replace the single screw that secures the silver-colored grounding cable to the printer chassis.

5. Gather the connector cables into the black plastic cable clamp and replace the black cable retainer pin.

6. Place the connector cables into the cable clamp located on the side of the drive assembly.

7. Replace the top cover.

8. Replace the cassette feeder tray (or bottom case if there is no cassette feeder tray).

Drum Drive
Assembly
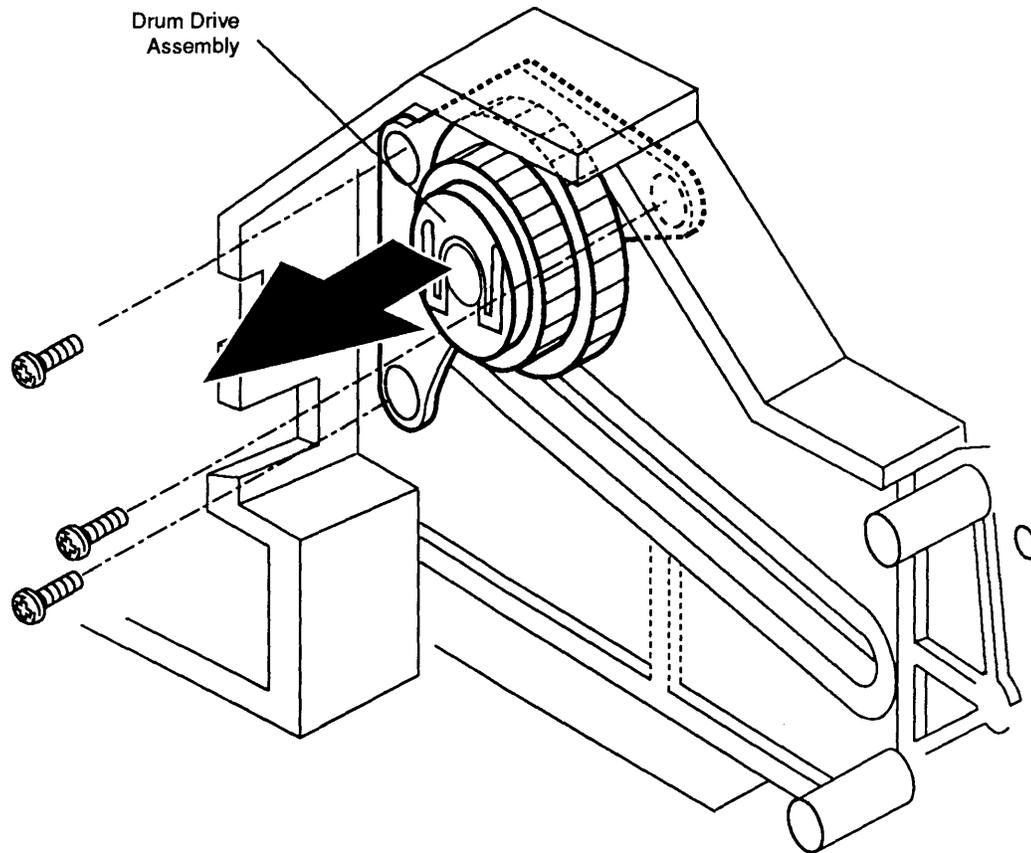
Figure 2-39 Drum Drive Assembly

❏ DRUM DRIVE ASSEMBLY

Remove

1. Remove the cassette feeder tray (or bottom case if there is no cassette feeder tray) and the top cover.

2. Remove the drive assembly.

3. Remove the three silver-colored screws that secure the drum drive assembly to the printer chassis **(Figure 2-39)**.

4. Remove the drum drive assembly from the printer **(Figure 2-39)**.

Replace

1. Slide the black drive gear through the opening on the right side of the printer chassis. Align the screw holes on the drum drive assembly with the screw holes on the printer chassis.

2. Replace the three drum drive assembly screws.

CAUTION: *Be careful not to overtighten the screws!*

3. Replace the drive assembly.

4. Replace the top cover and the cassette feeder tray (or bottom case if there is no cassette feeder tray).

A

Paper Pickup Sensor Access Panel

Gear

Feeder Assembly

Separation Pad

B

Paper Pickup Sensor Access Panel

Paper Pickup Sensor Latch

Right Roller Feeder Assembly

C

Paper Pickup Sensor Connector

D

E

Right Side

Bushing

Gear

F
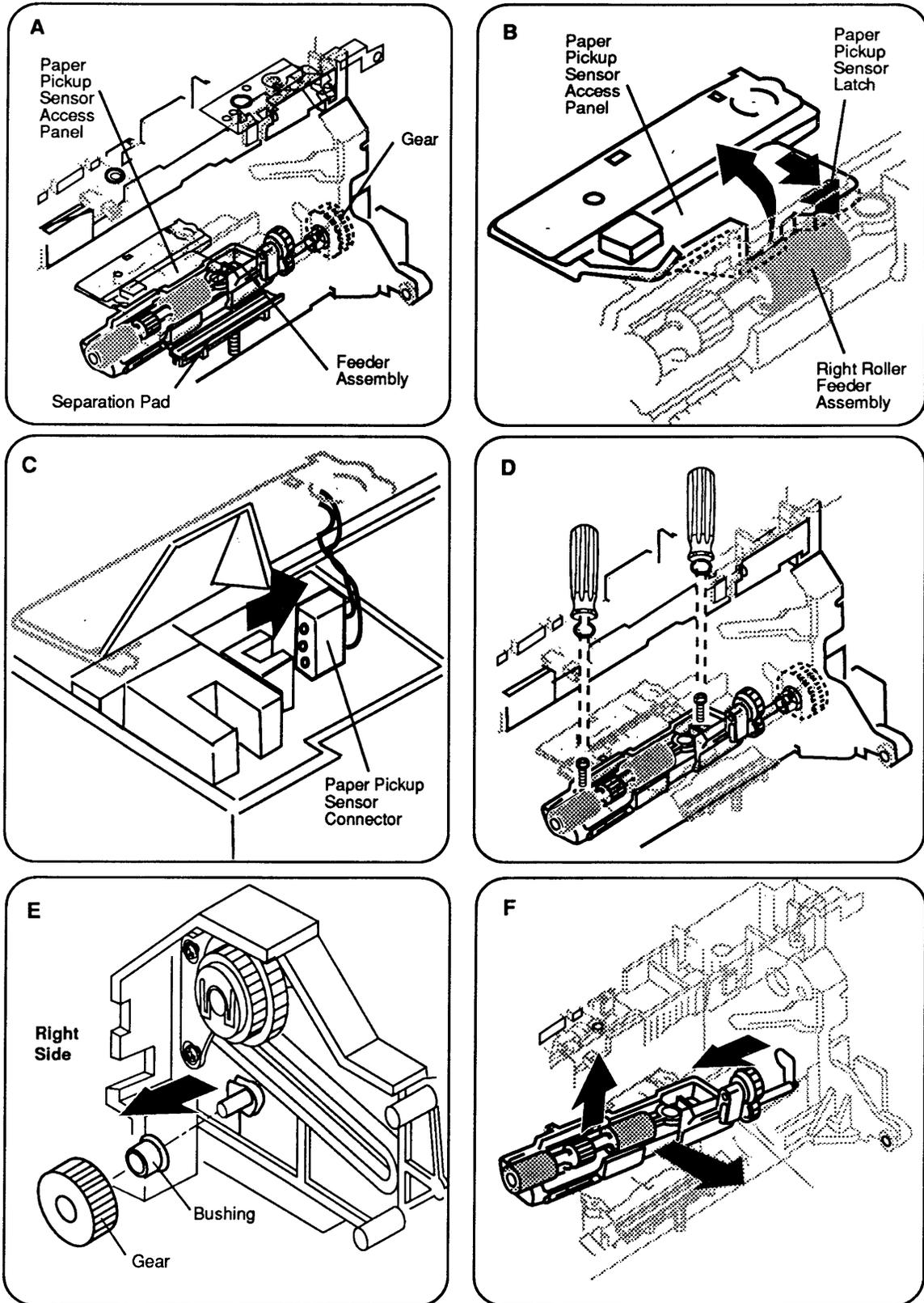
Figure 2-40 Feeder Assembly

❏ FEEDER ASSEMBLY

Remove

1. Remove the cassette feeder tray (or bottom case if there is no cassette feeder tray), the top cover, and the drive assembly.

2. Open the front access door.

3. Locate the access panel of the paper pickup sensor. The panel is behind the right roller of the feeder assembly and has a **very small**, hidden latch directly behind the right roller. You cannot see the latch, but you can feel it with your finger **(Figure 2-40A and B)**.

4. Pull the latch forward with your finger, lift up on the access panel, and expose the paper pickup sensor connector **(Figure 2-40B and C)**.

5. Disconnect the paper pickup sensor connector.

6. Remove the two screws that secure the feeder assembly to the printer chassis **(Figure 2-40D)**.

7. Remove the white gear and black plastic bushing from the end of the feeder assembly shaft **(Figure 2-40E)**.

8. Remove the feeder assembly by lifting the assembly up and to the left **(Figure 2-40F)**.

Replace

1. Place the feeder assembly into position inside the printer, directly behind the separation pad.

2. Replace the two screws that fasten the feeder assembly to the printer chassis.

3. Reconnect the paper pickup sensor connector and close the paper pickup sensor access panel.

4. Replace the feeder assembly gear and bushing on the end of the feeder assembly shaft.

5. Replace the drive assembly, the top cover, and the cassette feeder tray (or bottom case if there is no cassette feeder tray).

A

Fan

Rod Assembly

Front Access Door

B
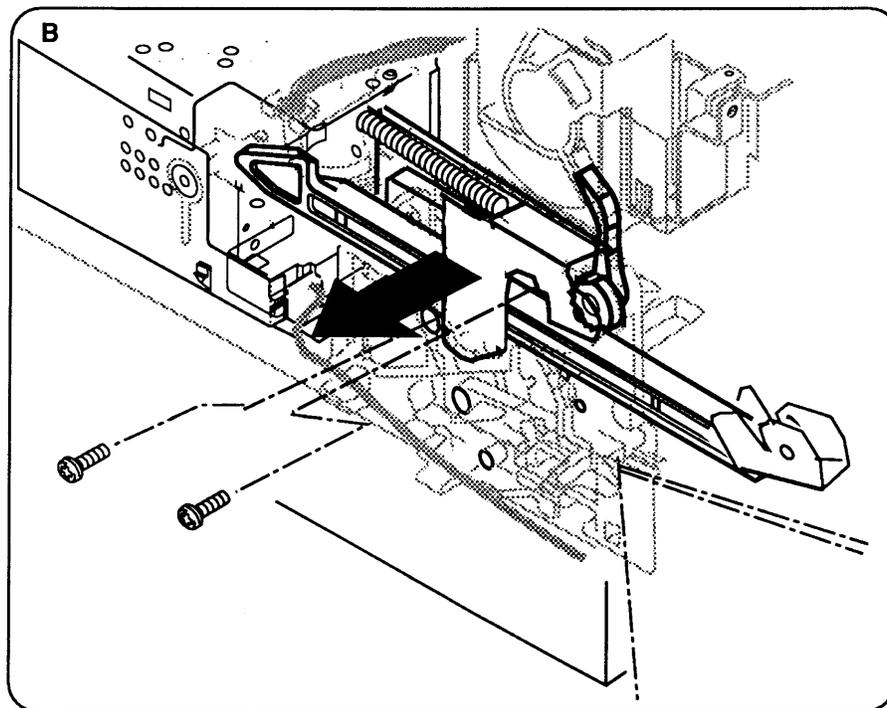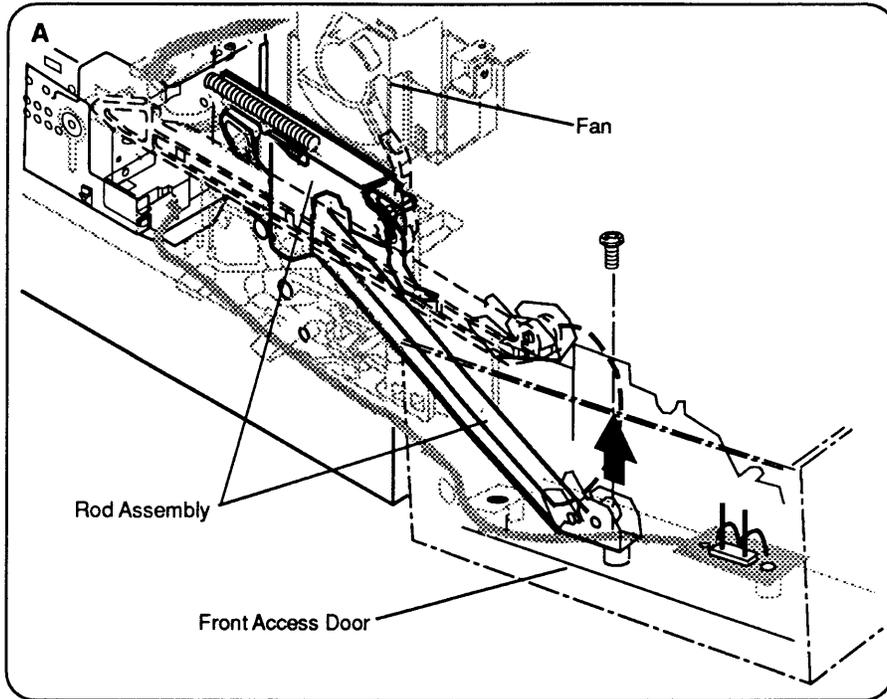
Figure 2-41 Rod Assembly

❑ ROD ASSEMBLY

Remove

1. <u>Remove the top cover</u>.

2. <u>Remove the fuser assembly</u>.

3. Locate the rod assembly on the left side of the printer, directly below the fan.

4. Remove the silver-colored screw that fastens the metal end of the rod assembly to the front access door **(Figure 2-41A)**.

5. Remove the two silver-colored screws that secure the rod assembly to the printer chassis. Lift the rod assembly out of the printer **(Figure 2-41B)**.

Replace

1. Place the rod assembly in position on the left side of the printer chassis.

2. Replace the two silver-colored screws that hold the rod assembly to the printer chassis.

3. Place the metal end of the rod assembly into position on the front access door. While holding the rod assembly in place with one hand, replace the silver-colored screw that fastens the metal end of the rod assembly to the front access door.

4. <u>Replace the fuser assembly</u>.

5. <u>Replace the top cover</u>.

High-Voltage Cable

J602 Connector

Cable Guide
for High-Voltage
Cable

Cable Guide
for High-Voltage
Cable (to Connector J101)

High-Voltage Contact Assembly
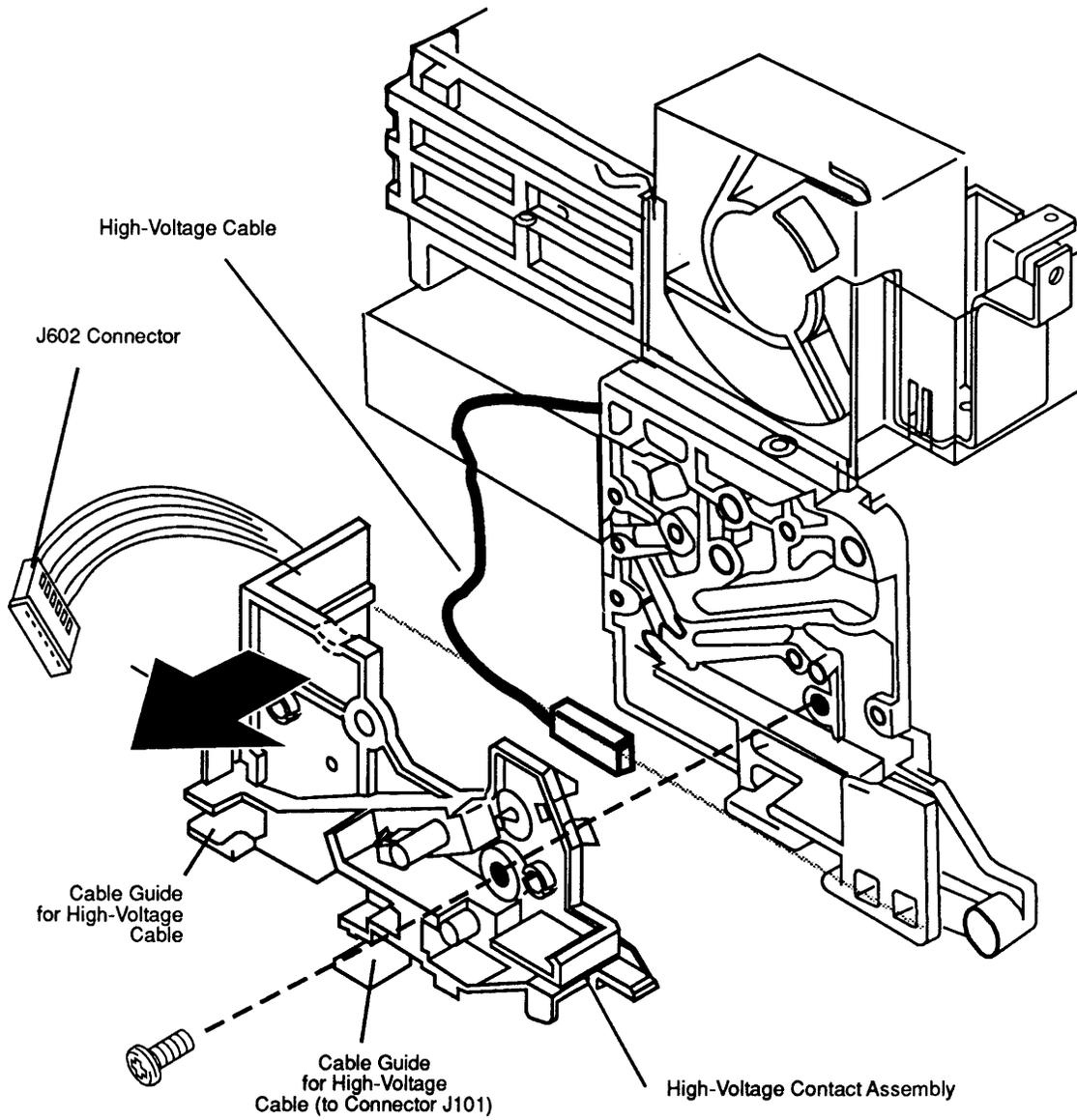
Figure 2-42 High-Voltage Contact Assembly

❏ HIGH-VOLTAGE CONTACT ASSEMBLY

Remove

1. On the LaserWriter NT, SC, NTR, and LS, remove the top cover, I/O board, I/O shield, end plate, power supply unit, fuser assembly, and rod assembly.

2. On the LaserWriter LS/L, remove the top cover, PCB shield, power supply unit, fuser assembly, and rod assembly.

3. Pull the plastic tray containing the high-voltage power supply from under the scanner assembly and disconnect connector J602 from the high-voltage power supply (**Figure 2-42**).

4. Disconnect the black, high-voltage cable connecting the high-voltage power supply to the high-voltage contact assembly (**Figure 2-42**).

5. Remove the silver-colored screw that fastens the high-voltage contact assembly to the printer chassis (**Figure 2-42**).

6. Remove the power supply cable (connector J101) from the cable guide on the high-voltage contact assembly. Lift the high-voltage contact assembly out of the printer (**Figure 2-42**).

Replace

1. Place the high-voltage contact assembly in position on the left side of the printer chassis.

2. Replace the silver-colored high-voltage contact assembly screw and reconnect J602 to the high-voltage power supply.

3. Slide the plastic tray containing the high-voltage power supply back under the scanner assembly and reconnect the black, high-voltage cable to the high-voltage contact assembly terminal.

4. Replace the power supply cable (connector J101) in the cable guide on the high-voltage contact assembly.

5. On the LaserWriter LS/L, replace the rod assembly, fuser assembly, power supply unit, PCB shield, and top cover.

6. On the LaserWriter NT, SC, NTR, and LS, <u>replace the rod assembly, fuser assembly, power supply unit, end plate, I/O shield, I/O board</u>, and <u>top cover</u>.

❑ SEPARATION PAD

Remove

1. Open the front access door. Place your thumb on the separation pad and grasp the clear plastic tab with your fingers **(Figure 2-43)**.

2. Press down firmly on the pad and pull the plastic tab straight up to remove the separation pad **(Figure 2-43)**.

Replace

1. Place the separation pad into position and make sure to align the grooves on each end of the pad with the tabs on the printer chassis.

2. Press straight down on the pad to secure it.
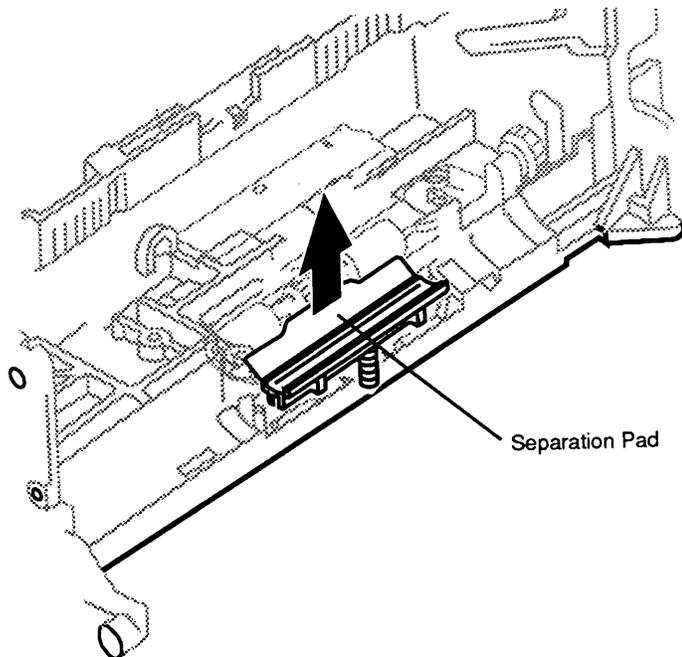
Separation Pad

Figure 2-43 Separation Pad

❏ MULTIPURPOSE TRAY ASSEMBLY

Remove

1. Pull out the multipurpose tray from the front access door **(Figure 2-44)**.

2. Place the heel of your hand at the center of the multipurpose tray and press straight down until the tray releases **(Figure 2-44)**.

   Note: Two latches attach the multipurpose tray to the front access door so you will feel resistance as you press down.

Replace

1. Position the guides on each side of the multipurpose tray beneath the posts on each side of the front access door.

2. Rotate the multipurpose tray up until the latches on each side are hooked onto the front access door.

3. Close the multipurpose tray.
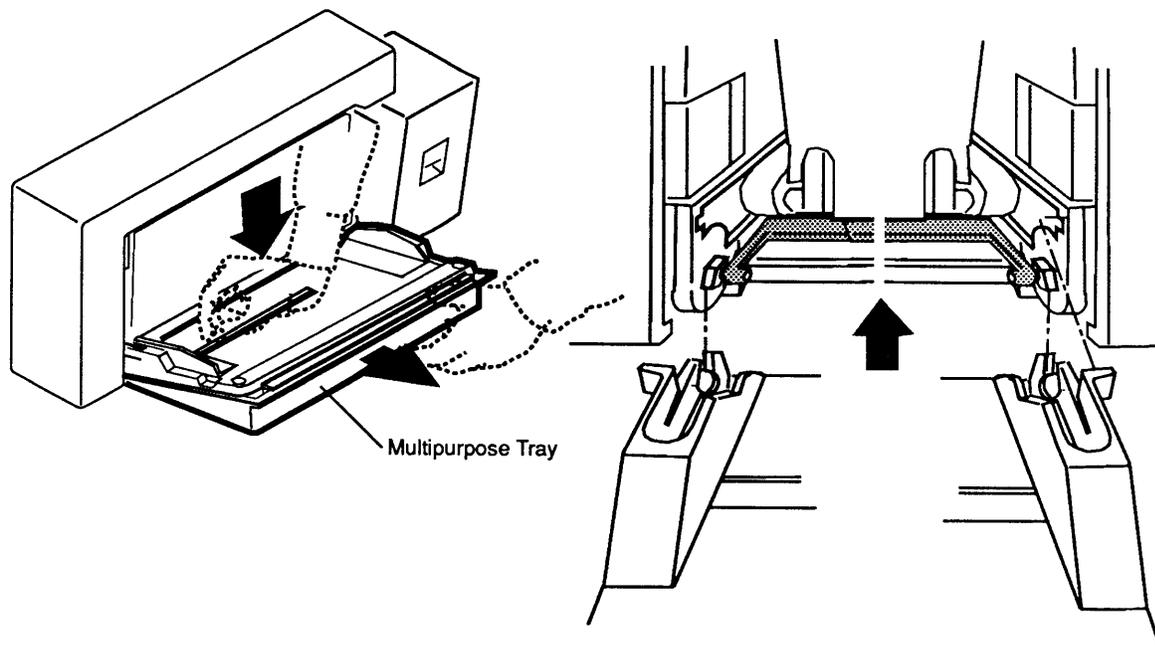
Multipurpose Tray

Figure 2-44 Multipurpose Tray Assembly

A

Multipurpose Tray

Press Green Latch

Face-Up Tray

B

Green Latch
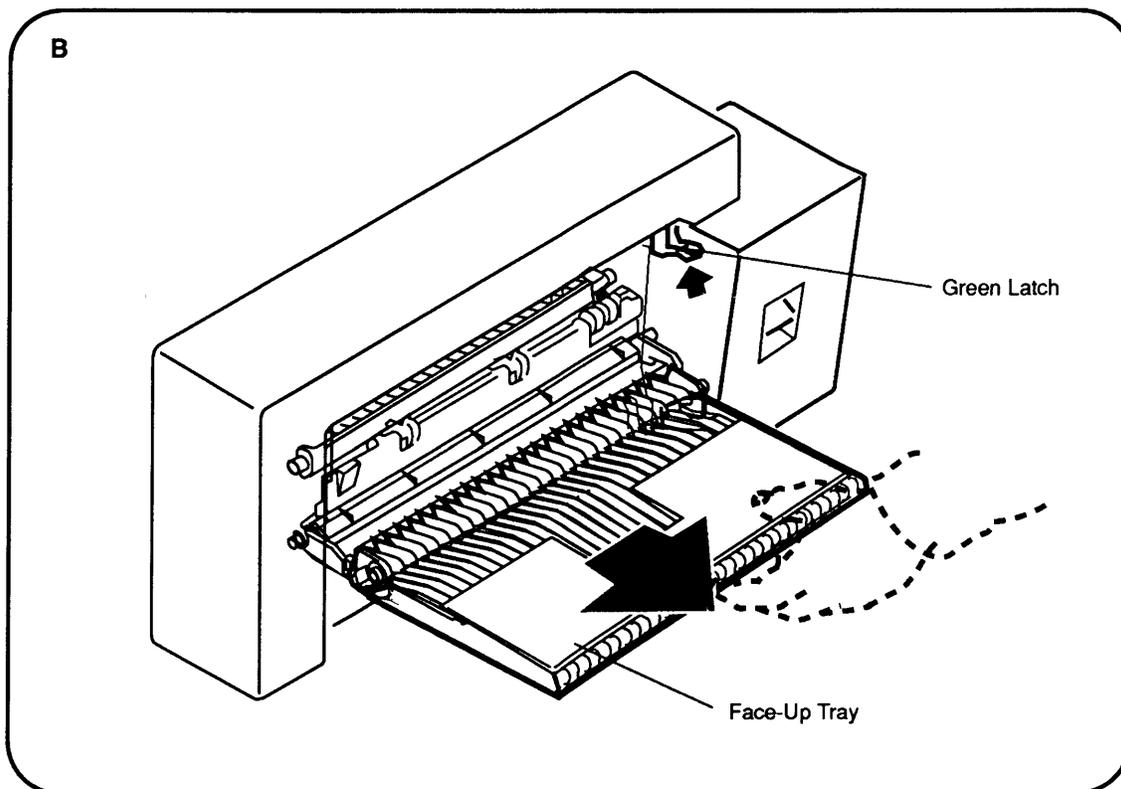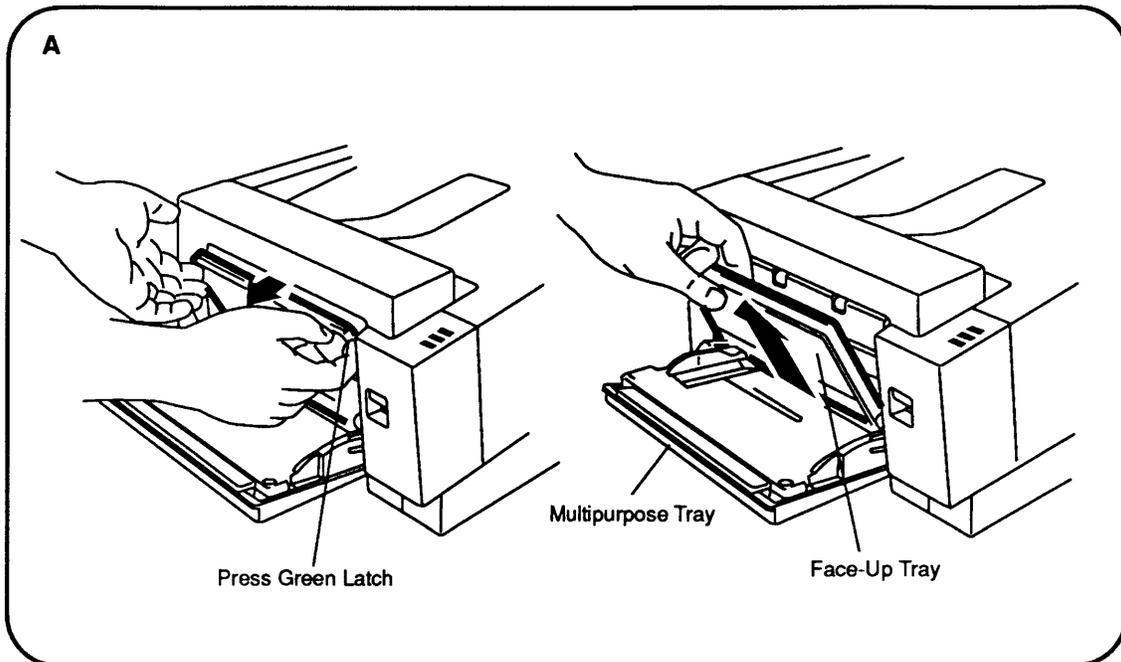
Face-Up Tray

Figure 2-45 Face-Up Tray Assembly

❏ FACE-UP TRAY ASSEMBLY

Remove

1. Lower the multipurpose tray from the front access door.

2. Press the green latch on the right side of the front access door to release the face-up tray **(Figure 2-45A)**.

3. To remove the face-up tray from the printer, grasp each side of the tray and pull straight out **(Figure 2-45B)**.

Replace

1. Grasp each side of the face-up tray and carefully slide the posts on each side of the tray into the grooves on the front access door.

2. Fold in the face-up tray and lift the tray up to lock it in place.

3. Close the multipurpose tray assembly.

A

Front Door Cover

Face Down
Delivery Assembly

Front Cover
Holding Tab

Front Cover
Holding Notch

B

Front Door
Underside

Front
Cover
Holding
Notch

Front Cover
Holding Tab
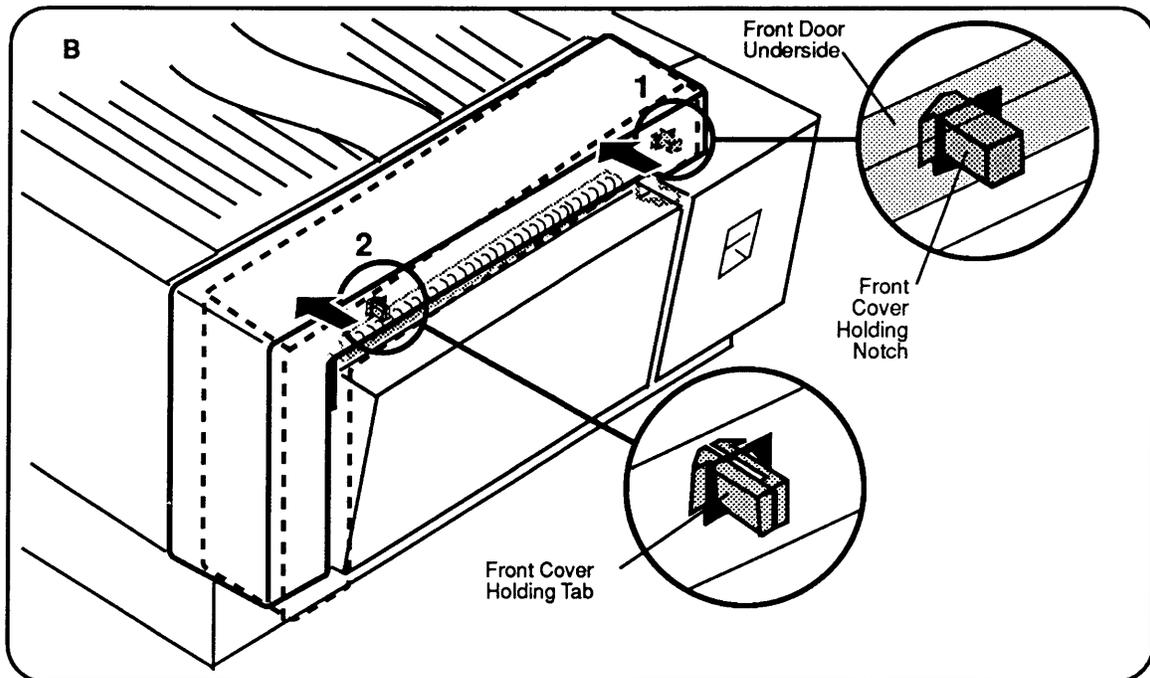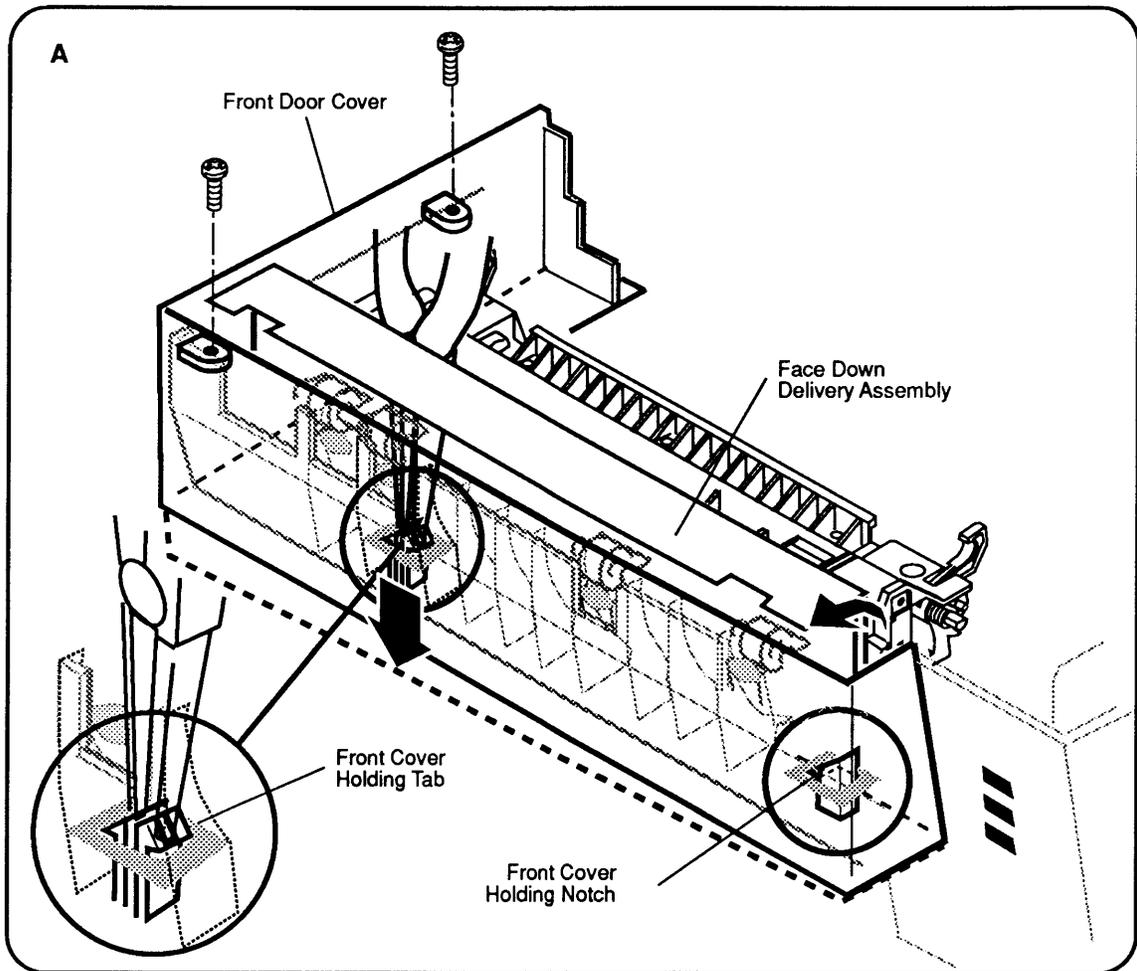
Figure 2-46 Front Cover

❏ FRONT COVER

Remove

1. Open the front access door.

2. Remove the two silver-colored screws that secure the front cover to the front access door **(Figure 2-46A)**.

3. Lift up on the face-down delivery assembly; locate the holding tab that holds the front cover in place **(Figure 2-46A)**.

4. With needlenose pliers, release the holding tab and lift off the cover **(Figure 2-46A)**.

Replace

1. Close the front access door and locate the right front cover notch **(Figure 2-46A)**.

2. Insert the tab on the right side of the front cover into the notch on the right side of the front access door **(Figure 2-46A and B)**.

3. Press the front cover up and to the left until the plastic holding tab snaps into place.

4. Open the front access door, and replace the two silver-colored screws that secure the front cover to the front access door.

❏ LED COVER

Remove

1. Remove the front cover.

2. Remove the two silver-colored screws that secure the LED cover to the front access door (**Figure 2-47**).

3. Lift the LED cover off the front access door and disconnect the LED cable from the LED holder (**Figure 2-47**).

Replace

1. Reconnect the LED cable to the LED holder.

2. Place the LED cover in position on the right front access door.

3. While holding the LED cover in place with one hand, replace the two silver-colored screws.

4. Replace the front cover.
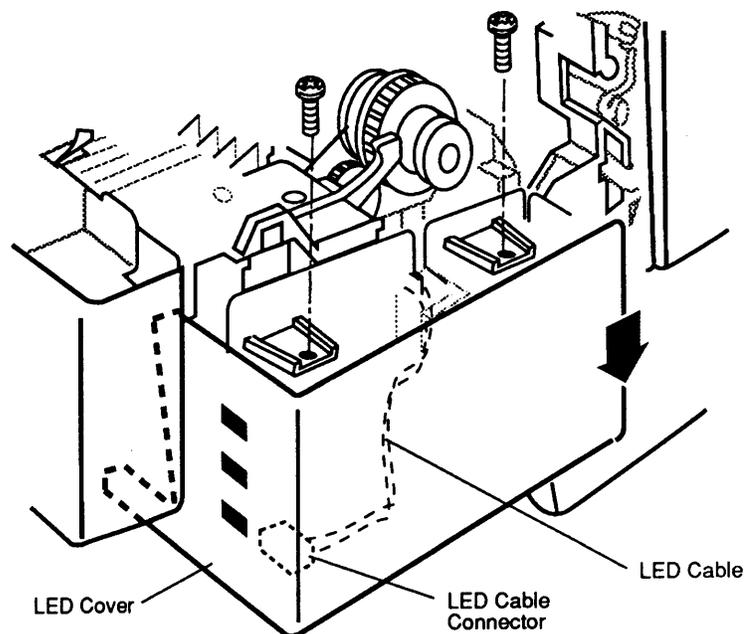
Figure 2-47 LED Cover

❏ TRANSFER GUIDE ASSEMBLY

Remove

1. Depress the release button and open the front access door.

2. Carefully grasp each end of the transfer guide assembly and lift it out of the printer **(Figure 2-48)**.

Replace

1. Place the transfer guide assembly into position next to the pickup roller. Make sure that the transfer guide grounding bracket encircles the transfer roller shaft.

2. Press down on the transfer guide assembly until it snaps into place.
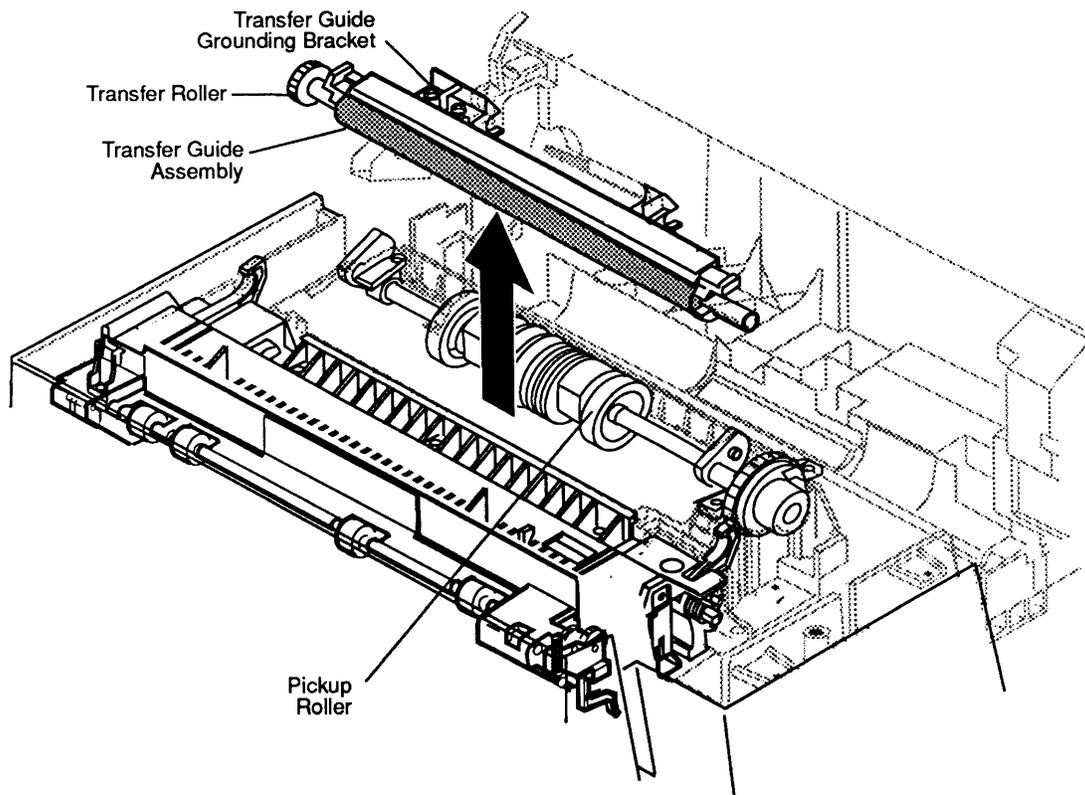
Figure 2-48 Transfer Guide Assembly

Transfer Guide
Grounding Bracket

Blue Gear

Transfer Guide Assembly
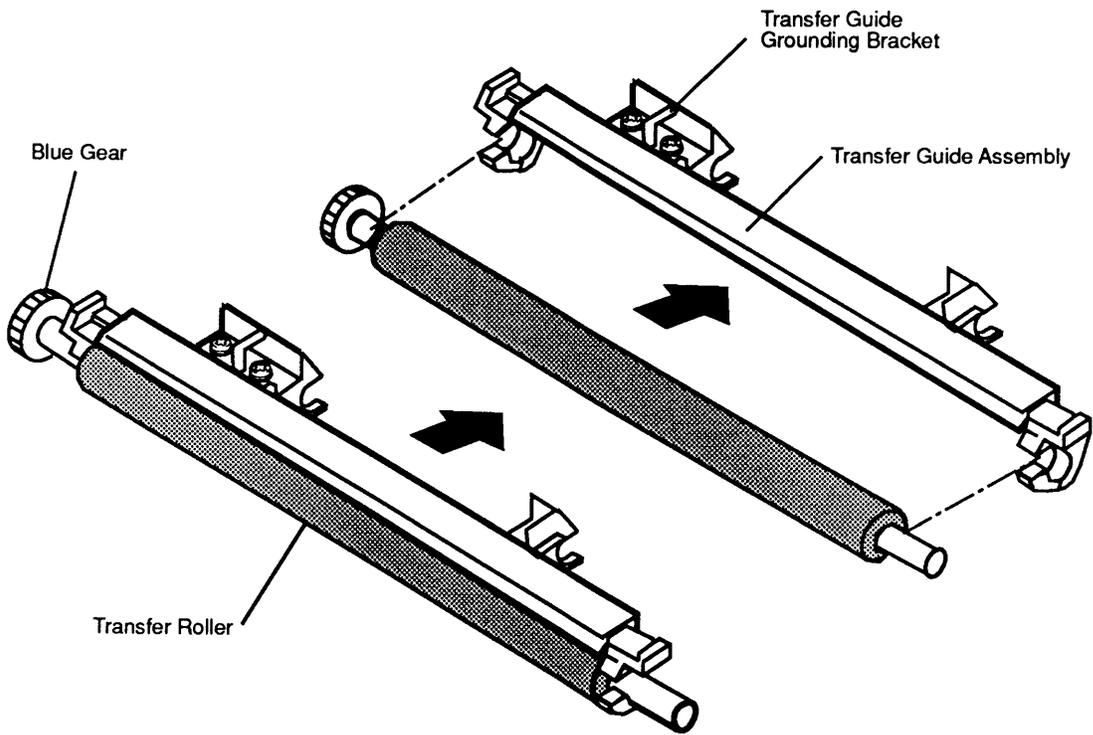
Transfer Roller

Figure 2-49 Transfer Roller

❏ TRANSFER ROLLER

Remove

1. <u>Remove the transfer guide assembly</u>.

2. Using your fingers or a small flat-blade screwdriver, release the transfer roller from the transfer guide assembly **(Figure 2-49)**.

3. Pull each end of the transfer roller shaft from the transfer guide assembly **(Figure 2-49)**.

Replace

1. Install the transfer roller inside the transfer guide assembly. Make sure the blue gear is on the same side of the transfer guide assembly as the transfer guide grounding bracket.

2. Snap the transfer roller into place.

3. <u>Replace the transfer guide assembly</u>.

Left
Transfer Roller
Mount
Assembly

Right
Transfer Roller
Mount
Assembly
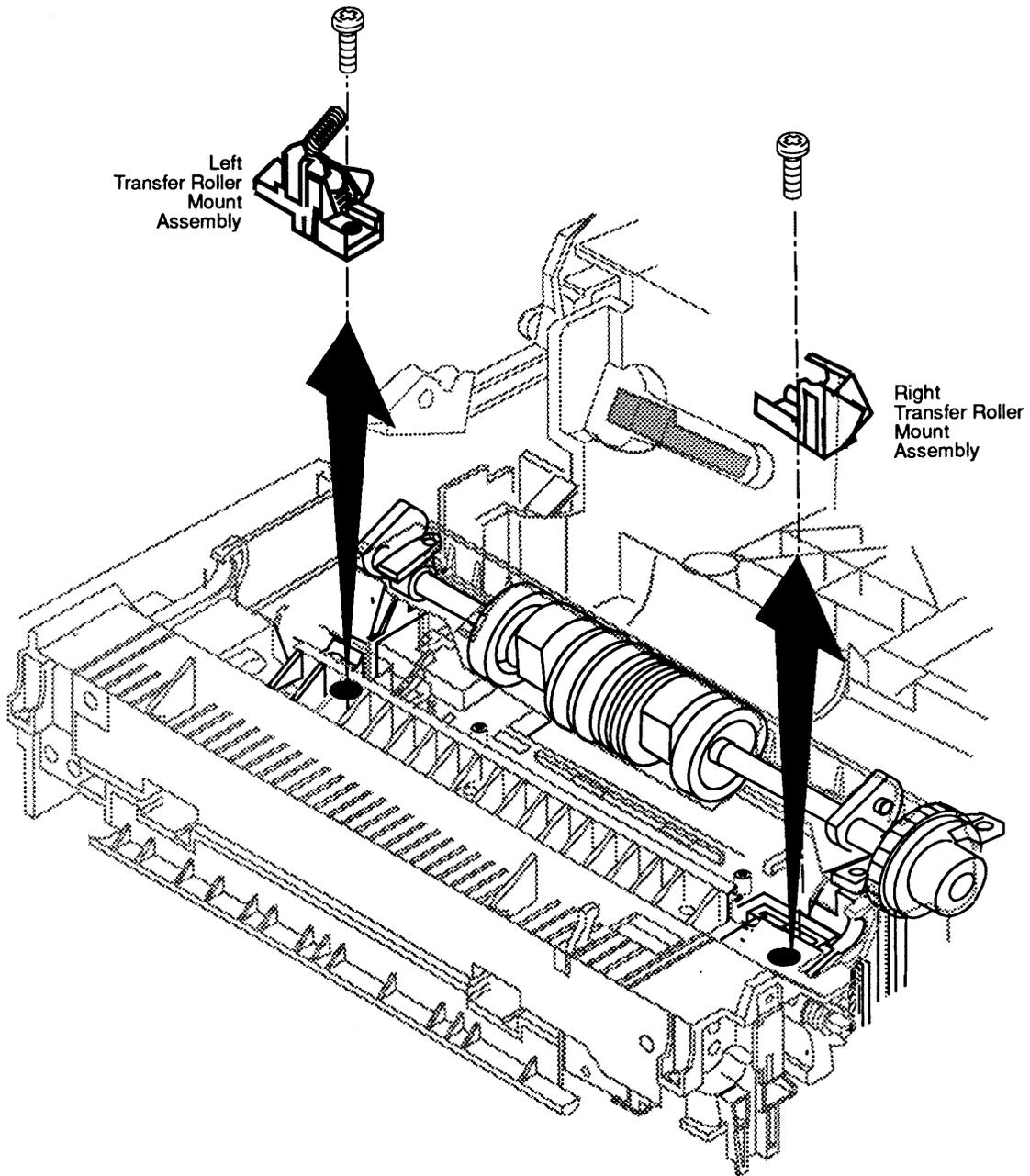
Figure 2-50 Left and Right Transfer Roller Mount Assemblies

❏ LEFT AND RIGHT TRANSFER ROLLER MOUNT ASSEMBLIES

Remove

1. Remove the transfer guide assembly.

2. Remove the single screw that secures the left transfer roller mount assembly to the front access door **(Figure 2-50)**.

3. Lift the left transfer roller mount assembly out of the printer **(Figure 2-50)**.

4. Remove the single screw that secures the right transfer roller mount assembly to the front access door **(Figure 2-50)**.

5. Lift the right transfer roller mount assembly out of the printer **(Figure 2-50)**.

Replace

1. Place the left transfer roller mount assembly into position.

2. Replace the silver-colored screw that holds the transfer roller mount assembly to the front access door.

3. Place the right transfer roller mount assembly into position.

4. Replace the silver-colored screw that holds the right transfer roller mount assembly to the front access door.

5. Replace the transfer guide assembly.

❏ PICKUP ROLLER ASSEMBLY

Remove

1. Remove the transfer guide assembly.

2. Remove the three black screws that hold the pickup roller assembly in place **(Figure 2-51)**.

3. Grasp each end of the roller shaft and lift the pickup roller out of the printer **(Figure 2-51)**.

Replace

1. Lower the pickup roller assembly into the printer. Align the screw holes on the pickup roller assembly with the screw holes on the front access door.

2. Replace the three black pickup roller assembly screws.

3. Replace the transfer guide assembly.

Pickup Roller Assembly
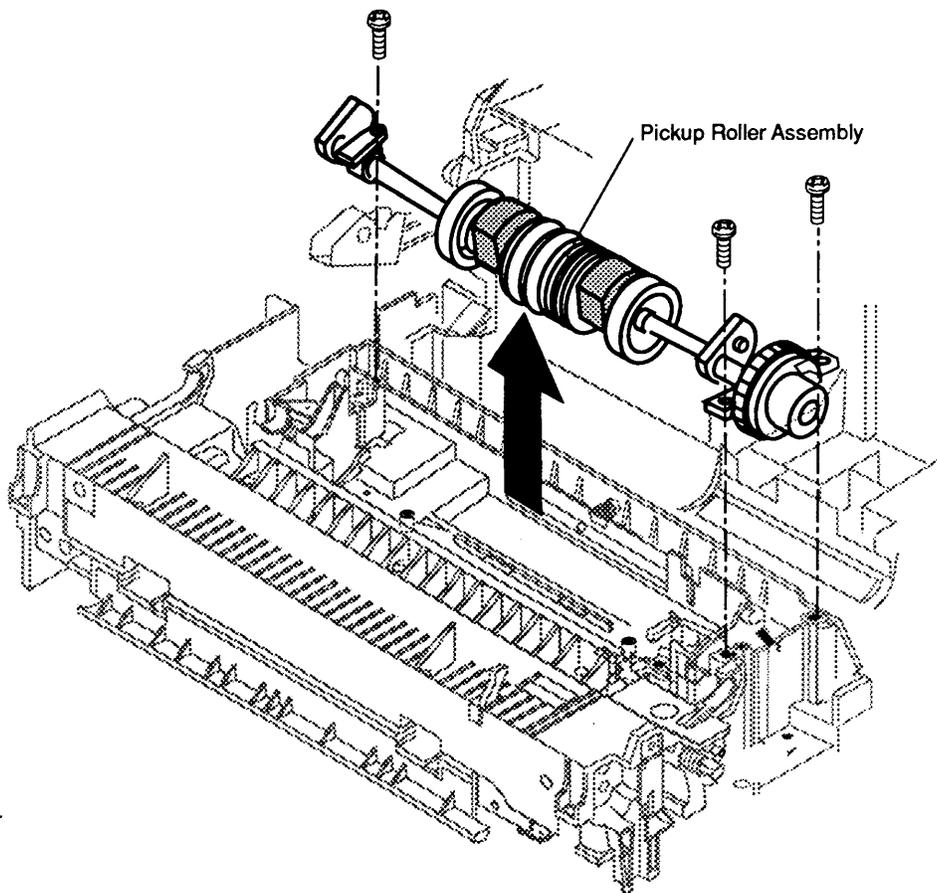
Figure 2-51 Pickup Roller Assembly

❏ FUSER ASSEMBLY

Remove

1. Open the front access door.

2. Remove the five gold-colored screws that secure the fuser assembly to the front access door **(Figure 2-52)**. (On the LaserWriter LS, you will need to lift up the face-down delivery assembly to reach the fifth screw.)

3. Lift the fuser assembly straight up and remove it from the printer **(Figure 2-52)**.

Replace

1. Hold the face-down delivery assembly open and lower the fuser assembly into position. Make sure that the connectors at each end of the fuser assembly mate with the connector pins inside the printer.

2. Replace the five fuser assembly screws.
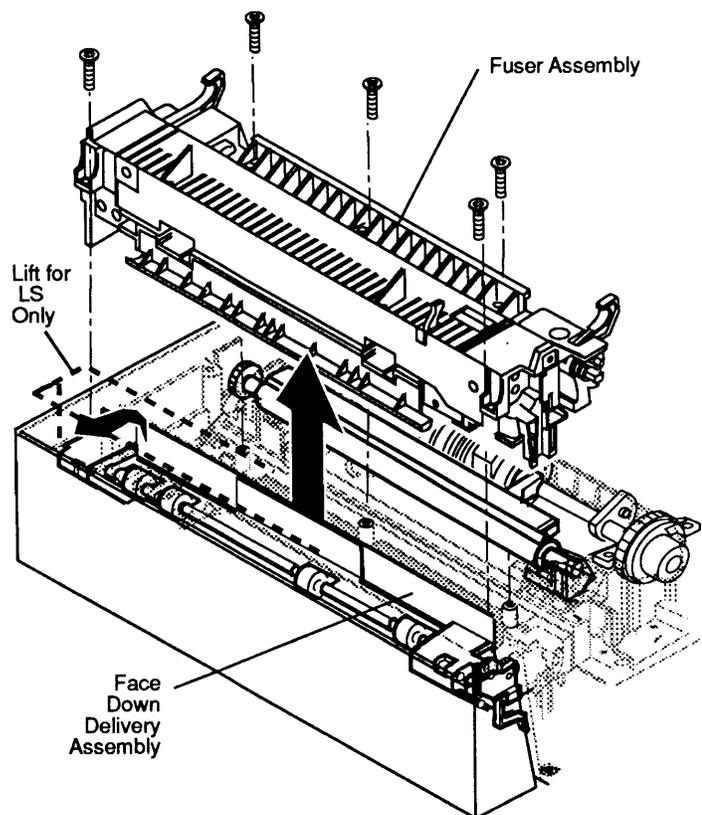
Figure 2-52 Fuser Assembly

A Door Release Button

(Right Side)

B Connector J501

(Left Side)

Connector Bracket Screws

C Connector Bracket Screw

Connector Bracket Screw

(Left Side)

D **(Left Side)**

Retaining Spring Screw

Heat Bulb Cable Screw

E Connector J501

(Left Side)

F Fuser Heater Bulb
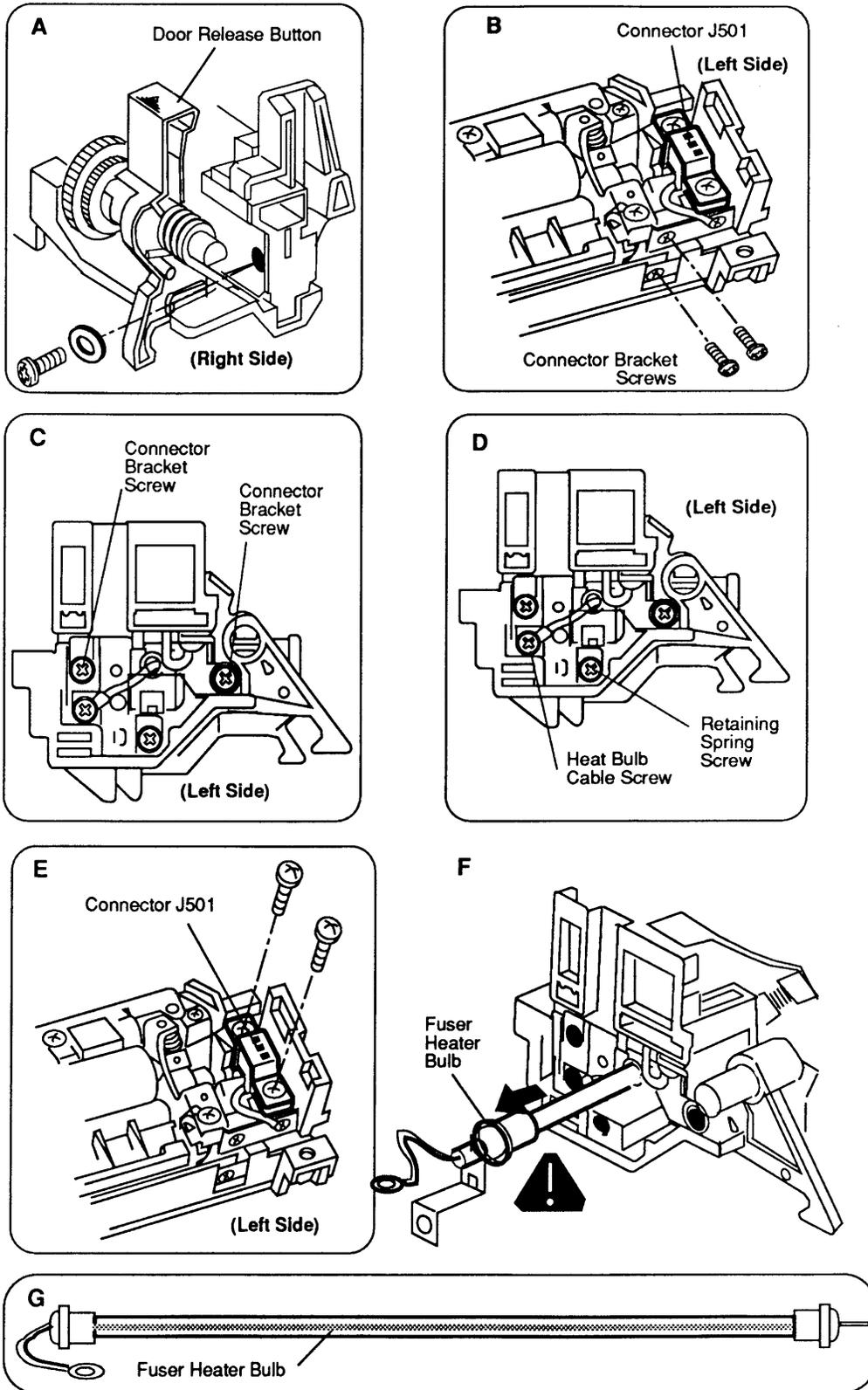
G Fuser Heater Bulb

Figure 2-53 Heater Bulb – Fuser Assembly

❏ HEATER BULB – FUSER ASSEMBLY

> **CAUTION:** Be careful not to touch the surface of the
> heater bulb when removing it from the fuser assembly.
> Oil from your fingers can cause the bulb to heat unevenly.
> If the bulb is accidentally touched, clean the bulb with
> isopropyl alcohol.

Remove

1. Remove the fuser assembly.

2. Remove the gold-colored screw and washer that secure the heater bulb to the right connector holder **(Figure 2-53A)**.

3. Remove the four gold-colored screws that secure the left connector bracket to the fuser assembly **(Figure 2-53B and C)**.

4. Remove the silver-colored screw and washer that secure the heater bulb cable to the left connector bracket **(Figure 2-53D)**.

5. Remove the small silver-colored screw that secures the heat bulb retaining spring to the left connector bracket. Set the retaining spring aside **(Figure 2-53D)**.

6. Remove the two black screws that fasten connector J501 to the left connector bracket **(Figure 2-53E)**.

7. **Carefully** pull the left connector bracket and heater bulb out of the upper fuser roller.

8. **Carefully** remove the heater bulb from the left connector holder **(Figure 2-53F and G)**.

A

Fuser Heater Bulb **(Left Side)**

B

(Left Side)

Heat Bulb Cable Screw

Retaining Spring Screw

C

Connector Bracket Screw

Connector Bracket Screw

(Left Side)

D

Connector J501

(Left Side)

Connector Bracket Screws

E

Connector J501

(Left Side)

F

Door Release Button

(Right Side)
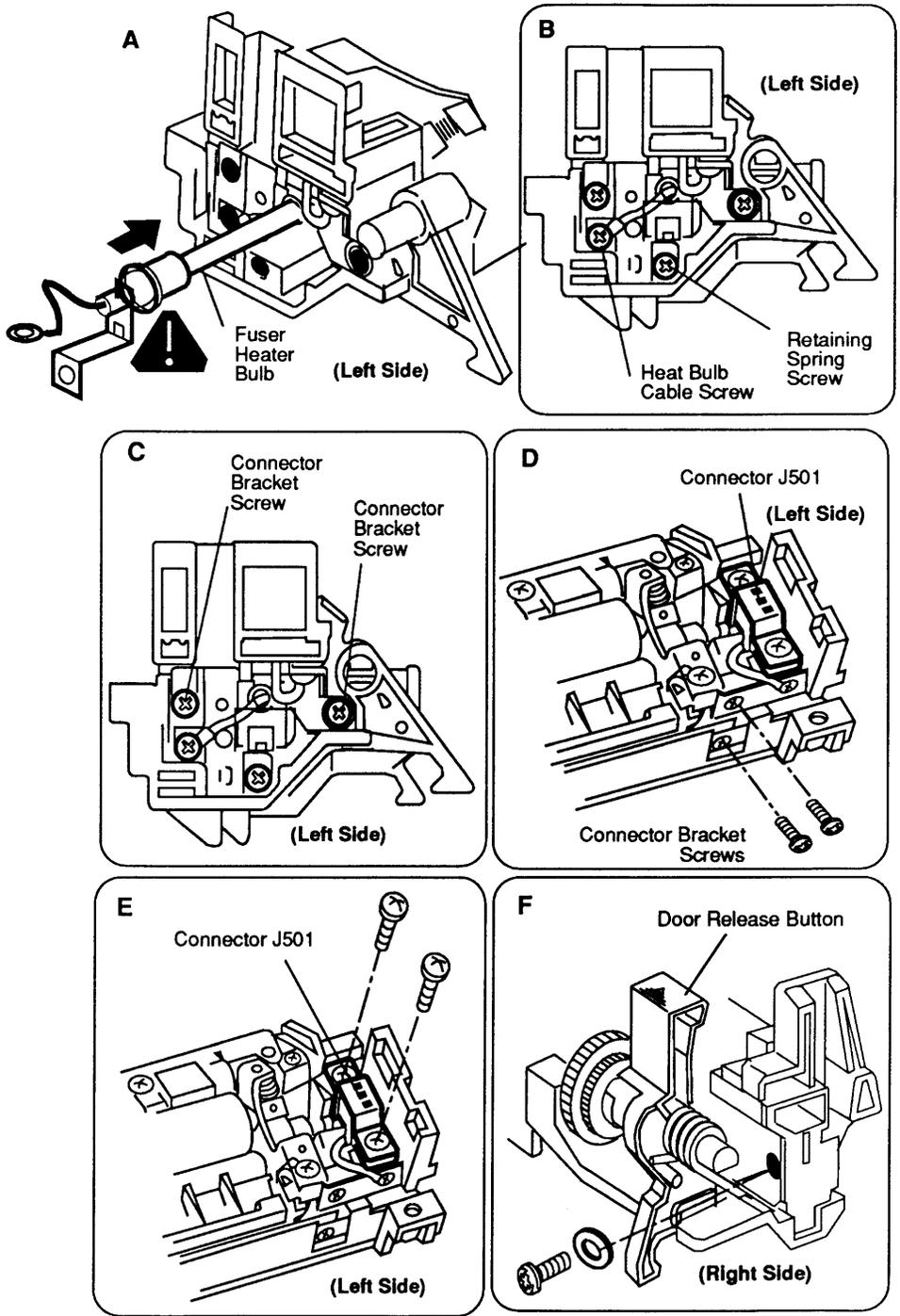
Figure 2-54 Heater Bulb – Fuser Assembly

Replace

1. Slide the heater bulb through the cutout on the left connector bracket **(Figure 2-54A)**.

2. Replace the heater bulb retaining spring on the left connector bracket and replace the silver-colored screw **(Figure 2-54B)**.

3. **Carefully** slide the heater bulb and the left connector bracket all the way into the upper roller. **Do not exert force when replacing the left connector bracket or you may break the heater bulb!**

4. Replace the four gold-colored screws that secure the left connector bracket to the fuser assembly **(Figure 2-54C and D)**.

5. Replace the two black screws that fasten connector J501 to the left connector bracket **(Figure 2-54E)**.

6. Replace the silver-colored screw and washer that hold the heater bulb cable to the left connector bracket **(Figure 2-54B)**.

7. Replace the screw and washer that hold the heater bulb to the right connector bracket **(Figure 2-54F)**.

8. Replace the fuser assembly.

Deflector

Face-Down Delivery Assembly

Face-Up Tray Latch

Face-Up Tray Latch
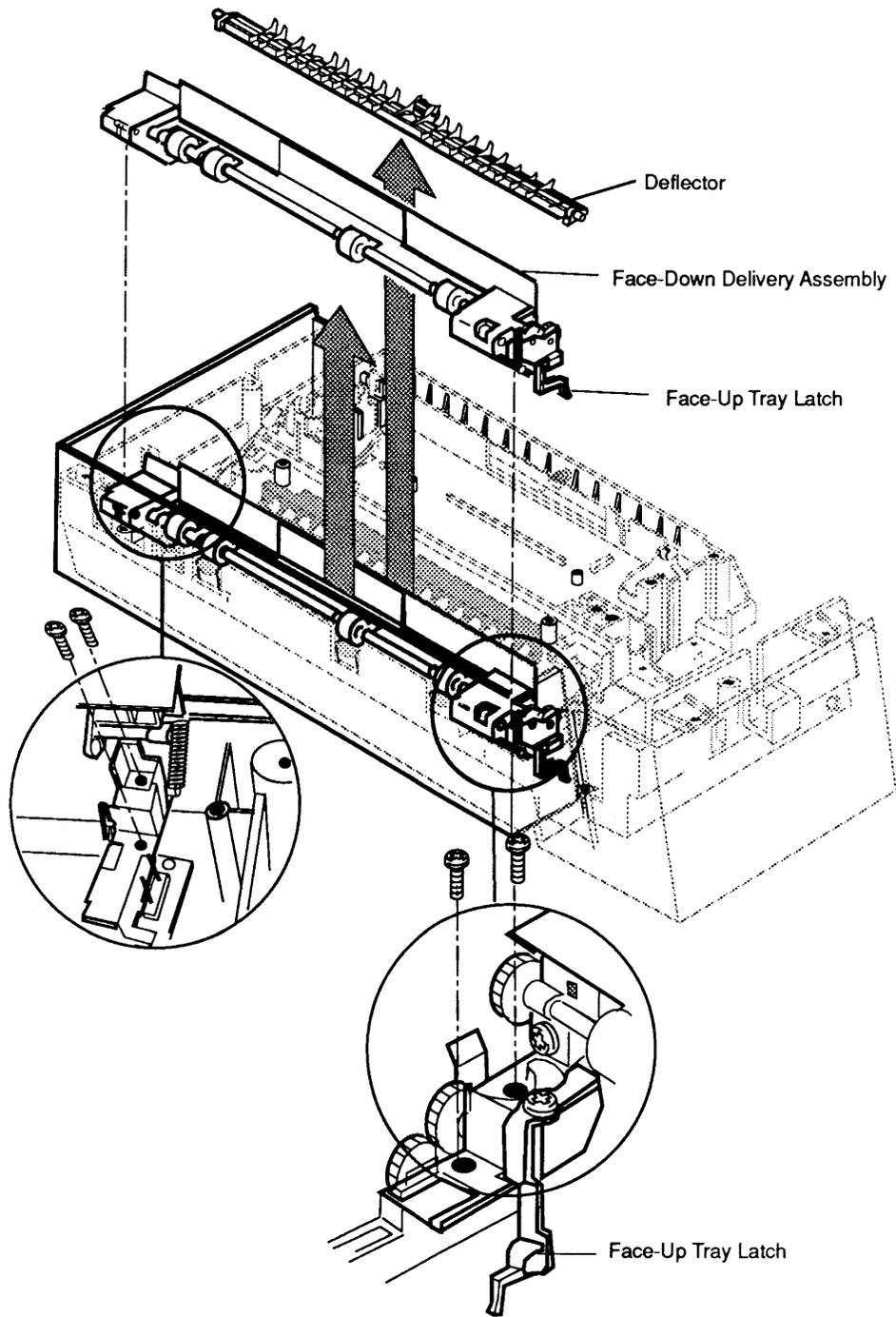
Figure 2-55 Face-Down Delivery Assembly and Deflector

❏ FACE-DOWN DELIVERY ASSEMBLY AND DEFLECTOR

Remove

1. Remove the fuser assembly.

2. Pull back the face-down delivery assembly cover and remove the four silver-colored screws (**Figure 2-55**).

3. Lift the face-down delivery assembly (and the green face-up tray latch) out of the printer (**Figure 2-55**).

4. Lift the deflector out of the printer (**Figure 2-55**).

Replace

1. Set the deflector in place.

2. Lift the right side of the deflector (so that the green face-up tray latch can fit through) and set the face-down delivery assembly in place.

3. Replace the four silver-colored screws that secure the face-down delivery assembly to the front access door.

4. Replace the fuser assembly.

Cable Retainer

Power/
Supply

J101 Connector

Fuser AC Connector Cable

Rod Assembly

Fuser PCB

J501
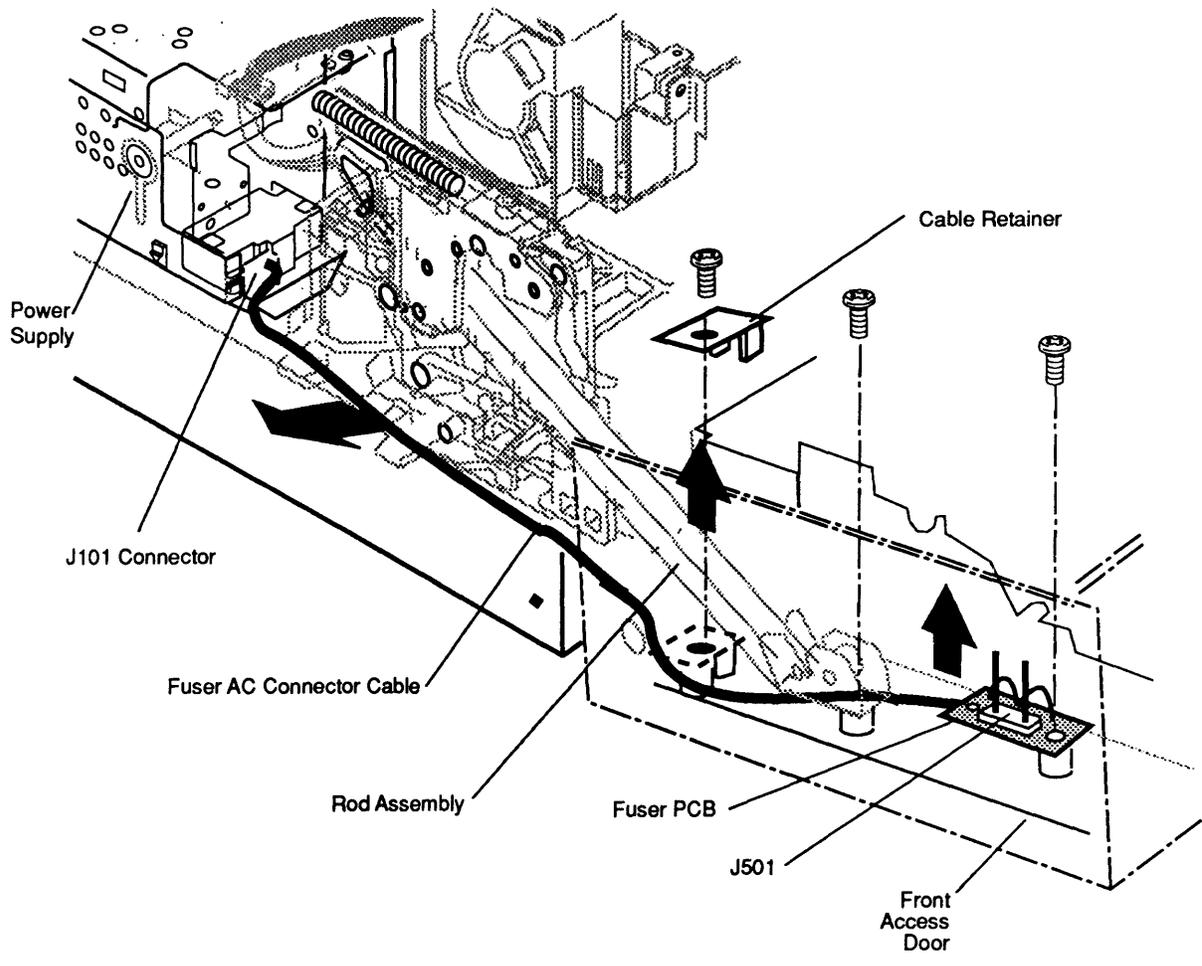
Front
Access
Door

Figure 2-56 Fuser AC Connector Cable

❑ FUSER AC CONNECTOR CABLE

Remove

1. Remove the top cover, the fuser assembly, and the face-down delivery assembly.

2. Remove the silver-colored screw that fastens the metal end of the rod assembly to the front access door **(Figure 2-56)**.

3. Remove the large black screw that holds connector J501 and the fuser PCB to the front access door **(Figure 2-56)**.

4. Remove the large black screw holding the black plastic cable retainer to the front access door. Lift out the cable retainer **(Figure 2-56)**.

5. Disconnect connector J101 from the power supply unit **(Figure 2-56)**.

6. Lift the fuser AC connector cable out of the printer **(Figure 2-56)**.

   Note: Carefully note the routing of the cable.

Replace

1. Connect connector J101 to the power supply unit.

2. Thread the black, fuser AC connector cable along the left side of the printer as shown in **Figure 2-56**.

3. Place connector J501 and the fuser PCB in position on the left side of the front access door.

4. Replace the large black screw that holds the fuser PCB in place.

5. Replace the black plastic cable retainer and the large black screw.

6. Replace the silver-colored screw that fastens the metal end of the rod assembly to the front access door.

7. Replace the face-down delivery assembly, the fuser assembly, and the top cover.

Face-Up Delivery Drive Assembly
(20-Tooth Gear)
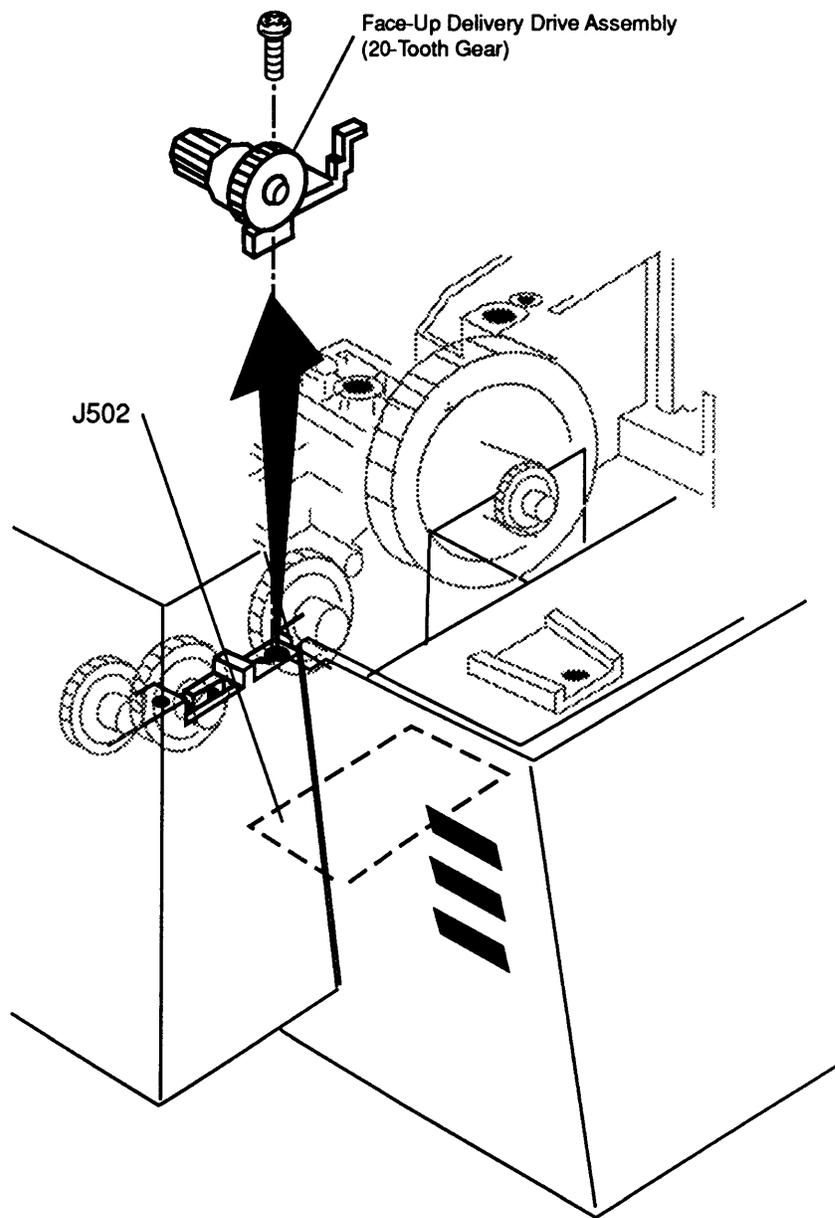
J502

Figure 2-57 Face-Up Delivery Drive Assembly

❑ FACE-UP DELIVERY DRIVE ASSEMBLY

Remove

1. Remove the fuser assembly.

2. Locate the face-up delivery drive assembly next to connector J502.

3. Remove the silver-colored screw holding the face-up delivery drive assembly to the front access door **(Figure 2-57)**.

4. Lift the face-up delivery drive assembly and the white, 20-tooth gear out of the printer **(Figure 2-57)**.

Replace

1. Place the white, 20-tooth gear inside the gear slot located behind connector J502.

2. Place the face-up delivery drive assembly in position inside the printer. It fits only one way.

3. Replace the silver-colored screw that fastens the face-up delivery drive assembly to the front access door.

4. Replace the fuser assembly.

Tension Spring

PRESS

PRESS

Face-Up
Cover
Assembly
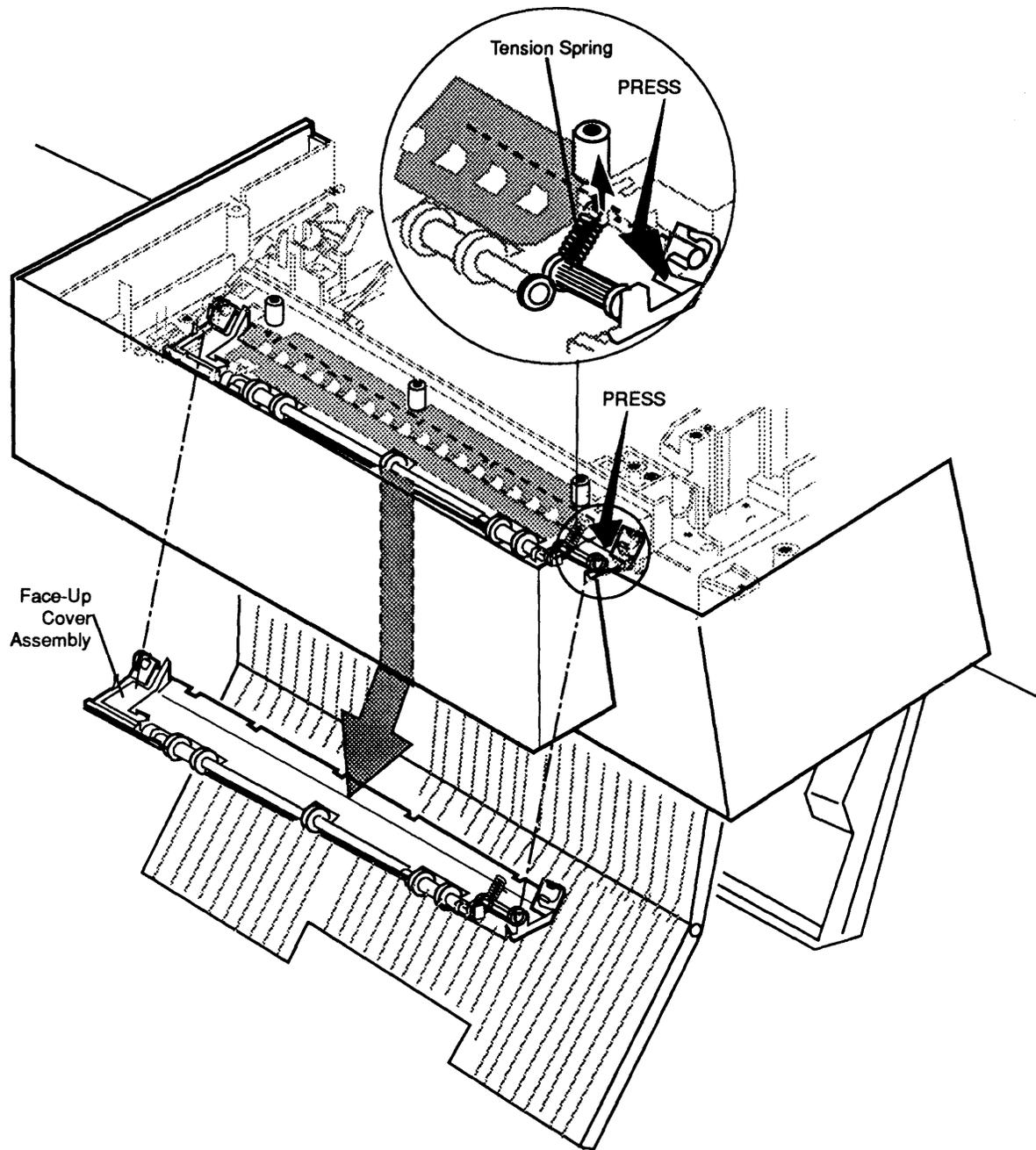
Figure 2-58 Face-Up Cover Assembly

❏ FACE-UP COVER ASSEMBLY

Remove

1. Remove the face-up tray assembly and the fuser assembly.

2. Using needlenose pliers, unhook the tension spring between the face-up cover assembly and the front access cover **(Figure 2-58)**.

3. Hold the face-up cover assembly with one hand and press down near the open catch on the right side of the printer until the cover assembly releases **(Figure 2-58)**.

4. Remove the face-up cover assembly from the printer **(Figure 2-58)**.

Replace

1. Install the left side of the cover assembly over the post on the left side of the front access cover.

2. Place the open catch on the right side of the assembly under the post on the right side of the front access cover.

3. Firmly press the cover assembly up until it snaps into place.

4. Replace the tension spring between the face-up cover assembly and the front access door.

5. Replace the face-up tray assembly and the fuser assembly.

A

Cable Retainers

Cable Clamp

J209   J303

J803
I/O
Board (LS)

Interconnect
PCB (NT, SC
& NTR)

DC
Controller
PCB

Cable Holding Pin

Grounding Cable

B

Rod
Assembly

Cable-Retaining
Bracket

Plastic Pin

Plastic Pin
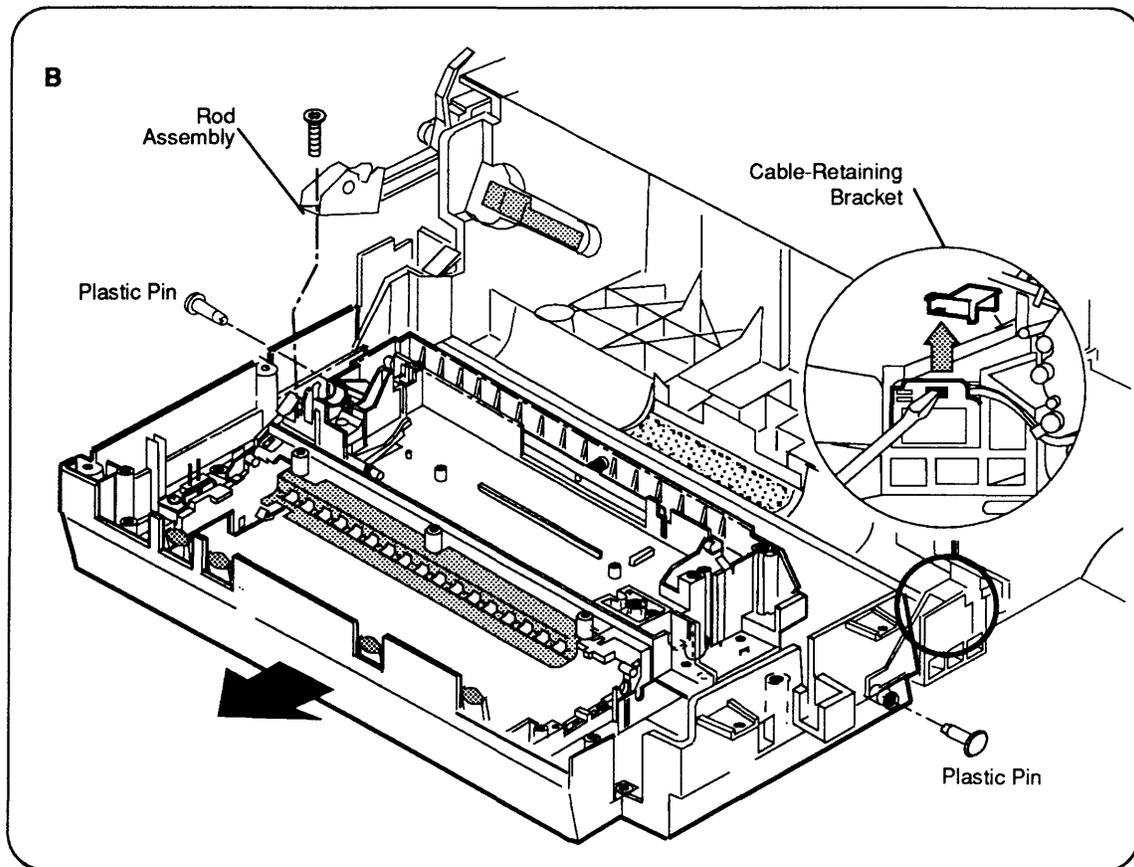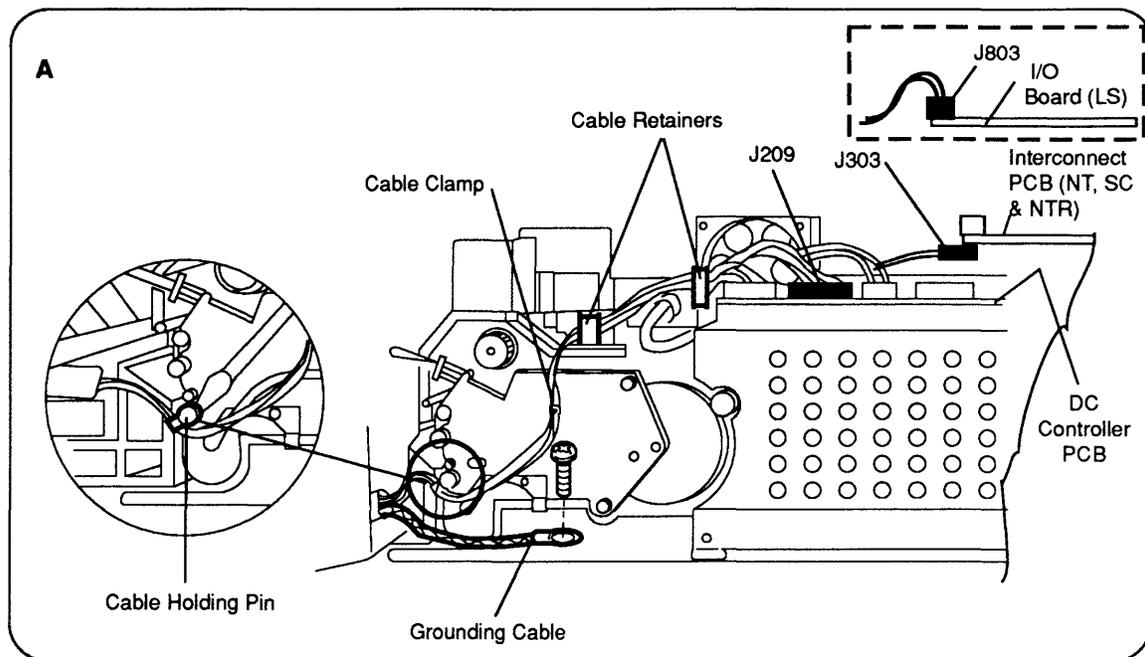
Figure 2-59 Front Access Door

❏ FRONT ACCESS DOOR

Remove

1. On the LaserWriter NT, SC, NTR, and LS, <u>remove the top cover</u>, <u>I/O board</u>, <u>I/O shield</u>, <u>fuser assembly</u>, <u>front cover</u>, and <u>LED cover</u>.

2. On the LaserWriter LS/L, <u>remove the top cover</u>, <u>PCB shield</u>, <u>fuser assembly</u>, <u>front cover</u>, and <u>LED cover</u>.

3. Disconnect connector J209 from the DC controller PCB **(Figure 2-59A)**. (In the case of the LaserWriter LS/L, disconnect J209 from the serial controller).

4. On the LaserWriter NT, SC, and NTR, disconnect connector J303 from the interconnect PCB **(Figure 2-59A)**.

   On the LaserWriter LS, disconnect connector J803 from the I/O board.

   On the LaserWriter LS/L, disconnect connector J215 from the serial controller.

5. Open the black cable retainers and remove the cables **(Figure 2-59A)**.

6. Remove the silver-colored screw securing the silver-colored grounding cable the printer chassis **(Figure 2-59A)**.

7. Remove the cables from the cable holding pin located on the drive assembly **(Figure 2-59A)**.

8. Using needlenose pliers, unclamp the black cable pin holding the cables to the right side of the printer chassis **(Figure 2-59A)**.

9. Using a small flat-blade screwdriver, remove the black cable-retaining bracket from the right side of the printer **(Figure 2-59B)**.

10. Remove the silver-colored screw that fastens the metal end of the rod assembly to the front access door **(Figure 2-59B)**.

11. Disconnect J101 from the power supply and locate the two clear plastic pins on each side of the front access door **(Figure 2-59B)**.

A

Rod
Assembly

Plastic Pin

B

J803 I/O
Board (LS)

Cable-Retaining
Bracket

Cable Retainers

J209

Cable Clamp

J303

Interconnect
PCB (NT, SC
& NTR)

DC
Controller
PCB

Grounding Cable

Cable Holding Pin
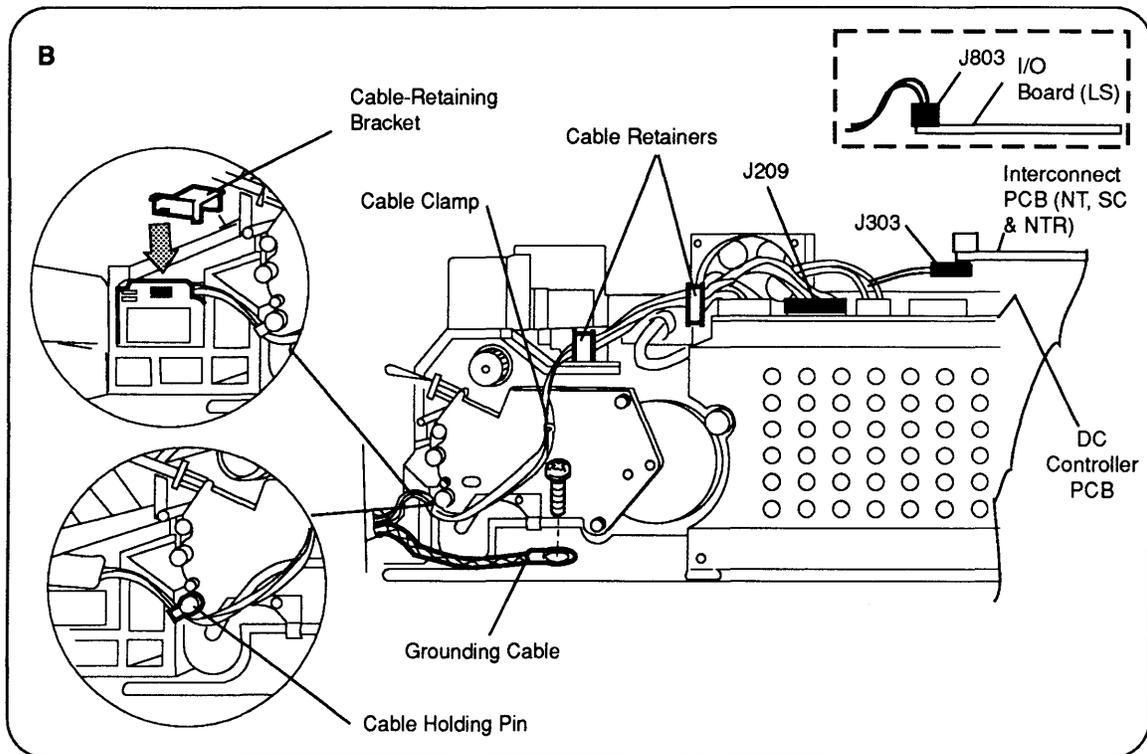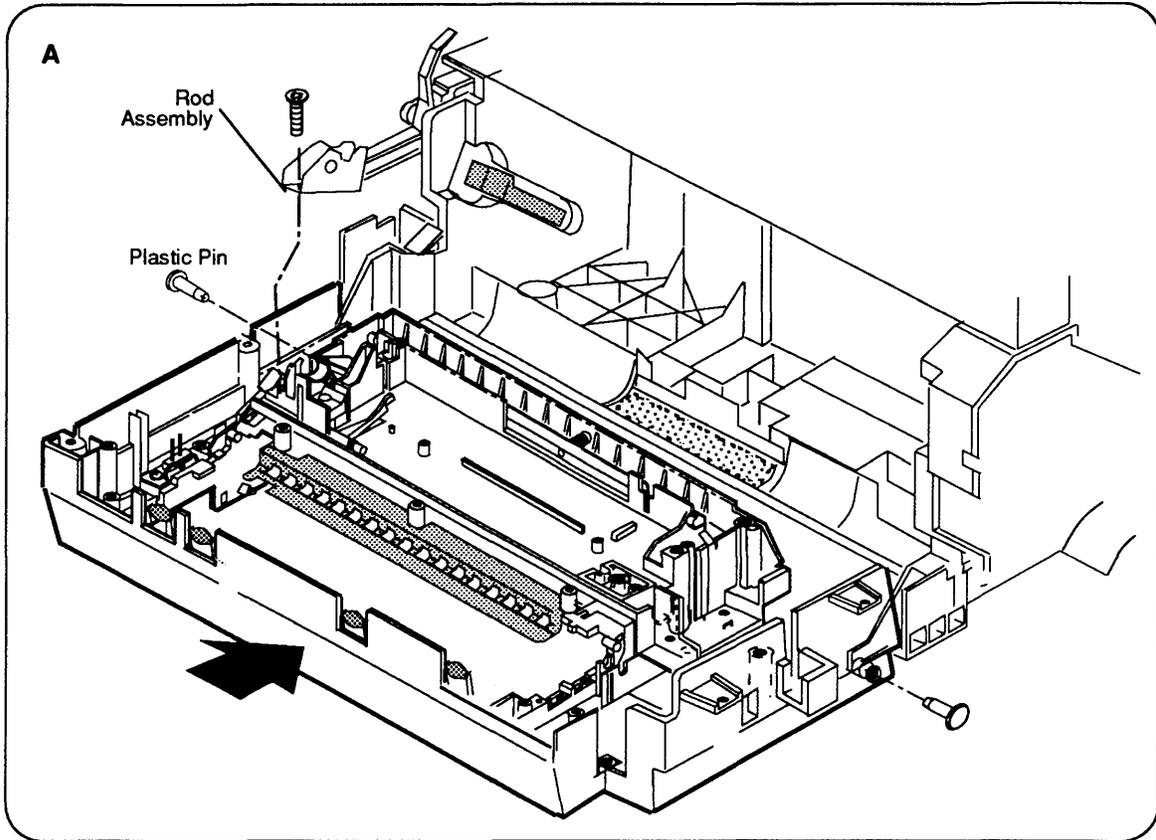
Figure 2-60 Front Access Door

12. Using a jeweler's screwdriver, carefully pry the plastic pins loose to remove them. The front access door will be released from the printer.

Replace

1. Place the front access door into position and replace the two clear plastic pins at each side of the front access door **(Figure 2-60A)**.

2. Reconnect J101 to the power supply.

3. Replace the silver-colored screw that fastens the metal end of the rod assembly to the front access door **(Figure 2-60A)**.

4. Thread the cables along the right side of the printer and replace the black cable-retaining bracket **(Figure 2-60B)**.

5. Gather the cables into the plastic cable clamp on the drive assembly and replace the black holding pin **(Figure 2-60B)**.

6. Reconnect connector J209 to the DC controller PCB **(Figure 2-60B)**.

7. On the LaserWriter NT, SC, and NTR, reconnect connector J303 to the interconnect PCB **(Figure 2-60B)**.

   On the LaserWriter LS, reconnect connector J803 to the I/O board. **(Figure 2-60B)**.

8. Replace all cables in the black cable retainers **(Figure 2-60B)**.

9. Replace the screw securing the silver-colored grounding cable to the right side of the printer chassis **(Figure 2-60B)**.

10. Replace the LED cover, front cover, and fuser assembly.

11. On the LaserWriter NT, SC, NTR, and LS, replace the I/O shield, I/O board, and top cover.

12. On the LaserWriter LS/L, replace the PCB shield and top cover.
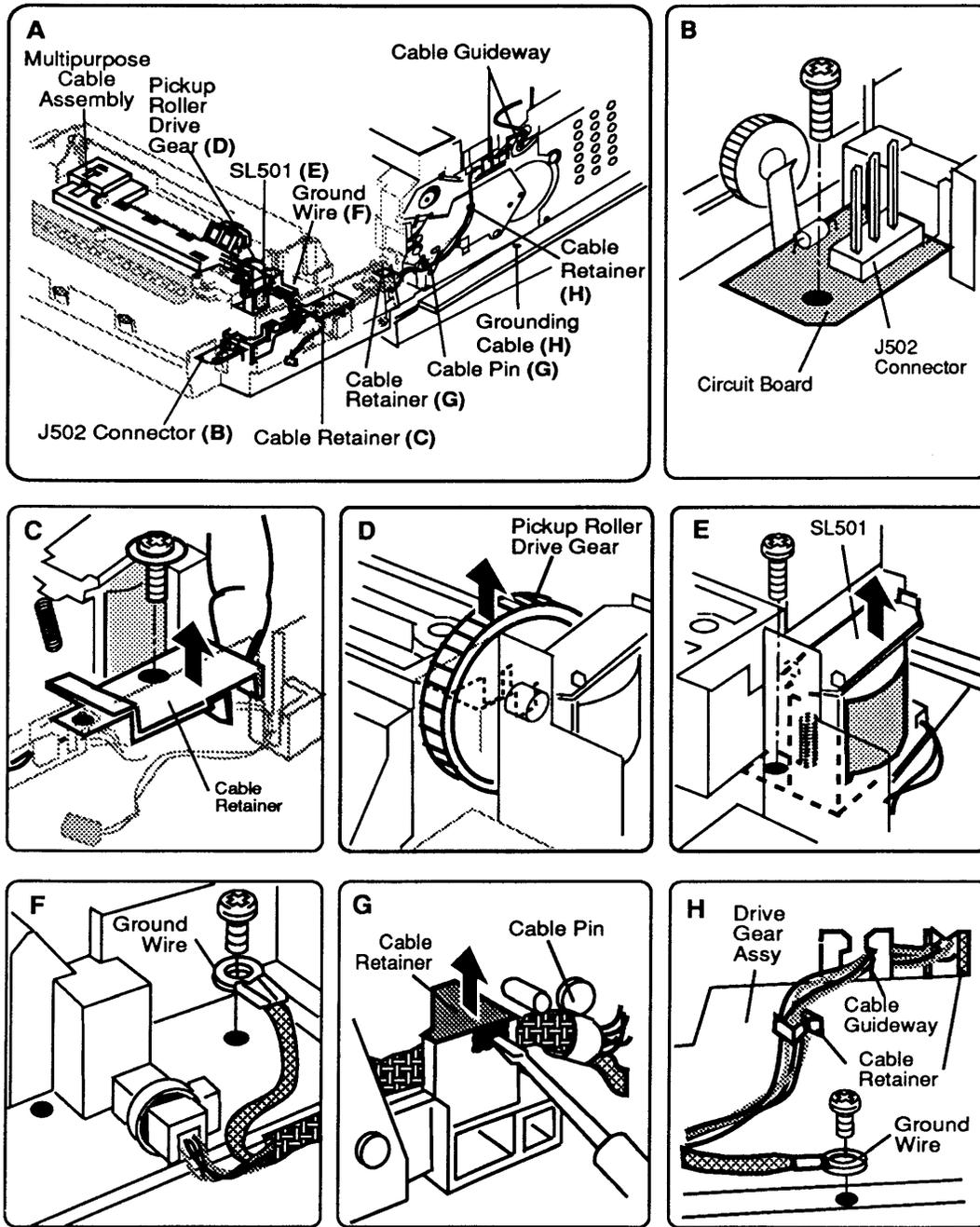
Figure 2-61 Multipurpose Cable Assembly

❑ MULTIPURPOSE CABLE ASSEMBLY

Note: Figure 2-54A shows the over-all view of the multipurpose cable assembly area. The letters in parentheses tell you which segment of the illustration to go to for greater detail.

Remove

1. On the LaserWriter NT, SC, NTR, and LS remove the top cover, I/O board, I/O shield, fuser assembly, front cover, LED cover, transfer guide assembly, pickup roller assembly, and right transfer roller mount assembly.

2. On the LaserWriter LS/L, remove the top cover, PCB shield, fuser assembly, front cover, LED cover, transfer guide assembly, pickup roller assembly, and right transfer roller mount assembly.

3. Remove the silver-colored screw that secures connector J502 and the small printed circuit board to the front access door **(Figure 2-61B)**.

4. Remove the large black screw that secures the black plastic cable retainer to the front access door. Firmly lift the cable retainer straight up and out of the printer **(Figure 2-61C)**.

5. Lift the white pickup roller drive gear out of the printer **(Figure 2-61D)**.

6. Remove the small, silver-colored screw that secures SL501, the pickup roller clutch solenoid, to the front access door **(Figure 2-61E)**.

7. Remove the screw that secures the remaining silver-colored grounding cable to the front access door **(Figure 2-61F)**.

8. Using a small flat-blade screwdriver, remove the black cable-retaining bracket from the right side of the printer **(Figure 2-61G)**.

9. Using a small flat-blade screwdriver, unclamp the black pin holding the cables to the drive assembly **(Figure 2-61G)**.
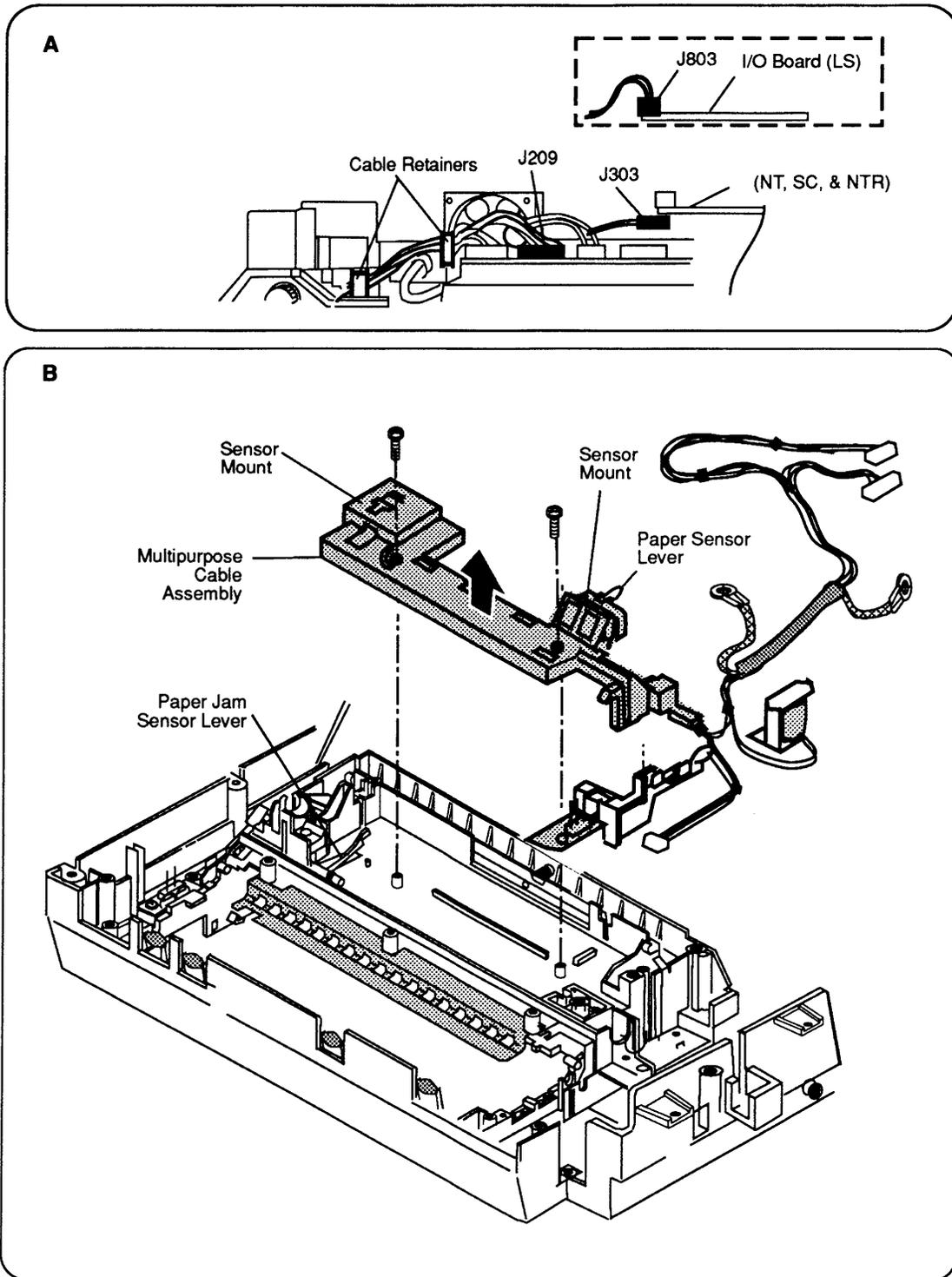
Figure 2-62 Multipurpose Cable Assembly

10. Remove the silver-colored screw that secures the silver-colored grounding cable to the right side of the printer chassis **(Figure 2-61H)**.

11. Disconnect connector J209 from the DC controller PCB **(Figure 2-62A)**. (In the case of the LaserWriter LS/L, disconnect connector J209 from the serial controller).

12. On the LaserWriter NT, SC, and NTR, disconnect connector J303 from the interconnect PCB **(Figure 2-62A)**.

    On the LaserWriter LS, disconnect connector J803 from the I/O board **(Figure 2-62A)**.

    On the LaserWriter LS/L, disconnect connector J215 from the serial controller.

13. Remove the two black screws that secure the plastic mount sensor to the front access door. Lift up slightly on the mount sensor **(Figure 2-62B)**.

14. Open the black cable retainers, remove the cables, and lift the multipurpose cable assembly and mount sensor out of the printer **(Figure 2-62B)**.

    Note: If the left transfer roller mount assembly has been removed, the paper jam sensor lever will flip loose when you lift off the mount sensor.

15. Remove the paper sensor lever from the multipurpose cable assembly and set it aside. You will need to install the paper sensor lever on the replacement multipurpose cable assembly **(Figure 2-62B)**.
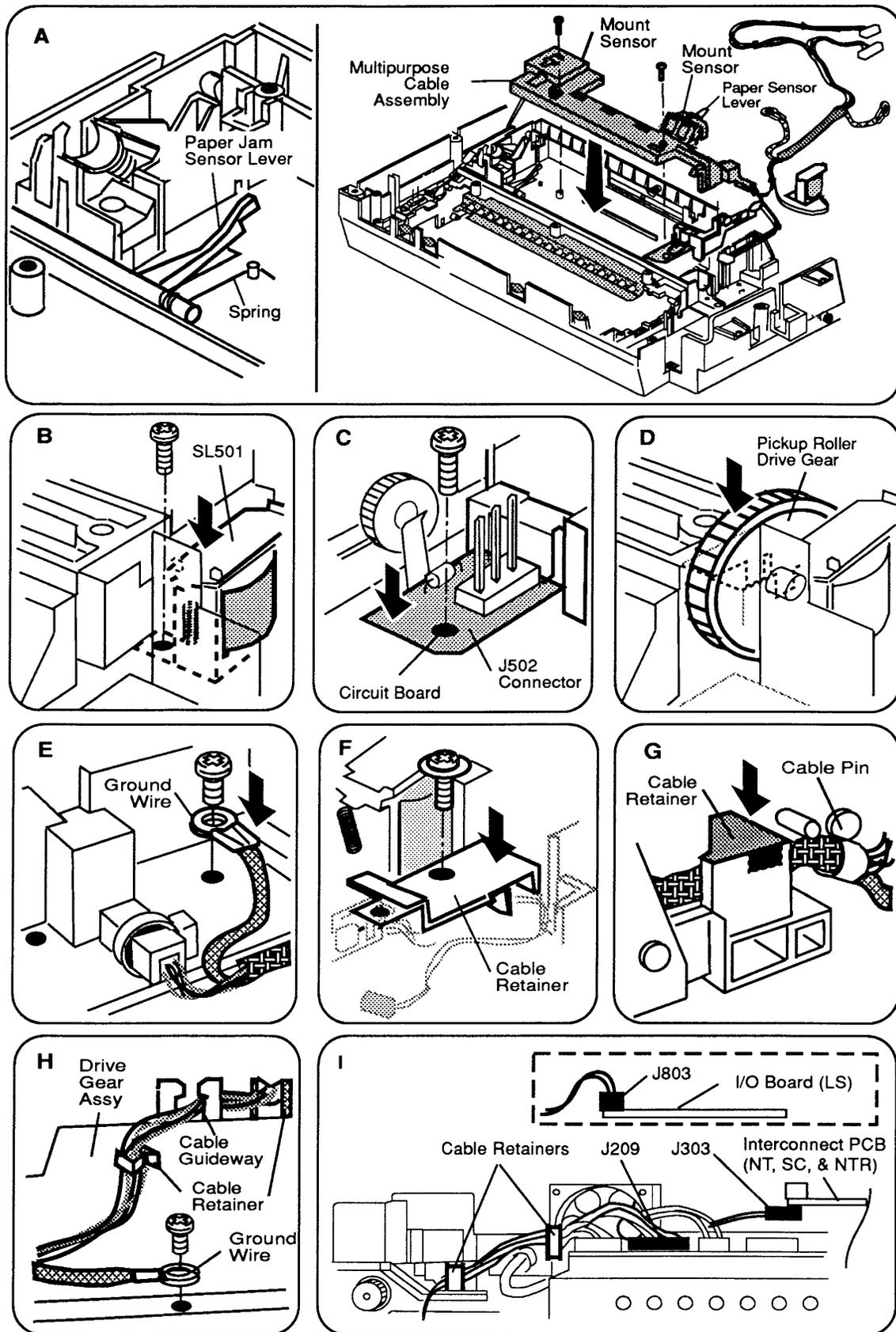
Figure 2-63 Multipurpose Cable Assembly

Replace

1. Install the paper sensor lever on the replacement multipurpose cable assembly **(Figure 2-63A).**

2. If the paper jam sensor was removed, replace the paper jam sensor spring as shown in **Figure 2-63A.**

3. Lower the multipurpose cable assembly and mount sensor into position on the front access door, and replace the two black screws **(Figure 2-63A).**

4. Place the pickup roller clutch solenoid, SL501, in position on the front access door and replace the silver-colored screw **(Figure 2-63B).** Be careful not to pinch any cable under the solenoid.

5. Place connector J502 and the small printed circuit board into position on the right side of the front access door. Replace the silver-colored screw **(Figure 2-63C).**

6. Replace the pickup roller drive gear **(Figure 2-63D).**

7. Replace the silver-colored screw that secures the grounding cable to the grounding plate in front of SL501 **(Figure 2-63E).**

8. Place the black plastic cable retainer into position over the connector cables and replace the black screw **(Figure 2-63F).**

9. Thread the cables along the right side of the printer and replace the black cable-retaining bracket **(Figure 2-63G).**

10. Gather the cables into the plastic cable clamp on the drive assembly and replace the black holding pin **(Figure 2-63G).**

11. Replace the screw that secures the silver-colored grounding cable to the right side of the printer chassis **(Figure 2-63H).**

12. On the LaserWriter NT, SC, and NTR, reconnect connector J303 to the interconnect PCB. On the LaserWriter LS, reconnect J803 to the I/O board **(Figure 2-63I).** On the LaserWriter LS/L, reconnect J215 to the serial controller.

13. Reconnect connector J209 to the DC controller PCB and replace the cables in the cable retainers. **(Figure 2-631)**.

14. Replace the pickup roller assembly, the right transfer roller mount assembly, the transfer guide assembly, the fuser assembly, the LED cover, and the front cover.

15. On the LaserWriter NT, SC, NTR, replace the I/O board, I/O shield, and top cover.

16. On the LaserWriter LS, replace the I/O shield and top cover.

17. On the LaserWriter LS/L, replace the PCB shield and top cover.

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Apple Personal LaserWriter

Section 3 – Adjustments

❏ **CONTENTS**

Note: If a step is underlined, detailed instructions for that step can be found in Section 2, Take-Apart.
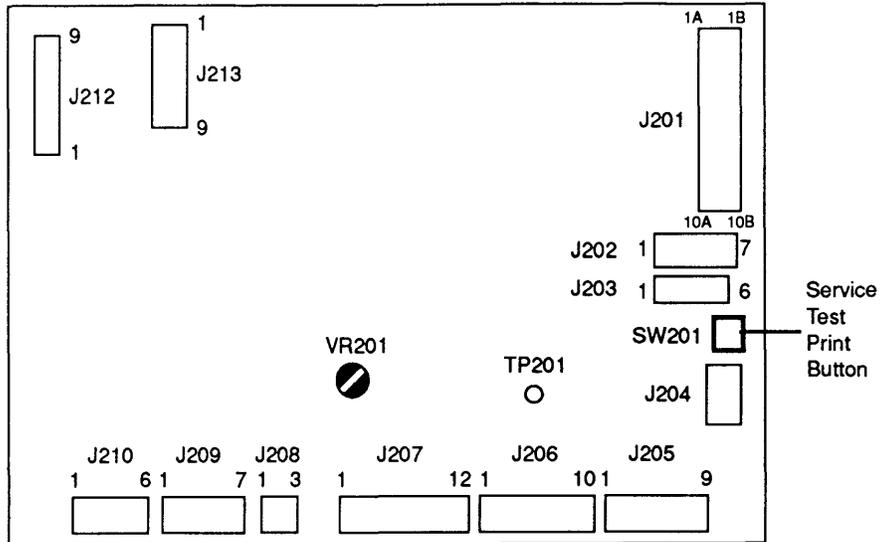
Figure 3-1 DC Controller PCB
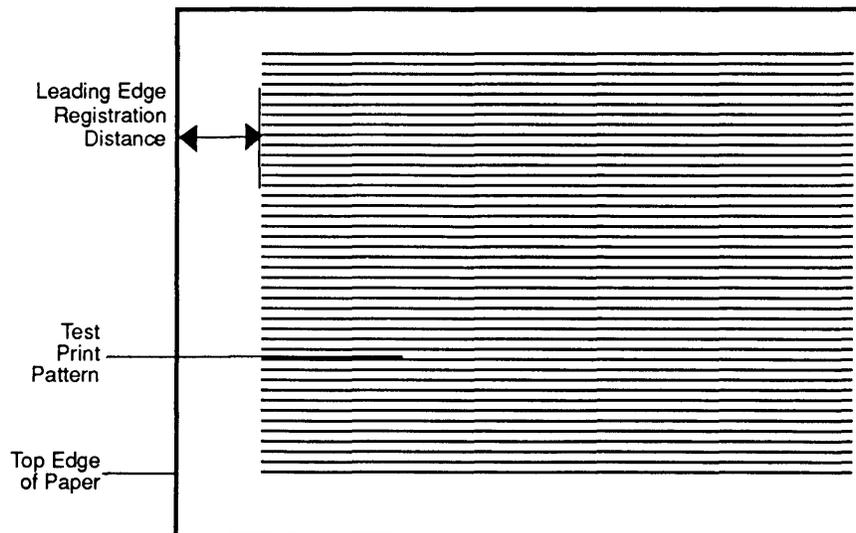
Figure 3-2 Test Print

❏ INTRODUCTION

The adjustment section provides detailed instructions for performing the registration adjustment.

Materials Required

#2 Phillips screwdriver, magnetized
Metric ruler
Jeweler's screwdriver
1.5 mm allen wrench
0.2 mm thickness gauge

Registration Adjustment

Perform the registration adjustment whenever you replace the DC controller PCB or the scanner assembly motor.

1. Remove the top cover, the I/O board, and the I/O shield.

2. Locate VR201 on the DC controller PCB **(Figure 3-1)**.

3. Using the jeweler's screwdriver, reset VR201 to "0."

4. Connect an AC power cord to the printer and power on the printer.

5. Press the service test print button on the DC controller PCB three times to make three service test prints.

6. Using a metric ruler, measure the distance from the top edge of each page to the printed test print pattern **(Figure 3-2)**. Calculate the average distance by adding the three measurements and dividing by 3.

7. Subtract the average distance from 3.6 mm to determine the correct adjustment distance.

(-) Counter Clockwise	
Correction Distance (mm)	VR201 Setting
-0.24	(-1)
-0.48	-2
-0.72	(-3)
-0.96	-4
-1.20	(-5)
-1.44	-6
-1.68	(-7)
-1.92	-8
-2.16	(-9)
-2.40	-10

(+) Clockwise	
Correction Distance (mm)	VR201 Setting
+2.40	+10
+2.16	(+9)
+1.92	+8
+1.68	(+7)
+1.44	+6
+1.20	(+5)
+0.96	+4
+0.72	(+3)
+0.48	+2
+0.24	(+1)

Table 3-1 Registration Adjustment
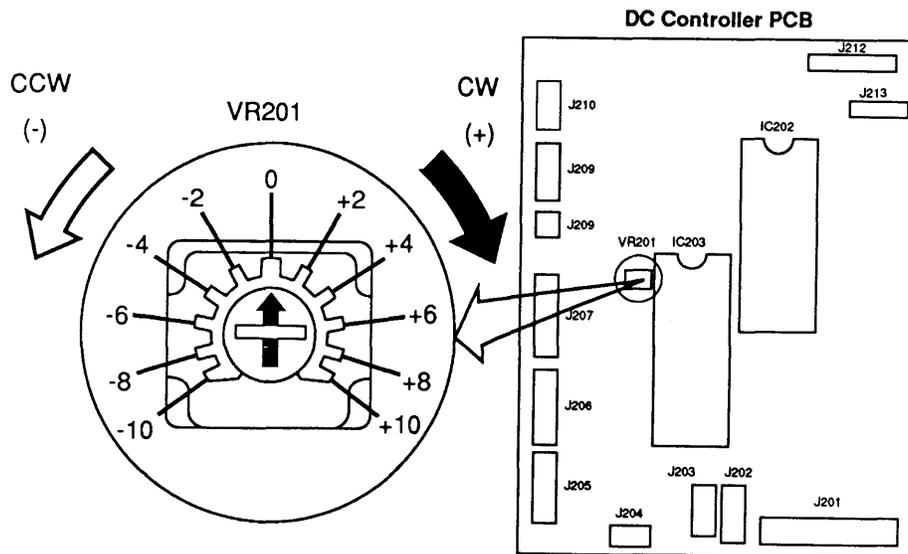
Figure 3-3 VR201 Adjustment Settings

8. Use Table 3-1 to identify the adjustment required to return the registration adjustment to 3.6 mm. (For example, if the average value obtained in step 5 is 2.4 mm, subtract 2.4 mm from 3.6 mm to arrive at the 1.2 mm adjustment required. Set VR201 at approximately +5 by turning it clockwise.)

9. Using the jeweler's screwdriver, adjust VR201 to the value indicated in Table 3-1.

   Note: If the adjustment measurement is greater than 3.6 mm, turn VR201 counterclockwise to the value indicated in Table 3-1. If the measurement is less than 3.6 mm, turn VR201 clockwise to the value indicated in Table 3-1.

10. Verify the registration adjustment by making three more service test prints.

11. Measure the distance from the top edge of each page to the printed test print pattern.

12. Calculate the average of the measured distances and confirm that the registration adjustment is 3.6 mm. **If the registration adjustment is not 3.6 mm,** repeat steps 8 and 9.

13. Replace the I/O shield, the I/O board, and the top cover.

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Section 4 – Troubleshooting

❑ CONTENTS

Note: Detailed instructions for underlined steps are in Section 2, Take-Apart.

❑ INTRODUCTION

**How to Use
the Troubleshooting
Section**

The troubleshooting section provides a logical and sequential method with which to isolate printer failures.

**Troubleshooting
Procedure**

To troubleshoot an Apple Personal LaserWriter, follow these steps:

1. Check the printer for proper setup and operating conditions by following the steps in:
   a) the "Preliminary Operating Checklist"
   b) the "Troubleshooting Setup Checklist"

2. To troubleshoot the Apple Personal LaserWriter NT, SC, or NTR begin with Flowchart 1 and proceed sequentially, function by function, until you verify all the printer main functions. If you encounter a problem, Flowchart 1 will refer you to another flowchart or the appropriate troubleshooting table for resolution of the failure.

   To troubleshoot the Apple Personal LaserWriter LS or LS/L begin with Flowchart 4 and proceed step-by-step. Then continue with Flowcharts 5 and 6. If you encounter a problem, Flowchart 4 will refer you to another flowchart or the appropriate troubleshooting table for resolution of the failure.

3. **If you replace a module or component and find that the problem remains**, reinstall the original module or component before proceeding.

4. When the printer is repaired, perform the appropriate preventive maintenance procedures described in Section 5.

5. **To clean a module**, refer to the cleaning procedures described in Section 5, Preventive Maintenance.

Materials Required

Multimeter
#2 Phillips screwdriver, magnetized
Small flat-blade screwdriver
Needlenose pliers

Status Lights

The Apple Personal LaserWriter has three status lights, which are located on the front access door of the printer.

LaserWriter NT, SC, and NTR

When the Apple Personal LaserWriter NT, SC, or NTR is switched on, the I/O board executes a self-test diagnostic. At the conclusion of this test, the status lights indicate the status of the printer. Use the status light configurations in **Table 4-1** when you troubleshoot the Apple Personal LaserWriter NT, SC, or NTR.

Ready Light	Paper-Out Light	Paper Jam Light	Printer Status
On	Off	Off	Ready
Off	On	Off	Paper cartridge not installed or Printer out of paper
Off	Off	On	Paper jam
Off	Off	Off	Front access door open or Toner cartridge not installed or Face-up cover assembly open
Flashing	Off	Off	Test printing or Engine warmup
Off	Flashing (Sync)	Flashing (Sync)	Fuser assembly error or Laser assembly malfunction or Scanner assembly malfunction
Off	Flashing (Toggle)	Flashing (Toggle)	I/O board failure

Table 4-1 LaserWriter NT, SC, and NTR Status Light Configurations

LaserWriter LS and LS/L

When you connect the Apple Personal LaserWriter LS or LS/L to a Macintosh computer that is using the LS driver, the appropriate LED indicates a paper jam or a paper-out condition.

Because the LS and LS/L LEDs do not indicate as many conditions as do the NT, SC, and NTR LEDs, the LaserWriter LS driver displays the following error messages on the monitor screen:

- Printing is being terminated because you have run out of disk space. Free up some disk space; then try printing again.

- Error in the Personal LaserWriter LS printer, Receive Timeout Error. Please check the Peripheral 8 cable connections, then try printing again.

- Error in the Personal LaserWriter LS printer, Engine Error. Contact an authorized service provider.

- Error in the Personal LaserWriter LS printer, Fuser Assembly Malfunction. Contact an authorized service provider.

- Error in the Personal LaserWriter LS printer, Scanner Motor Malfunction. Contact an authorized service provider.

- Error in the Personal LaserWriter LS printer, intermittent Laser Beam Detection Error. Please try printing the document again.

- Error in the Personal LaserWriter LS printer, Laser Assembly Malfunction. Contact an authorized service provider.

- A communications error has occurred. Please check the Peripheral 8 cable connections, then try printing again.

- You must set the serial switch for your Mac IIfx to "compatible" in the Control Panel, and restart your Mac before you can print.

- The Personal LaserWriter LS has run out of memory and cannot print this page. Press Continue to print the rest of the document, or Cancel to terminate the print job.

- Printing is being terminated because the document has a page containing more data than can be printed on this size paper.

- The front of the Personal LaserWriter LS is either open, or the toner cartridge is not properly installed. Please check the toner cartridge, close the front of the printer, then click Continue.

- The Personal LaserWriter LS has a paper jam. Please clear it, close the front of the printer, then click Continue.

- The Personal LaserWriter LS is out of paper. Please add paper, then click Continue.

- The Personal LaserWriter LS is missing its paper cassette. Please check that the paper cassette is properly inserted in the printer.

- No Personal LaserWriter LS is available. Please check that the printer is properly connected and switched on.

Test Prints

All Apple Personal LaserWriters produce a service test print. In addition, the LaserWriter NT and SC produce user test prints.

Service Test Print

To produce a service test print, press the service test print button **(Figure 4-1)** on the DC controller PCB. The service test print confirms the operation of the print engine.

SC User Test Print

The LaserWriter SC produces a user test print only if the SCSI select switch is set to "7." When the printer is switched on, the SC prints the user test print repeatedly until the paper cassette is out of paper. The SC user test print confirms the operation of the SC I/O board.

NT and NTR User Test Print

The LaserWriter NT and NTR produce a user test print each time you switch the printer on. The user test print confirms the operation of the NT and NTR I/O boards.
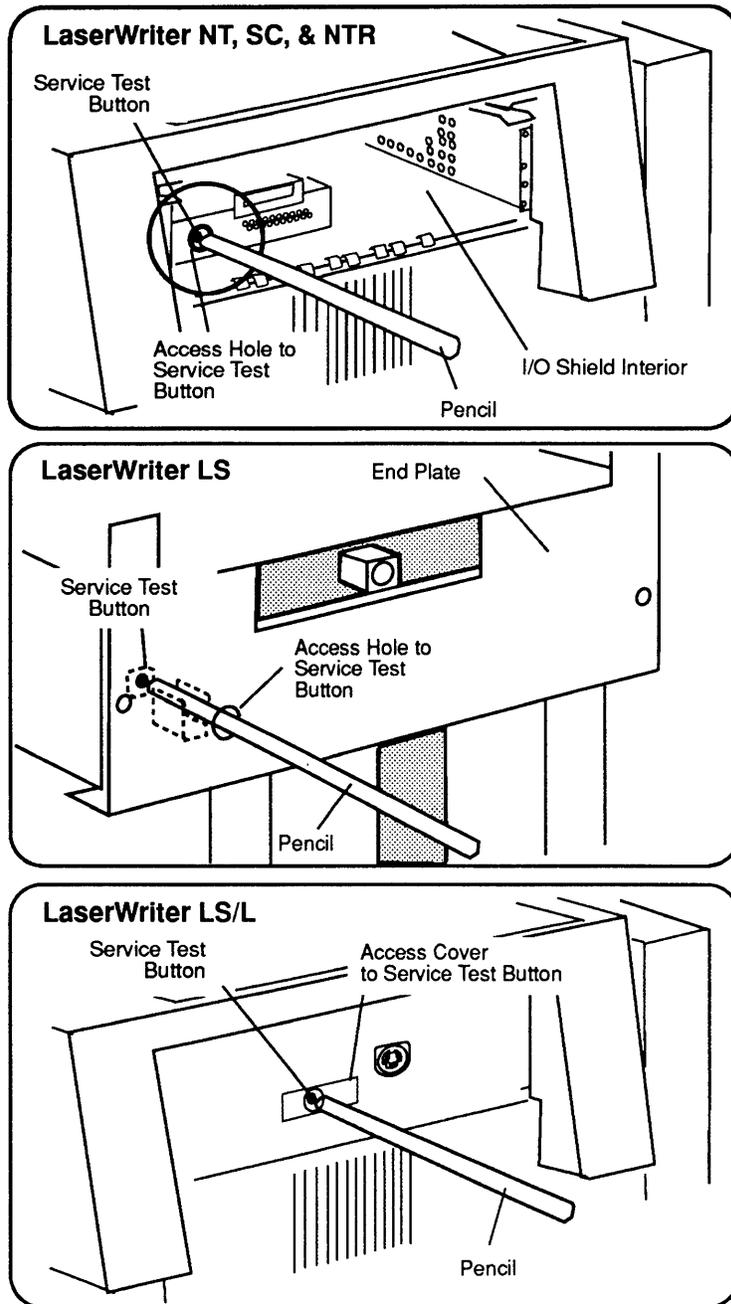
Figure 4-1 Service Test Print Button

**Electronic
Tests**

Many of the troubleshooting tables include electronic tests that you must perform to isolate a failed module or component. To perform these tests, you will need to know how to use the voltmeter and ohmmeter functions of the multimeter.

❑ PRELIMINARY CHECKS

Before beginning to troubleshoot the Apple Personal LaserWriter, make sure the printer meets the following operating and setup conditions:

Preliminary Operating Checklist

1. The line voltage does not vary more than 10% from the voltage shown on the serial number plate.

2. The printer is installed on a solid and level surface.

3. The room temperature is kept between 10 degrees C and 32.5 degrees C.

4. The printer is not exposed to ammonia gas and is not located in a hot or humid area (such as near a water faucet or humidifier), near open flames, or in a dusty place.

5. The printer is not exposed to direct sunlight.

6. The room is well ventilated.

7. The printer is using the recommended type of paper.

Troubleshooting Setup Checklist

1. **If the printer is an Apple Personal LaserWriter SC, set the SCSI select switch to "7."** Setting the SCSI select switch to "7" enables the printer to produce a user test print.

2. **Install the toner cartridge.** If no toner cartridge is installed, the DC controller will not send a READY signal to the I/O board.

3. **If the printer has a cassette feeder, fill the paper cassette with paper and install the cassette.** If the paper cassette is not installed, the DC controller will not send a READY signal to the I/O board.

4. **Close the front access door.** If the front access door is open, the DC controller will not send a READY signal to the I/O board.

START

1. Open the printer and remove any paper jams.
2. Install a toner cartridge in the printer.
3. Fill the paper cassette tray with paper.
4. Close the front access door.
5. Switch on the printer, wait 60 seconds, and observe the status LEDs.

Is the paper-out LED on? — **YES** → Go to Table F — Paper-Out LED Lights When There Is Paper.

NO

Is the paper jam LED on? — **YES** → Go to Table K — Jams Detected When There Are No Jams.

NO

Do the paper-out and paper jam LEDs flash alternately? — **YES** → Go to Table C — I/O Board Failure.

NO

Do the paper-out and paper jam LEDs flash simultaneously? — **YES** → Go to Flowchart 3 — Print Engine Error.

NO

Do all three LEDs come on and remain on? — **YES** → Go to Table C — I/O Board Failure.

NO

Does the ready LED flash during warmup and then glow steadily? — **NO** → Go to Flowchart 2 — Print Engine Check.

YES → Go to A, next page

❏ FLOWCHART 1 – MAIN TROUBLESHOOTING FLOWCHART
(LaserWriter NT, SC, and NTR; Page 2 of 2)

A

1. Switch off the printer and remove the I/O board.
2. Switch on the printer, wait 60 seconds, and press the service test print button.

Go to Table J — Paper Transport Problems

Does the printer deliver a service test print? — **NO** → **Did the paper jam inside the printer?**

YES (up to Table J)

YES ↓

Is the print quality of the test print OK? — **NO** → Go to Table H — Print Quality Problems.

Did the paper jam inside the printer? — **NO** ↓ → Go to Flowchart 2 — Print Engine Check.

YES ↓

Reinstall the I/O board and perform the "Checking the Installation" procedure described in Section 6, Additional Procedures.

Was a printout of the directory produced? — **NO** → Go to Table C — I/O Board Failure.

YES ↓

1. Open the File menu and select Print Directory.
2. Place paper on the multipurpose tray.
3. Select Manual Feed in the Print dialog box.

Was a printout of the directory produced? — **NO** → Go to Table E — Manual Feed Failure.

YES ↓

The printer is fully functional.

☐ FLOWCHART 2 – PRINT ENGINE CHECK
(LaserWriter NT, SC, and NTR)

START

1. Switch off and unplug the printer.
2. Remove the top cover.
3. Remove the I/O board.
4. Plug in and switch on the printer.

Is the fan (FM11) connected and operational?

NO → Go to Table A — No Power.

YES

Does the main motor rotate after power on?

NO → Go to Table D — Main Motor Failure.

YES

Press the service test print button.

Does the printer deliver a service test print?

NO →

Did the paper jam inside the printer?

YES → Go to Table J — Paper Transport Problems.

NO → Go to Flowchart 3 — Print Engine Error.

YES

Is the print quality of the test print good?

NO → Go to Table H — Print Quality Problems.

YES

The printer is fully functional.

❑ FLOWCHART 3 – PRINT ENGINE ERROR
(LaserWriter NT, SC, and NTR)

```
                    ┌─────────────────┐
                    │      START      │
                    └─────────────────┘
                             │
                             ▽
    ┌──────────────────────────────────────────────┐
    │ 1. Switch off the printer.                     │
    │ 2. Wait 3 minutes to reset the error and allow │
    │       the printer to cool.                     │
    │ 3. Remove the top cover and the I/O board.     │
    │ 4. Switch on the printer.                      │
    │ 5. Watch the sides of the front access door.   │
    └──────────────────────────────────────────────┘
                             │
                             ▽
```

Does the fuser lamp turn on and off?

NO → Go to Table B —
Fuser Assembly Malfunction

YES

Go to Table G —
Laser/Scanner Malfunction

❏ FLOWCHART 4 – MAIN TROUBLESHOOTING FLOWCHART
(LaserWriter LS and LS/L)

START

1. Remove the top cover and the I/O board.
2. Install a toner cartridge in the printer.
3. Close the front access door.
4. Place paper on the multipurpose tray.
5. Plug in and switch on the printer.

Is the fan (FM11) connected and operational?

NO → Go to Table A — No Power

YES

Does the fuser lamp go on and off?

NO → Go to Table B — Fuser Assembly Malfunction

YES

Does the main motor rotate after power on?

NO → Go to Table D — Main Motor Failure

YES → Press the service test print button.

Did the printer deliver a service test print to the output tray?

NO → Go to Flowchart 5 — Print Engine Error

YES

Is the print quality of the test print good?

NO → Go to Table H — Print Quality Problems

YES

Go to Flowchart 6 — Communication Check

❑ FLOWCHART 5 – PRINT ENGINE ERROR
(LaserWriter LS and LS/L)

START → Open the front access door and check for paper stuck inside the printer.

Is paper jammed inside the printer?
YES → Go to Table J — Paper Transport Problems.
NO ↓

Is a toner cartridge installed inside the printer?
YES → Install a toner cartridge.
NO ↓

1. Remove the I/O shield.
2. Place paper on the multipurpose tray.
3. Connect the multimeter between connector pin J209-2 (PFRDV) on the DC controller PCB and the chassis ground.
4. Press the service test print button.

↓

Does the voltage briefly drop from about +24 VDC to 0 VDC?
YES → Replace the multipurpose cable assembly.
NO ↓

Replace the DC controller PCB. If problem persists, go to Table G — Laser/Scanner Malfunction.

❏ FLOWCHART 6 – COMMUNICATION CHECK
(LaserWriter LS and LS/L)

```
┌─────────────────┐        ┌──────────────────────────────────────────┐
│     START       │───────▷│ 1. Replace the I/O board.                │
└─────────────────┘        │ 2. Connect the printer to a Macintosh computer. │
                           └──────────────────────────────────────────┘
                                              │
                                              ▽
                                       ╱─────────────╲
                                      ╱     Was        ╲
                                     ╱   a printout      ╲        NO      ┌──────────────────────────┐
                                    ◁  of the directory   ▷───────────────▷│  Go to Table C7 —        │
                                     ╲   produced?        ╱                │  LS and LS/L I/O Board   │
                                      ╲                 ╱                  └──────────────────────────┘
                                       ╲─────────────╱
                                            │ YES
                                            ▽
                                       ╱─────────────╲
                                      ╱      Is         ╲
                                     ╱  the print quality ╲       NO      ┌──────────────────────────┐
                                    ◁  of the test print   ▷──────────────▷│  Go to Table H —        │
                                     ╲     good?          ╱                │  Print Quality Problems  │
                                      ╲                 ╱                  └──────────────────────────┘
                                       ╲─────────────╱
                                            │ YES
                                            ▽
                                  ┌──────────────────────┐
                                  │  The printer is fully │
                                  │      functional.      │
                                  └──────────────────────┘
```

STEP	CHECK	RESULT	ACTION
1	Does the AC outlet provide the correct voltage?	No	Try another AC outlet.
2	Locate circuit breaker CB1 at the rear of the power supply unit, just above and to the right of the AC power cord receptacle. Does the plastic shaft extend out from the power supply unit?	Yes	Reset circuit breaker CB1. If the circuit breaker trips again when you switch the printer on, the printer has a short that you must locate.
3	Remove the AC power cord and disconnect the power switch, SW11. First, measure the resistance between the top two terminals at SW11. Then measure the resistance between the bottom-two terminals at SW11. Does the resistance measure 0 ohms when you switch the power on and infinite ohms when you switch the power off?	No	Replace power switch, SW11.
4	Connect the multimeter across pins J101-1 and J101-2 on the power supply unit. Does the voltage measure 110/115 volts (or 220/240 volts) when you switch the power on? For steps 5 through 12, you must remove the I/O shield and install a toner cartridge.	No	Replace the power supply unit.
5	Connect the multimeter between pin J212-3 on the DC controller PCB and chassis ground. Switch on the printer. Is the voltage about +24 VDC?	No	Replace the power supply unit.

STEP	CHECK	RESULT	ACTION
6	Connect the multimeter between pin J212-6 on the DC controller PCB and the chassis ground. Switch on the printer. Is the voltage about +12 VDC?	No	<u>Replace the power supply unit</u>.
7	Connect the multimeter between pin J212-8 on the DC controller PCB and the chassis ground. Switch on the printer. Is the voltage about +5 VDC?	No	<u>Replace the power supply unit</u>.
8	Is connector J701 properly connected to the density-adjusting PCB?	No	Reconnect J701 to the density-adjusting PCB.
9	Connect the multimeter between J701-1 on the density-adjusting PCB and the chassis ground. Switch on the printer. Is the voltage approximately +12 VDC?	Yes	<u>Replace the fan</u>.
10	Connect the multimeter between J701-3 on the density-adjusting PCB and the chassis ground. Switch on the printer. Is the voltage about +4 VDC?	Yes	<u>Replace the fan</u>.
11	Connect the multimeter between J701-3 on the density-adjusting PCB and the chassis ground. Press the service test print button. Is the voltage about +2 VDC when the main motor starts to rotate?	Yes	<u>Replace the fan</u>.
12	Connect the multimeter between connector J213-1 on the DC controller PCB and the chassis ground. Switch on the printer. Is the voltage approximately +12 VDC?	Yes	<u>Replace the density-adjusting PCB</u>.
		No	<u>Replace the DC controller PCB</u>.

Note: When there is a failure of the fusing system, the microprocessor on the DC controller PCB shuts off current to the fuser roller heater and charges capacitor C212 to prevent overheating. If there is a failure of the fusing system, you must turn the power off for three minutes or manually discharge C212 on the DC controller PCB before switching power on again.

STEP	CHECK	RESULT	ACTION
1	Disconnect J101 from the power supply unit. Measure the resistance at the top of the cable connector between J101-1 and J101-2. Is the resistance less than 10 ohms?	No	Check the cable connection. If the cable is securely connected, <u>replace the fuser heater bulb</u>.
2	Is connector J209 on the DC controller PCB making good contact?	No	Reconnect J209 to the DC controller PCB.
3	Allow the fuser to cool and remove the fuser assembly from the printer. Measure the resistance between J502-1 and J502-3 on the fuser assembly. Is the resistance between 180K and 290K ohms at room temperature?	No	<u>Replace the fuser assembly</u>. If the problem persists, check the cable connections between the fuser assembly (J502) and the DC controller PCB (J209). If the connections are secure, replace the cable.
4	Reinstall the fuser assembly and close the front access door. <u>Remove the I/O shield</u>. Connect a multimeter between connector J212-9 (FSRDRV) on the DC controller PCB and the chassis ground. Switch on the power.		
	Does the voltage change from +5 VDC to 0 VDC as the fuser heater bulb turns on and off?	No	<u>Replace the DC controller PCB</u>.

STEP	CHECK	RESULT	ACTION
5	Switch off the printer and wait three minutes for the printer to cool. Connect a multimeter between connector J101-1 and J101-2 on the power supply unit. Switch on the power.		
	Is the voltage 110/115 volts (or 220/240 volts) when the power is switched on?	No	Replace the power supply unit.
		Yes	Replace the fuser assembly.

❏ TABLE C – I/O BOARD FAILURE

Use the table appropriate for the I/O board
and communication mode being used.

❏ TABLE C1 – SC I/O BOARD

STEP	CHECK	RESULT	ACTION
1	Is the printer connected to a Macintosh computer?	No	Proceed to step 6.
2	Are the SCSI cable connections and terminators correct and secure?	No	Tighten cable connections or refer to Section 6, Additional Procedures, "Checking the Installation for proper cabling information.
3	Are the SCSI cables and terminators good? (Have you tried the cables elsewhere?)	No	Replace defective cable(s) and terminator(s).
4	Is the SCSI device address set to the same address as another device on the daisy chain?	Yes	Change the SCSI device address to a different address.
5	Is the Personal LaserWriter SC file installed in the System Folder and is the printer selected using the Chooser?	No	Copy the LaserWriter and LaserPrep files to the System Folder and use the Chooser to select the printer.
6	Install a different SC I/O board.		
	Can the computer now print?	Yes	Finished.

STEP	CHECK	RESULT	ACTION
1	Is the printer connected to a Macintosh computer?	No	Proceed to step 5.
2	Is the rotary switch on the I/O board set to "0?"	No	Set the rotary switch to "0."
3	Are the LaserWriter and LaserPrep files installed in the System Folder, and is the printer selected using the Chooser?	No	Copy the LaserWriter and LaserPrep files to the System Folder and use the Chooser to select the printer.
4	Are the LocalTalk cables and connectors correct and secure?	No	Tighten cable connections or refer to Section 6, Additional Procedures, for "Checking the Installation for proper cabling information.
5	To identify the problem on the NT I/O board, perform the following actions: a) Switch off the printer. b) Install the LaserWriter II Test Connector on the 25-pin serial port. c) Switch on the printer. d) Observe the status lights and use Table 4-2 to troubleshoot the I/O board.		

NT I/O BOARD STATUS LIGHTS			
Ready Light	Paper-Out Light	Paper Jam Light	Action
On	Flashing	Off	Replace SIMM 2.
Off	Flashing	On	Replace SIMM 2.
On	Flashing	Off	Replace SIMM 1.
Off	Flashing	Off	Replace SIMM 1.
On	Off	Flashing	Replace the ROM SIMM. If two ROM SIMMs are installed and the problem still exists, replace the other ROM SIMM.
Off	Off	Flashing	Replace the ROM SIMM. If two ROM SIMMs are installed and the problem still exists, replace the other ROM SIMM.
For other NT I/O board status light configurations, replace the I/O board.			

Table 4-2 NT I/O Board Status Lights

❏ TABLE C3 – NT I/O BOARD: RS-232 SERIAL

STEP	CHECK	RESULT	ACTION
1	Are the RS-232 serial cable connections correct and secure?	No	Tighten the cable connections or refer to the *Owner's Guide* for proper cabling information.
2	Is the pushwheel switch on the I/O board set correctly?	No	Set the pushwheel switch as shown in the *Owner's Guide*.
3	Are the RS-232 serial cables and connectors good? (Have you tried the cables elsewhere?)	No	Replace defective cables and connectors.
4	Have you tried a different computer?	No	Try a different computer.
5	Install a different NT I/O board.		
	Can the computer now print?	Yes	Finished.

❏ TABLE C4 – NTR I/O BOARD: LOCALTALK

STEP	CHECK	RESULT	ACTION
1	Is the printer connected to a Macintosh computer?	No	Connect the printer to a Macintosh computer.
2	Is the pushwheel switch on the I/O board set to "0"?	No	Set the pushwheel switch to "0."
3	Is the Personal LaserWriter NTR driver installed in the System Folder?	No	Copy the Personal LaserWriter NTR driver to the System Folder.
4	Are the LocalTalk cables and and connectors correct and secure?	No	Tighten cable connections.
5	Have you tried a different computer?	No	Try a different computer.
6	Install a different NTR I/O board.		
	Can the computer now print?	Yes	Finished.

❏ TABLE C5 – NTR I/O BOARD: RS-232 SERIAL

STEP	CHECK	RESULT	ACTION
1	Are the RS-232 serial cable connections correct and secure?	No	Tighten the cable connections or refer to the *Owner's Guide* for proper cabling information.
2	Is the pushwheel switch on the I/O board set correctly?	No	Set the pushwheel switch as shown in the *Owner's Guide*. $\emptyset$ = Postscript
3	Are the RS-232 serial cables and connectors good? (Have you tried the cables elsewhere?)	No	Replace defective cables and connectors.
4	Is the computer software and hardware properly configured to communicate with the RS-232 serial port on the printer?	No	Refer to the *Owner's Guide* and the computer documentation for proper configuration information.
5	Install a different NTR I/O board.		
	Can the computer now print?	Yes	Finished.

❑ TABLE C6 – NTR I/O BOARD: PARALLEL

STEP	CHECK	RESULT	ACTION
1	Are the parallel cable connections correct and secure?	No	Tighten the cable connections or refer to the *Owner's Guide* for proper cabling information.
2	Is the pushwheel switch on the I/O board set correctly?	No	Set the pushwheel switch as shown in the *Owner's Guide*.
3	Are the parallel cables and connectors good? (Have you tried the cables elsewhere?)	No	Replace defective cables and connectors.
4	Is the computer software and hardware properly configured to communicate with the parallel port on the printer?	No	Refer to the Owner's Guide and the computer documentation for proper configuration information.
5	Install a different NTR I/O board.		
	Can the computer now print?	Yes	Finished.

❏ TABLE C7 – LS AND LS/L I/O BOARD

STEP	CHECK	RESULT	ACTION
1	Is the printer connected to a Macintosh computer?	No	Connect the printer to a Macintosh computer.
2	Is the serial cable connection secure?	No	Tighten cable connections.
3	Is the Personal LaserWriter LS driver installed in the System Folder?	No	Copy the Personal LaserWriter LS driver to the System Folder.
4	Are the Personal LaserWriter LS driver and the correct serial port selected?	No	Use the Chooser to select the LS driver and the port icon for the port (printer or modem) to which the printer is connected.
5	Is the printer connected to the printer port on the Macintosh computer?	Yes	Make sure that AppleTalk is inactive.
6	Is Background Printing disabled?	No	Disable Background Printing (so that error messages display on the screen). Switch the printer off and on again.
7	Install a different I/O board.		
	Can the computer now print?	Yes	Finished.

❏ TABLE D – MAIN MOTOR FAILURE (1 of 2)

STEP	CHECK	RESULT	ACTION
1	Is a toner cartridge installed in the printer?	No	Install a toner cartridge in the printer.
2	Open the multipurpose tray, pull out the face-up tray assembly, and open and close the face-up cover assembly. Is the problem fixed?	Yes	The lever on the face-up cover assembly is now making contact with the arm of photo-interrupter PS502, the face-up cover sensor, located on the multipurpose cable assembly.
3	Are there any obstructions in the drive assembly or paper feeder assembly gear train? For steps 4 through 7, remove the I/O shield, close the front access door, and install a toner cartridge.	Yes	Remove the obstructions.
4	Connect the multimeter between J213-4 on the DC controller PCB and chassis ground. Switch on the printer. Is the voltage about +3.4 VDC?	No	Check the wiring from J213 on the DC controller to J12 on the mounting plate sensor. If the wiring is faulty, replace the density-adjusting PCB. If the wiring is correct, replace photo-interrupter PS11, the toner cartridge sensor, located on the mounting plate sensor.
5	Connect the multimeter between J209-8 on the DC controller PCB and chassis ground. Switch on the printer. Is the voltage about +3.4 VDC?	No	Replace the multipurpose cable assembly.
6	Is connector J210 on the DC controller PCB making good contact?	No	Reconnect connector J210 to the DC controller PCB.

STEP	CHECK	RESULT	ACTION
7	Disconnect connector J210 from the DC controller PCB. Measure the resistance on the connector (not the DC controller PCB) between each of the following pairs of pins: a) J210-1 and J210-2 b) J210-1 and J210-3 c) J210-4 and J210-5 d) J210-4 and J210-6 Is the resistance approximately 13 ohms?	No Yes	Replace the main motor. Replace the DC controller PCB.

❏ TABLE E – MANUAL FEED FAILURE

STEP	CHECK	RESULT	ACTION
	For steps 1 and 2 you will need to remove the top cover and the I/O shield, and have a toner cartridge installed.		
1	Is connector J209 on the DC controller PCB making good contact?	No	Reconnect connector J209 to the DC controller PCB.
2	Place a sheet of paper on the multipurpose tray. Connect a multimeter between connectors J209-2 (PFRDV) on the DC controller PCB and the chassis ground. Switch on the printer and press the service test print button.		
	Does the voltage change from about +24 VDC to 0 VDC?	No	Replace the DC controller PCB.
		Yes	Open the front access door and replace the multipurpose cable assembly.

❏ TABLE F – PAPER-OUT LED LIGHTS WHEN THERE IS PAPER

STEP	CHECK	RESULT	ACTION
1	Is the paper cassette installed and does it contain paper?	No	Fill the paper cassette with paper and install the paper cassette.
2	Is the paper cassette seated properly?	No	Remove and reseat the paper cassette.
3	Remove the paper cassette tray. Visually inspect the paper-out sensor arm. Does the paper-out sensor arm move freely? Is it damaged? For step 4 you will need to remove the top cover, the I/O board, and the I/O shield. Install a toner cartridge.	Yes	Replace the paper-out sensor arm.
4	Connect a multimeter between connector J205-6 (OPPOUT) on the DC controller PCB and the chassis ground. While removing and inserting a paper cassette tray that contains paper, does the voltage toggle from +5 VDC (inserted) to 0 VDC (removed)?	No Yes	Replace photo-interrupter PS901, the cassette paper sensor, on the cassette feeder tray. Replace the DC controller PCB.

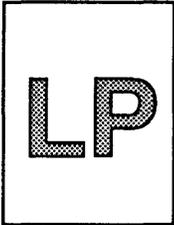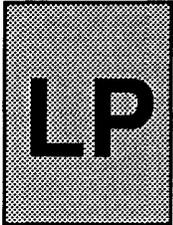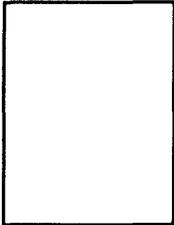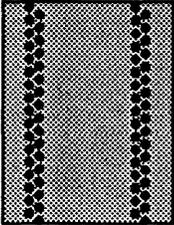| STEP	CHECK	RESULT	ACTION
	For steps 1 through 6, you will need to <u>remove the I/O shield</u> and have a toner cartridge installed.		
1	Is the optical fiber cable J204 disconnected from the DC controller PCB?	Yes	Reconnect connector J204 to the DC controller PCB.
2	Jumper J207-6 (LPC) on the DC controller PCB to the chassis ground. Measure the voltage between J202-4 (LSRPWR) and J202-2 (GND) on the DC controller PCB.		
	Is the voltage between 1.5 VDC and 2 VDC after one second?	No	<u>Replace the DC controller PCB.</u>
3	Jumper J207-6 (LPC) on the DC controller PCB to the chassis ground. Measure the voltage between J202-3 (APCIN) and J202-2 (GND) on the DC controller PCB.		
	Does the voltage drop to +1.5 VDC within 5 seconds?	No	<u>Replace the laser assembly.</u>
4	Is the connection between J301 on the scanner assembly and J203 on the DC controller PCB good?	No	Reconnect connector J301 to the scanner assembly and J203 to the DC controller PCB.
5	Remove the jumper from J207-6 (LPC). Measure the voltage between J203-2 (+12 VDC) and J203-6 (GND) on the DC controller PCB. Is the voltage between +11 VDC and +12 VDC?	No	Check whether +12 VDC is present between connector J202-6 (+12 VDC) and J212-5 (GND) on the DC controller PCB. If the voltage is not between +11 VDC and +12 VDC, <u>replace the power supply unit.</u>

STEP	CHECK	RESULT	ACTION
6	Measure the voltage between connector J203-3 (SCNON) on the DC controller PCB and the chassis ground. Press the service test print button.		
	Does the voltage change from approximately +4 VDC to below 0 VDC?	Yes	Replace the scanner assembly.
		No	Check the cable connection between the DC controller PCB (J203) and the scanner motor PCB (J301), and replace the cable if necessary. If the problem persists, replace the DC controller PCB.

□ TABLE H – PRINT QUALITY PROBLEMS

Compare the images from your printer to the images shown below.
Determine which image yours most nearly resembles.

Go to Table H1	Go to Table H2	Go to Table H3	Go to Table H4
Light Image	Dark Image	All-Blank Print	Black Image

Go to Table H5	Go to Table H6	Go to Table H7	Go to Table H8
Large Dots Vertically in Line	Stains on Back of Paper	Dark Vertical Line	Smudged Vertical Bands
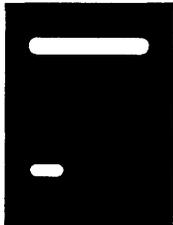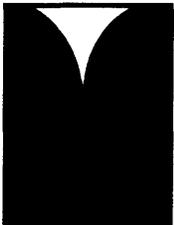
Go to Table H9	Go to Table H10	Go to Table H11
Smudged Horizontal Bands	Blank Spots	Solid Vertical White Lines
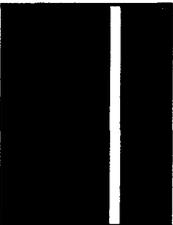
Go to Table H12

Go to Table H13

Shaky Print — Replace Toner

Faulty Registration

Poor Fusing

STEP	CHECK	RESULT	ACTION
1	Adjust the print density-adjustment lever to darken the image. Does the print quality improve?	Yes	Finished.
2	Replace the toner cartridge. Does the print quality improve?	Yes	Finished.
3	Is this a new toner cartridge?	Yes	Hold the toner cartridge lengthwise and rock it from side to side three or four times.
4	Do prints improve when new paper is used?	Yes	Replace with recommended paper for type of printing being done. See Section 1, Basics, "Specifications," for recommended paper.
5	Replace the transfer roller. Does the print quality improve?	Yes	Finished.
6	Locate the transfer roller spring on the left transfer roller mount assembly. Does the spring make contact with the high-voltage contact as the front access door closes?	No	Replace the left transfer roller mount assembly.
7	Is connector FT101 making good contact at the high-voltage contact assembly?	No	Reconnect FT101 to the high-voltage contact assembly.
	For steps 8 and 9, you will need to remove the top cover, the I/O board, and the I/O shield. Install a toner cartridge.		
8	Place paper on the multipurpose tray. Connect the multimeter at connector pin J206-7 (HVT1) on the DC controller PCB and chassis ground. Press the service test print button. Is the voltage 0 VDC within five seconds after the pickup roller starts to rotate?	No	Replace the DC controller PCB.

STEP	CHECK	RESULT	ACTION
9	Connect the multimeter at connector pin J206-9 (HVT2) on the DC controller PCB and chassis ground. Press the service test print button. Does the voltage measure about +3.2 VDC within five seconds after the pickup roller starts to rotate?	No	Replace the DC controller PCB.
10	Connect the multimeter at connector pin J206-10 (HVT3) on the DC controller PCB and chassis ground. Press the service test print button. Does the voltage measure about 0 VDC within five seconds after the pickup roller starts to rotate?	No	Replace the DC controller PCB.
11	Connect the multimeter at connector pin J206-8 (HVD) on the DC controller PCB and chassis ground. Initiate a service test print. Does the voltage drop from about 7 VDC to about 0 VDC two seconds after the pickup roller starts to rotate?	Yes	Replace the high-voltage power supply.
		No	Replace the DC controller PCB.

❏ TABLE H2 – DARK IMAGE: WHOLE PRINT

STEP	CHECK	RESULT	ACTION
1	Adjust the print density-adjustment lever to lighten the image. Does the print quality improve?	Yes	Finished.
2	Clean the contact between the grounding plate of the high-voltage contact assembly and the toner cartridge. Press the service test print button. Does the print quality improve?	Yes	Finished.
3	Are the high-voltage contacts making good contact with the toner cartridge?	No	Clean the contacts or replace the high-voltage contact assembly.
4	Connect the multimeter between connector pin J206-3 (HVAC) on the DC controller PCB and the chassis ground. Press the service test print button. Does the voltage drop from about +4.5 VDC to 0 VDC when the main motor starts rotating?	Yes	Replace the high-voltage power supply.
		No	Replace the DC controller PCB.

❏ TABLE H3 – ALL-BLANK PRINT

STEP	CHECK	RESULT	ACTION
1	Does the printer spontaneously print blank pages without being sent a print command?	Yes	Replace the I/O board.
2	Has the toner cartridge sealing tape been removed?	No	Remove the sealing tape.
3	Replace the toner cartridge. Does the print quality improve?	Yes	Finished.
4	Are the high-voltage contacts making good contact with the toner cartridge?	No	Clean the contacts or replace the high-voltage contact assembly.
5	Connect the multimeter between pins J206-3 (HVAC) on the DC controller PCB and the chassis ground. Press the service test print button. Does the voltage drop from +4.5 VDC to 0 VDC when the main motor starts to rotate?	No	Replace the DC controller PCB.
6	Place paper on the multipurpose tray and connect the multimeter between pin J206-8 (HVD) on the DC controller PCB and chassis ground. Press the service test print button. Does the voltage drop from +7 VDC to 0 VDC two seconds after the pickup roller starts to rotate?	Yes	Replace the high-voltage power supply.
		No	Replace the DC controller PCB.

❑ TABLE H4 – BLACK IMAGE

STEP	CHECK	RESULT	ACTION
1	Replace the toner cartridge. Does the print quality improve?	Yes	Finished.
2	Connect the multimeter across connector pin J206-6 (HVDC) on the DC controller PCB and the chassis ground. Press the service test print button. Does the voltage drop from about +8.2 VDC to 0 VDC when the main motor starts to rotate?	Yes	Replace the high-voltage power supply.
		No	Replace the DC controller PCB.

❑ TABLE H5 – LARGE DOTS VERTICALLY IN LINE

STEP	CHECK	RESULT	ACTION
1	Locate the static charge eliminator on the fuser assembly. Is the static charge eliminator dirty?	Yes	Clean the static charge eliminator. If the problem persists, replace the static charge eliminator.
2	Use the Cleaning Page to remove excess toner from rollers inside the printer. Refer to Section 5, Preventive Maintenance, for more information. Does the print quality improve?	Yes	Finished.
3	Is the transfer roller dirty?	Yes	Clean the transfer roller using a dry, lint-free cloth. If the transfer roller cannot be cleaned, replace the transfer roller.

❏ TABLE H6 – STAINS ON BACK OF PAPER

STEP	CHECK	RESULT	ACTION
1	Is the transfer roller dirty?	Yes	Clean the transfer roller with a dry, lint-free cloth. If the transfer roller cannot be cleaned, replace the transfer roller.
2	Is the paper cassette entrance guide dirty?	Yes	Clean the paper cassette entrance guide with a clean, lint-free cloth.
3	Are the feeder rollers dirty?	Yes	Clean the feeder rollers with a clean, lint-free cloth dampened slightly with water.
4	Are the upper and lower fuser rollers dirty?	Yes	Use the Cleaning Page to remove excess toner from the fuser rollers. Refer to Section 5, Preventive Maintenance, for more information.

❏ TABLE H7 – DARK VERTICAL LINES

STEP	CHECK	RESULT	ACTION
1	Press the service test print button. Open the front access door while a print is being made. Open the protective shield of the toner cartridge. Can you see vertical black lines on the drum?	Yes	Replace the toner cartridge.
2	Are the fuser rollers dirty?	Yes	Use the Cleaning Page to remove excess toner from the fuser rollers. Refer to Section 5, Preventive Maintenance, for more information.
3	Is the fuser assembly damaged?	Yes	Replace the fuser assembly.

❏ TABLE H8 – SMUDGED VERTICAL BANDS

STEP	CHECK	RESULT	ACTION
1	Replace the toner cartridge. Does the print image improve?	Yes	Finished.
2	Are the fuser rollers dirty?	Yes	Use the Cleaning Page to remove excess toner from the fuser rollers. Refer to Section 5, Preventive Maintenance, for more information.
3	Locate the static charge eliminator on the fuser assembly. Is the static charge eliminator dirty?	Yes	Clean the static charge eliminator. If the problem persists, replace the static charge eliminator.

❑ TABLE H9 – SMUDGED HORIZONTAL BANDS

STEP	CHECK	RESULT	ACTION
1	Are the fuser rollers dirty?	Yes	Use the Cleaning Page to remove excess toner from the fuser rollers. Refer to Section 5, Preventive Maintenance, for more information.
2	Press the service test print button. Do the horizontal bands appear at regular intervals on the test print?	Yes	Replace the toner cartridge.
		No	Replace the fuser assembly.

❏ TABLE H10 – BLANK SPOTS

STEP	CHECK	RESULT	ACTION
1	Check the paper in the paper cassette tray for dampness. Is the paper damp?	Yes	Replace the paper.
2	Replace the toner cartridge. Does the print quality improve?	Yes	Finished.
3	Is the transfer roller dirty?	Yes	Clean the transfer roller using a dry, lint-free cloth. If the transfer roller cannot be cleaned, replace the transfer roller.

❏ TABLE H11 – SOLID WHITE VERTICAL LINES

STEP	CHECK	RESULT	ACTION
1	Remove the toner cartridge from the printer and rock it back and forth to distribute toner evenly. Does the print quality improve?	Yes	Finished.
2	Remove the toner cartridge from the printer and open the toner cartridge protective shield. Can vertical white streaks be seen on the surface of the drum?	Yes	Replace the toner cartridge.
3	Remove the toner cartridge from the printer. Is any foreign material adhering to the laser beam outlet on the inside of the printer chassis? Is any foreign material adhering to the laser beam access slot on the toner cartridge?	Yes	Remove the foreign material.
4	Remove the lens assembly from the printer. Is any foreign material adhering to the lens?	Yes	Replace the lens assembly.

❏ TABLE H12 – FAULTY REGISTRATION

STEP	CHECK	RESULT	ACTION
1	Is the paper cassette or the multipurpose tray loaded with too much paper?	Yes	Remove excess paper.
2	Is recommended paper being used?	No	Replace with recommended paper for type of printing being done. See Section 1, Basics, "Specifications," for recommended paper.
3	Perform the leading-edge registration adjustment procedure. (See Section 3, Adjustments.) Does the print image improve?	Yes	Finished.
4	Is the pickup unit paper sensor arm/spring damaged or broken?	Yes	Replace the pickup unit paper sensor arm.
5	Connect the multimeter between J208-1 (PFSNS) on the DC controller PCB and the chassis ground. Press the service test print button. Does the voltage change from +5 VDC to 0 VDC when the paper passes the pickup unit paper sensor arm (PS13)?	No	Replace photo-interrupter PS13, the pickup unit paper sensor, on the feeder assembly.
		Yes	Replace the DC controller PCB.

❏ TABLE H13 – POOR FUSING

STEP	CHECK	RESULT	ACTION
1	Is the transfer roller dirty?	Yes	Clean the transfer roller with a dry, lint-free cloth. If the transfer roller cannot be cleaned, replace the transfer roller.
2	Initiate 10 service test prints. Is the print quality of the last test print lighter than the first test print?	Yes	Replace the fuser assembly.
3	Is the lower fuser roller dirty?	Yes	Use the Cleaning Page to remove excess toner from the lower fuser roller.
4	Perform the nip width measurement procedure described in Section 4, Troubleshooting. Is the nip width correct?	Yes	Replace the fuser assembly.
5	Replace the paper used with paper recommended for type of printing being done. See Section 1, Basics, "Specifications," for recommended paper.		
	Does the print quality improve?	Yes	Finished.
		No	Replace the fuser assembly.

❑ TABLE J – PAPER TRANSPORT PROBLEMS

STEP	CHECK	RESULT	ACTION
1	Remove the top cover, the I/O board, and the I/O shield. Open the front access door to observe the location of the paper.		
a)	Was any paper picked up from the paper cassette?	No	Go to "Table J1 – No Paper Pickup from Cassette."
b)	Was any paper picked up from the multipurpose tray?	No	Go to "Table J2 – No Paper Pickup from Multipurpose Tray."
c)	Is the paper jam in the paper pickup area?	Yes	Go to "Table J3 – Jams in Paper Pickup Area."
d)	Is the paper jam in the fuser or delivery area?	Yes	Go to "Table J4 – Jams In Fuser/Delivery Area."
e)	Are there any sheets of paper stuck together in the paper path?	Yes	Go to "Table J5 – Sheets Stuck Together."
f)	Is the paper wrinkled?	Yes	Go to "Table J6 – Wrinkles."
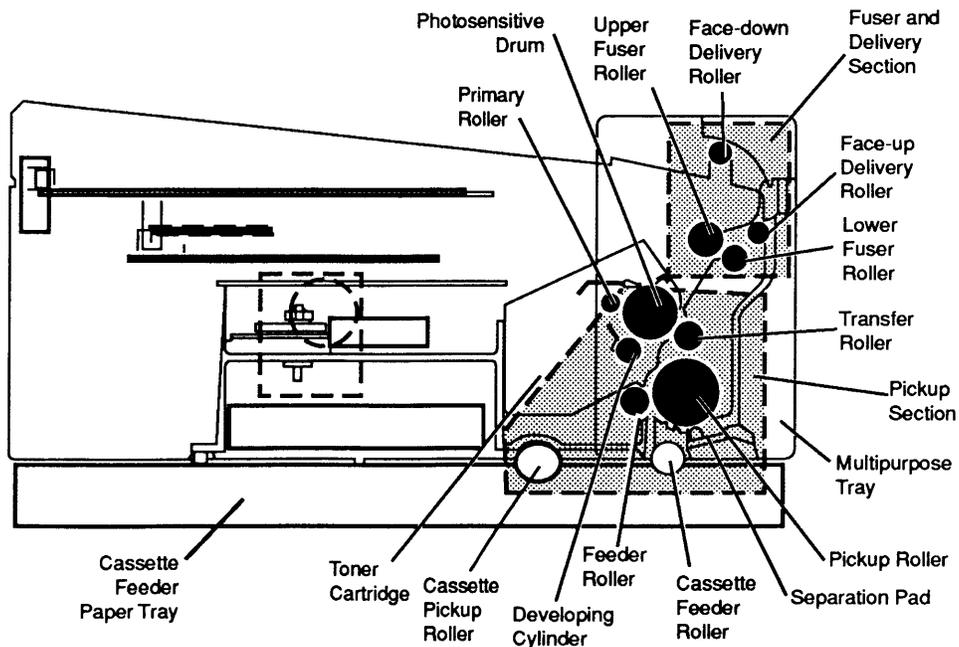
Figure 4-2 Paper Feed Path

❏ TABLE J1 – NO PAPER PICKUP FROM CASSETTE

STEP	CHECK	RESULT	ACTION
1	Is connector J205 on the DC controller PCB making good contact?	No	Reconnect J205 to the DC controller PCB.
2	With connector J208 connected to the DC controller PCB, connect one lead of the multimeter to connector pin J208-1 (PFSNS) and the other lead to chassis ground. Switch on the printer. Is the voltage +5 VDC?	No	Replace photo-interrupter PS13, the pickup unit paper sensor, on the feeder assembly.
3	Connect the multimeter to TB703-1 on the density-adjusting PCB and the chassis ground. Switch on the printer. Is the voltage +5 VDC?	No	Replace photo-interrupter PS 12, the delivery unit paper sensor, on the mounting plate sensor.
4	Remove the paper cassette from the printer. Did the leading edge of the paper from the paper cassette feed as far as the cassette feed rollers?	No	Proceed to step 7.
5	Install paper in the paper cassette and place the cassette in the printer. Connect one lead of the multimeter to connector pin J205-7 (OPMD) on the DC controller PCB and the other lead to the chassis ground. Switch on the printer, wait one minute, and press the service test print switch. Does the voltage briefly change from 0 VDC to 1.4 VDC?	No	<u>Replace the DC controller PCB.</u>
6	Disconnect connector J902 on the cassette feeder PCB assembly. Measure the resistance between J902-4 and J902-5 on the cassette feeder roller clutch solenoid side. Is the reading approximately 0 ohms (ideally 0.22 ohms)?	No	Replace the cassette sensor cable.
		Yes	<u>Replace the cassette feeder PCB assembly.</u>

| 7 | Connect one lead of the multimeter to connector pin J205-8 (OPCD) and the other lead to the chassis ground. Press the service test print button. Does the voltage briefly change from 0 VDC to 1.4 VDC? | No | Replace the DC controller PCB. |

| 8 | Disconnect connector J902 from the cassette feeder PCB assembly. Measure the resistance between J902-6 and J902-7. Is the reading approximately 0 ohms (ideally 0.124 ohms)? | No | Replace the cassette sensor cable. |
| | | Yes | Replace the cassette feeder PCB assembly. |

❏ TABLE J2 – NO PAPER PICKUP FROM MULTIPURPOSE TRAY (1 of 2)

STEP	*CHECK*	*RESULT*	*ACTION*
	Open the front access door. Locate the paper guide plate directly behind the pickup roller assembly **(Figure 4-3)**.		
1	Are the paper guide plate spring and access door cap installed?	No	Install the paper guide plate spring and access door cap.
2	Does grounding plate A prevent the paper guide plate from moving freely? (Grounding plate A is located to the right of the paper guide plate.)	Yes	Replace the old grounding plate A.
3	Is connector J209 on the DC controller PCB making good contact?	No	Reconnect connector J209 to the DC controller PCB.
4	With connector J208 connected to the DC controller PCB, connect the multimeter to connector pin J208-1 (PFSNS) and the chassis ground. Switch on the printer. Is the voltage +5 VDC?	No	Replace photo-interrupter PS 13, the pickup unit paper sensor, on the feeder assembly.

Figure 4-3 Paper Guide Plate

5	Connect the multimeter to TB703-1 on the density-adjusting PCB and the chassis ground. Switch on the printer. Is the voltage +5 VDC?	No	Replace photo-interrupter PS12, the delivery unit paper sensor, located on the mounting plate sensor.
6	Place paper on the multipurpose tray. Connect the multimeter between connector pin J209-2 (PFRDV) on the DC controller PCB and the chassis ground. Press the service test print button. Does the voltage briefly drop from about +24 VDC to 0 VDC?	Yes	Replace the multipurpose cable assembly.
		No	Replace the DC controller PCB.

❏ TABLE J3 – JAMS IN PAPER PICKUP AREA (1 of 2)

STEP	CHECK	RESULT	ACTION
1	Is recommended paper being used?	No	Replace with recommended paper for the type of printing being done. See Section 1, Basics, "Specifications," for recommended paper.
2	Is the paper wrinkled or curled?	Yes	Use fresh paper.
3	Does the jam occur when using the paper cassette?	Yes	Proceed to step 9.
4	Is the multipurpose tray loaded with too much paper?	Yes	Remove excess paper.
5	Open the front access door and observe the rollers on the pickup roller assembly. Are the pickup rollers worn or deformed?	Yes	Replace the pickup roller assembly.
6	Rotate the large black gear on the pickup roller assembly. Does the pickup roller rotate without binding?	No	Replace the pickup roller assembly.
7	Is connector J209 on the DC controller PCB making good contact?	No	Reconnect connector J209 to the DC controller PCB.
8	Place paper on the multipurpose tray. Connect the multimeter between connector pin J209-2 (PFRDV) on the DC controller PCB and the chassis ground. Press the service test print button. Does the voltage change from +24 VDC to 0 VDC?	Yes	Replace the multipurpose cable assembly.
		No	Replace the DC controller PCB.
9	Is the paper cassette installed properly in the printer?	No	Reinstall the paper cassette properly.
10	Is the paper cassette loaded with too much paper?	Yes	Remove excess paper.
11	Are the cassette pickup rollers deformed or worn?	Yes	Replace the cassette pickup rollers.

STEP	*CHECK*	*RESULT*	*ACTION*
12	Are the cassette feed rollers deformed or worn?	Yes	Replace the cassette feed rollers.
13	Does the paper move from the paper cassette to the printer feeder rollers?	No	Check the cassette tray for damage or missing pressure plate springs. Check for obstruction in the printer inlet to the feeder roller area. Check the cassette feeder tray for proper alignment.
14	Is connector J208 on the DC controller PCB making good contact?	No	Reconnect J208 to the DC controller PCB.
15	Locate the pickup unit paper sensor arm between the feeder rollers and the separation pad. Is the pickup unit paper sensor arm/spring damaged or broken?	Yes	Replace the pickup unit paper sensor arm.
16	Connect the multimeter across connector pins J208-1 (PFSNS) and J208-2 (GND) on the DC controller PCB. Depress the service test print button. Does the voltage change from +5 VDC to 0 VDC when the paper passes the pickup unit paper sensor?	No	Replace photo-interrupter PS13, the pickup unit paper sensor, on the feeder assembly.
		Yes	Replace the DC controller PCB.

❏ TABLE J4 – JAMS IN FUSER/DELIVERY AREA (1 of 2)

STEP	CHECK	RESULT	ACTION
1	Open the front access door and locate the delivery unit paper sensor arm on the fuser assembly. Is the delivery unit paper sensor arm damaged or broken?	Yes	Replace the delivery unit paper sensor arm.
2	Allow the fuser rollers to cool and then remove the fuser assembly. Inspect the lower fuser roller. Is the lower fuser roller dirty?	Yes	Use the Cleaning Page to remove excess toner from the lower fuser roller. See "Using the Cleaning Page" in Section 5, Preventive Maintenance.
3	Do the fuser rollers rotate without binding?	No	Use the Cleaning Page to remove excess toner from the fuser rollers. If the problem persists, replace the fuser assembly.
4	Locate the three white gears next to connector J502 on the front access door. Rotate the largest of the three gears. Do the face-down delivery rollers and the face-up cover delivery rollers rotate freely?	No	Replace the face-down delivery assembly or the face-up cover assembly, as required.
5	Is the paper deflector correctly set to send paper to either the face-down tray or the face-up tray?	No	Set the paper deflector to the correct face-up or face-down position.
6	Locate the delivery rollers on the face-down delivery assembly. Are the face-down delivery rollers worn or deformed?	Yes	Replace the face-down delivery assembly.
7	Locate the delivery rollers on the face-up cover assembly. Are the face-up delivery rollers worn or deformed?	Yes	Replace the face-up cover assembly.
8	Locate the pickup unit paper sensor arm between the feed rollers and the separation pad. Is the pickup unit paper sensor arm/spring damaged or broken?	Yes	Replace the pickup unit paper sensor arm.

STEP	CHECK	RESULT	ACTION
9	Connect the multimeter across connector pins J208-1 (PFSNS) and J208-2 (GND) on the DC controller PCB. Depress the service test print button. Does the voltage change from +5 VDC to 0 VDC when the paper passes the pickup unit paper sensor?	No	Replace photo-interrupter PS13, the pickup unit paper sensor, located on the feeder assembly.
10	Connect the multimeter across connector pins J213-5 (POSNS) and J213-9 (GND) on the DC controller PCB. Press the service test print button. Does the voltage change from +5 VDC to 0 VDC when the paper passes the delivery unit paper sensor?	No	Check the wiring from J213 on the DC controller to J13 on the mounting plate sensor. If the wiring is faulty, replace the density-adjusting PCB. If the wiring is correct, replace photo-interrupter PS12, the delivery unit paper sensor, located on the mounting plate sensor.
		Yes	Replace the DC controller PCB.

❑ TABLE J5 – SHEETS STUCK TOGETHER

STEP	CHECK	RESULT	ACTION
1	Is recommended paper being used?	No	Replace with recommended paper for type of printing being done. See Section 1, Basics, "Specifications," for recommended paper.
2	Is the surface of the separation pad worn?	Yes	<u>Replace the separation pad</u>.
3	Remove the paper cassette. Is the paper positioned correctly under the paper cassette hold-down brackets?	No	Replace the paper in the paper cassette.
4	Are the paper cassette hold-down brackets damaged or deformed?	Yes	Replace the paper cassette hold-down brackets.

❏ TABLE J6 – WRINKLES

STEP	CHECK	RESULT	ACTION
1	Is recommended paper being used?	No	Replace with recommended paper for type of printing being done. See Section 1, Basics, "Specifications," for recommended paper.
2	Do the wrinkles disappear when fresh paper is used?	Yes	Finished.
3	Press the service test print button and open the front access door while the paper is passing through the feeder assembly.		
	Is the paper wrinkled?	Yes	Check that the cassette pickup rollers and the cassette feed rollers are clean and undamaged. If the rollers are damaged, replace the cassette pickup and the cassette feed rollers.
4	Remove the fuser assembly and inspect the lower fuser roller. Is the lower fuser roller dirty?	Yes	Use the Cleaning Page to remove excess toner from. the lower fuser roller. See Section 5, Preventive Maintenance, "Using the Cleaning Page."
		No	Replace the fuser assembly.

❏ TABLE K – JAMS DETECTED WHEN THERE ARE NO JAMS

STEP	CHECK	RESULT	ACTION
1	Does the Paper Jam LED immediately light when you switch the printer on?	Yes	Check that no paper fragments or other obstructions are in the fuser/delivery area or paper pickup area.
2	Open the front access door and locate the delivery unit paper sensor arm on the fuser assembly. Is the delivery unit paper sensor arm damaged or broken?	Yes	Replace the delivery unit paper sensor arm.
3	Locate the pickup unit paper sensor arm between the feed rollers and the separation pad. Is the pickup unit paper sensor arm/spring damaged or broken?	Yes	Replace the pickup unit paper sensor arm.
4	Connect the multimeter across connector pins J208-1 (PFSNS) and J208-2 (GND) on the DC controller PCB. Depress the service test print button. Does the voltage change from +5 VDC to 0 VDC when the paper passes the pickup unit paper sensor?	No	Replace photo-interrupter PS13, the pickup unit paper sensor, located on the feeder assembly.
5	Connect the multimeter across connector pins J213-5 (POSNS) and J213-9 (GND) on the DC controller PCB. Press the service test print button. Does the voltage change from +5 VDC to 0 VDC when the paper passes the delivery unit paper sensor?	No	Check the wiring from J213 on the DC controller to J13 on the mounting plate sensor. If the wiring is faulty, <u>replace the density-adjusting PCB</u>. If the wiring is correct, replace photo-interrupter PS12, the delivery unit paper sensor, located on the mounting plate sensor.
		Yes	<u>Replace the DC controller PCB</u>.

❏ DC CONTROLLER PCB

Figure 4-4 LaserWriter NT, SC, and NTR DC Controller PCB

J201 (Interconnect PCB)
J202 (Laser Assembly)
J203 (Scanner Motor)
J204 (Optical-Fiber Cable)
J205 (Cassette Feeder PCB)
J206 (High-Voltage Power Supply)

J207 (Test Connector)
J208 (Photo-Interrupter PS13)
J209 (Fuser Assembly)
J210 (Main Motor)
J212 (Power Supply Unit)
J213 (Density-Adjusting PCB)

Figure 4-5 LaserWriter LS DC Controller PCB

J201 (LS I/O Board)

J202 (Laser Assembly)

J203 (Scanner Motor)

J204 (Optical-Fiber Cable)

J205 (Cassette Feeder PCB)

J206 (High-Voltage Power Supply)

J207 (Test Connector)

J208 (Photo-Interrupter PS13)

J209 (Fuser Assembly)

J210 (Main Motor)

J211 (Test Connector)

J212 (Power Supply Unit)

J213 (Density-Adjusting PCB)

Figure 4-6 LaserWriter LS/L Serial Controller

J202	(Laser Assembly)	J208	(Photo-Interrupter PS13)
J203	(Scanner Motor)	J209	(Fuser Assembly)
J204	(Optical-Fiber Cable)	J210	(Main Motor)
J205	(Cassette Feeder PCB)	J212	(Power Supply Unit)
J206	(High-Voltage Power Supply)	J213	(Fan and Sensor PCB)
J207	(Test Connector)	J215	(Status Lights)

❏ CASSETTE FEEDER PCB AND DENSITY-ADJUSTING PCB
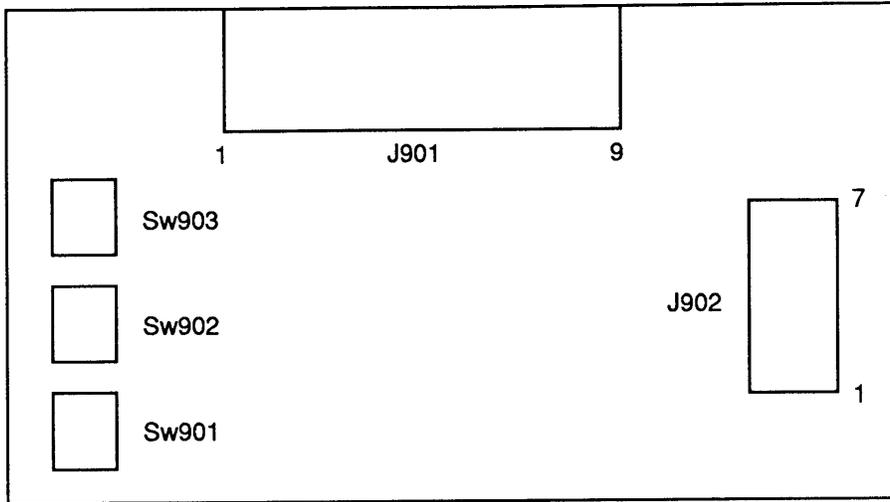
Figure 4-7 Cassette Feeder PCB

J901 (DC Controller PCB)   J902 (Photo-Interrupter PS901,
                                                  SL901, SL902)
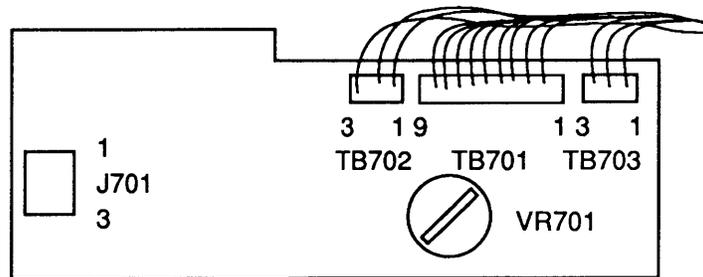
Figure 4-8 Density-Adjusting PCB

J701 (Fan)   TB702 (Photo-Interrupter PS11)
TB701 (DC Controller PCB)   TB703 (Photo-Interrupter PS12)

❏ SENSOR AND SOLENOID LOCATIONS

PS13
Pickup Unit
Paper Sensor

PS12
Delivery Unit
Paper Sensor

PS11
Toner Cartridge
Sensor

PS502
Face-up
Cover Sensor

PS901
Paper Cassette
Sensor

SL901
Cassette Pickup
Roller Solenoid

SL902
Cassette Feed
Roller Solenoid

PS501
Multipurpose Tray
Sensor

SL501
Pickup Roller
Solenoid
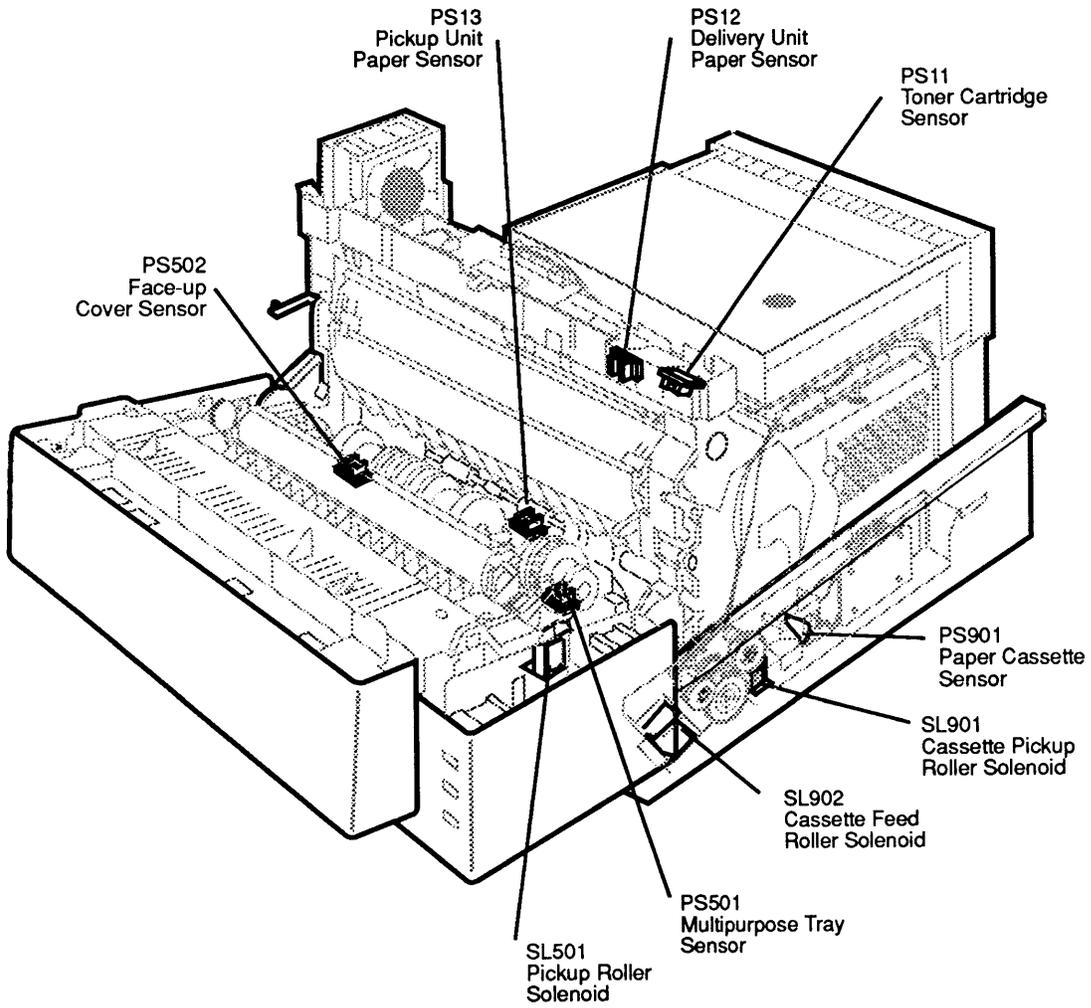
Figure 4-9 Sensors and Solenoids

❏ SWITCH LOCATIONS
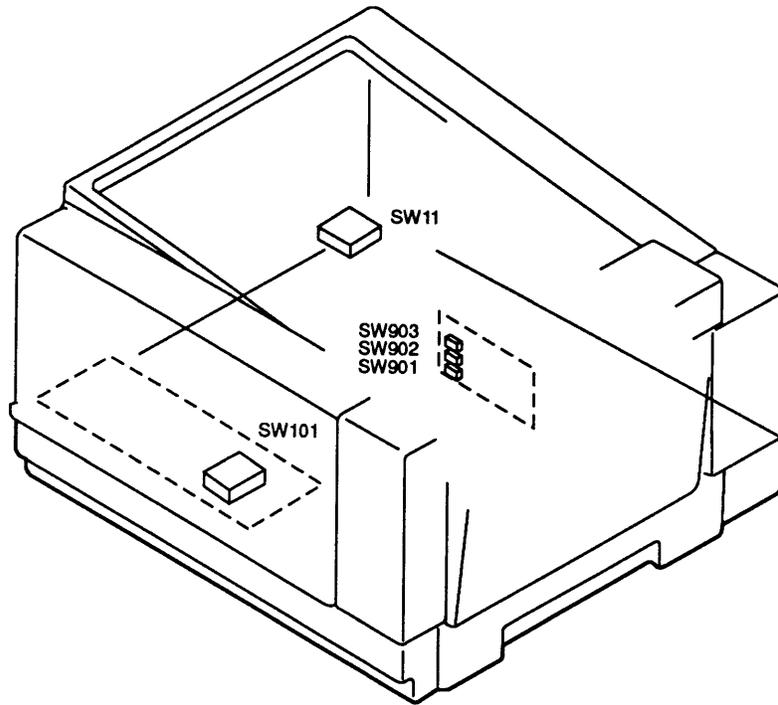
Figure 4-10 Switches

SW11   (AC Power Switch)   SW902   (Paper Size Microswitch)
SW101 (Power Interlock Switch)   SW903   (Paper Size Microswitch)
SW901 (Paper Size Microswitch)

❏ MOTOR LOCATIONS
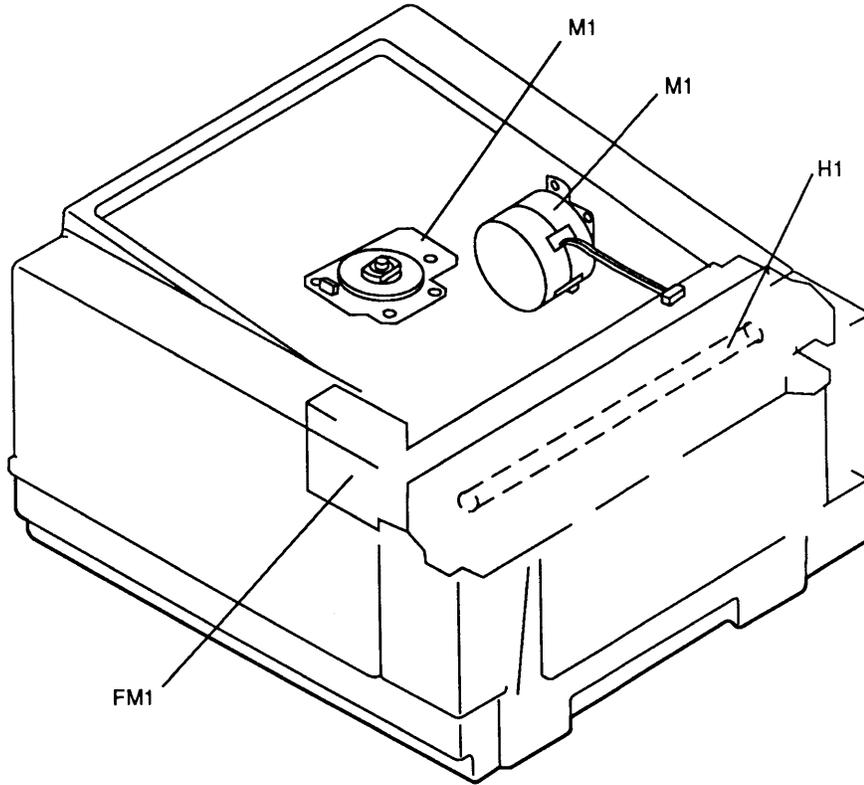
Figure 4-11 Motors

M1 (Main Motor)   FM11   (Exhaust Fan Motor)
M2 (Scanner Motor)

❏ NIP WIDTH MEASUREMENT

Perform the nip width measurement whenever poor or irregular fusing occurs. The nip width measurement shows whether the fuser assembly rollers exert uniform pressure on each printed page. If they do not, replace the lower fuser roller. If the problem remains, replace the fuser assembly.

Measurement Procedure

1. Remove the top cover, the I/O board, and the I/O shield.

2. Using a copy machine, make several copies of letter size, all-black paper.

3. Place the all-black sheets of paper on the multipurpose tray.

4. Switch on the power and press the service test print button on the DC controller PCB.

5. When the leading edge of the paper appears at the face-down delivery rollers, switch off the power, wait 10 seconds, and switch the power back on.

Width	Measure when upper and lower rollers are hot.
b	2-3 mm
a-b	Under 0.5 mm
b-c	Under 0.5 mm
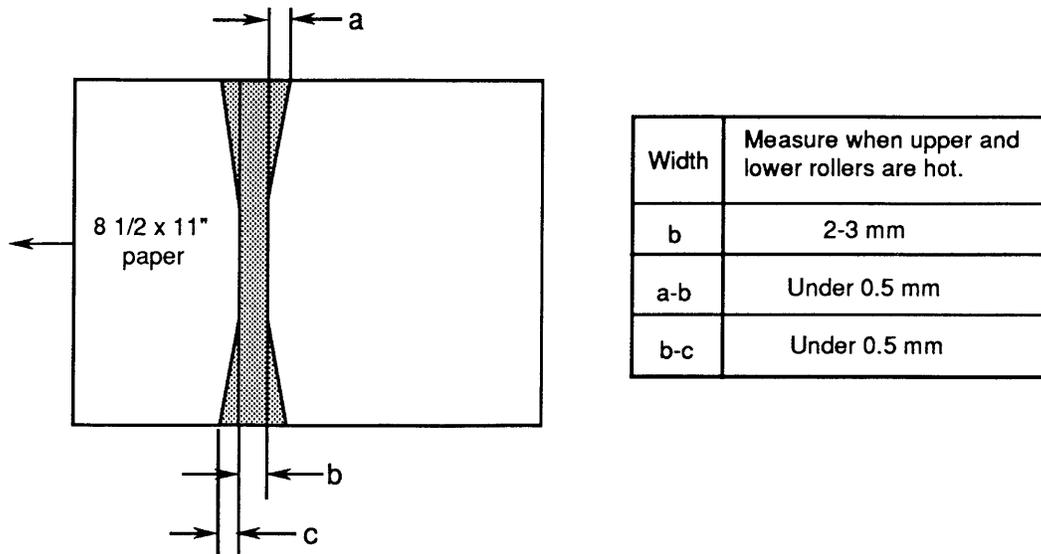
Figure 4-12 Nip Width Measurement

6. Using a metric ruler, measure the width of the glossy band on the paper. The band should be 2 to 3 mm wide at its center **(Figure 4-10, measurement b)** and should extend no more then .5 mm at the top or bottom edge **(Figure 4-10, measurements a and c).**

7. If the measurement fails to meet specifications, replace the lower fuser roller and perform the nip width measurement again. If the nip width measurement is still outside specifications, replace the fuser assembly.

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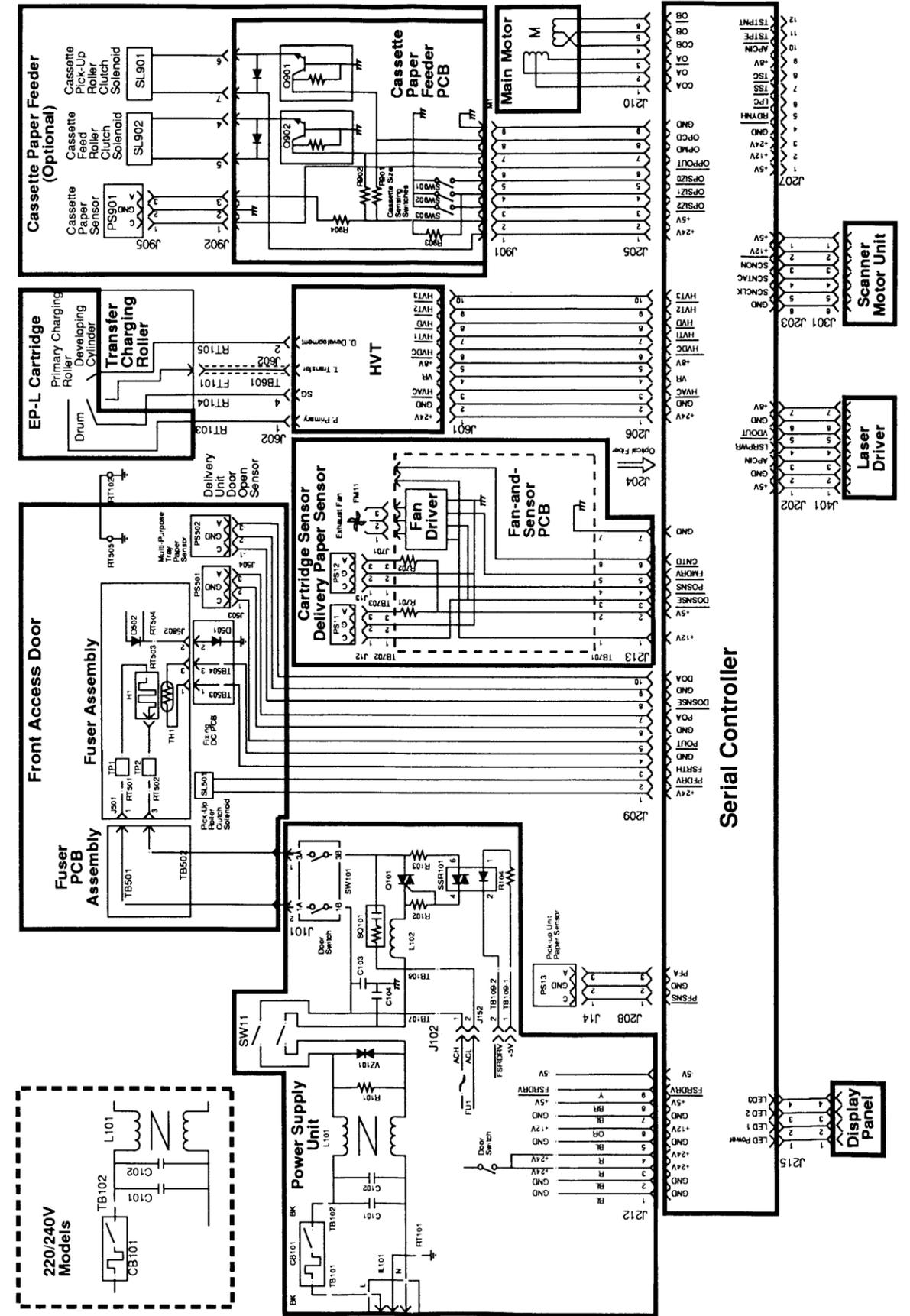
Apple Personal LaserWriter

Section 5 – Preventive Maintenance

❏ CONTENTS

Note: If a step is underlined, detailed instructions for that step can be found in Section 2, Take-Apart.

Figure 5-1 Replacing the Toner Cartridge

❑ PREVENTIVE MAINTENANCE

Introduction

The Apple Personal LaserWriter requires very little routine maintenance. Maintenance procedures include replacing the toner cartridge when it runs out of toner, using the Cleaning Page to remove excess toner from rollers inside the printer, and cleaning the inside and outside of the printer.

Before Beginning

Before you begin performing preventive maintenance on the Apple Personal LaserWriter, be sure to do the following:

- Power off and unplug the printer.

- Allow the internal mechanisms to cool before starting preventive maintenance procedures.

- Prepare your work area for electrostatic discharge (ESD) prevention.

Materials Required

#2 Phillips screwdriver, magnetized
ESD-safe workstation
Soft, lint-free cloth (for cleaning)

Replacing the Toner Cartridge

Each toner cartridge prints approximately 3500 prints, depending upon the kind of printing being done. When prints begin to fade or you can see thin white lines in dark images, replace the toner cartridge as follows:

1. Open the front access door and remove the used toner cartridge.

2. Unpack the new toner cartridge.

3. Hold the cartridge horizontally and slowly rock it from side to side to distribute the toner evenly **(Figure 5-1)**.

4. Pull the tab located at one end of the toner cartridge to remove the tape **(Figure 5-1)**.

5. Install the new toner cartridge and close the front access door **(Figure 5-1)**.

**Using the
Cleaning Page**

Use the Cleaning Page whenever you replace a toner cartridge or if frequent paper jams are occurring in the fuser area. The Cleaning Page is used to remove excess toner from the fuser rollers and other rollers inside the printer.

1. Open the multipurpose tray and place several sheets of letter-size paper on the tray.

2. Select the Cleaning Page document located on the *Installation Disk*.

3. Select **Print** from the File menu.

4. In the Print dialog box, select **Manual Feed** and click **OK**. The printer will produce a Cleaning Page print.

5. Place the Cleaning Page print face-up on the multipurpose tray **(Figure 5-2)**.

6. Reselect the Cleaning Page document and choose **Print** from the File menu.

7. When the Print dialog box reappears, select **Manual Feed** and click **OK**.

Ajust guide to fit
snugly against page

Insert page face up.
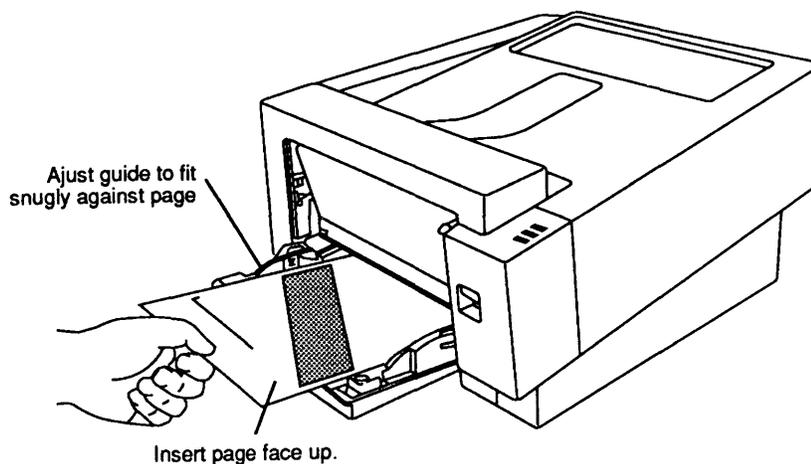
Figure 5-2 Cleaning Page

**Cleaning Inside
the Printer**

Perform the following cleaning procedures whenever the printer is being serviced:

WARNING: *To prevent serious injury, always unplug the printer's power cord from the AC power outlet before cleaning the printer.*

Separation Pad

Clean the separation pad with a dry, lint-free cloth, or replace the separation pad if it is worn.

Transfer Roller

1. Remove the transfer roller.

2. Clean the transfer roller with a dry, lint-free cloth.

3. Replace the transfer roller.

CAUTION: *Do not touch the transfer roller with your fingers during cleaning. Oil from your fingers can damage the roller.*

Pickup Roller

1. Remove the pickup roller assembly.

2. Using a clean, lint-free cloth dampened with water, clean the pickup rollers.

3. Replace the pickup roller assembly.

Feeder Assembly

Clean the feeder assembly rollers using a clean, lint-free cloth dampened with water.

Cassette Rollers

1. Remove the paper cassette from the printer.

2. Remove the cassette feeder tray.

3. Using a clean, slightly damp cloth, clean the cassette pickup rollers and the cassette feed rollers.

4. Replace the cassette feeder tray.

5. Replace the paper cassette.

Fuser Assembly

To remove toner buildup from the the fuser assembly rollers, use the printer generated Cleaning Page. For additional information on performing this procedure, refer to "Using the Cleaning Page" in this section.

**Cleaning Outside
the Printer**

1. Power off and unplug the printer.

2. Clean the exterior of the printer with a clean, damp cloth **(Figure 5-3)**. Use a mild soap or detergent if necessary.

CAUTION: *Never use an ammonia-based cleaner or any other chemical-based cleaning solution on the Apple Personal LaserWriter. These cleaners can discolor the printer's plastic covers.*
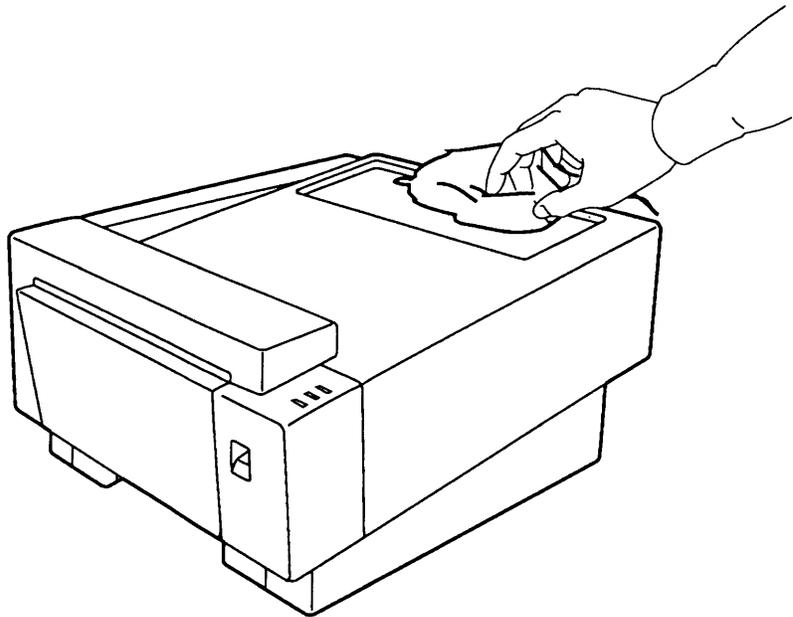
Figure 5-3 Cleaning Outside the Printer

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Apple Personal LaserWriter

Section 6 – Additional Procedures

❏ CONTENTS

Note: Detailed instructions for underlined steps are found in Section 2, Take-Apart.

❏ I/O BOARD INSTALLATION (LASERWRITER NT, SC, AND NTR)

Introduction

Apple ships the Apple Personal LaserWriter NT, SC, and NTR without the I/O board installed. Before giving the printer to the customer, check the operation of the print engine, install the I/O board, and verify the installation by connecting the printer to a Macintosh computer and printing a test document.

Materials Required

Apple Personal LaserWriter printer
NT, SC, or NTR I/O board
#2 Phillips screwdriver
Paper
Power cord
Toner cartridge
Pencil
ESD-safe workstation

Electrostatic Discharge Precautions

The Personal LaserWriter I/O boards contain components that are sensitive to electrostatic discharge (ESD). When handling the I/O boards, be sure to follow the ESD prevention information in Section 1, Basics.

Checking the Print Engine

Before installing the I/O board, verify that the print engine functions properly.

1. Unpack the printer and the toner cartridge, using the instructions in the *Personal LaserWriter Owner's Guide.*

2. Open the front access door of the printer and remove the orange plastic shipping containers.

3. Install the toner cartridge and close the front access door.

4. Load the paper cassette with paper and install the cassette in the printer.

5. <u>Remove the top cover</u>.

6. Connect a power cord to the printer.

7. Power on the printer and wait 60 seconds for the printer to warm up.

8. Push a pencil (eraser-end first) through the opening at the rear of the printer and press the service test print button on the DC controller PCB. The service test print verifies the print engine operation.

   If the service test print is not delivered, refer to "Troubleshooting Procedure," in Section 4, Troubleshooting to isolate the failure.

9. Replace the top cover and proceed to Configuring the I/O Board.

Configuring the I/O Board

The Apple Personal LaserWriter I/O board should not need to be configured. Switches are preset at the factory and generally should not need to be changed.

NT and NTR I/O Boards

The NT and NTR boards come from the factory configured to communicate over an AppleTalk network using the LocalTalk cabling system. If you wish to communicate via the 25-pin serial port, refer to the *Personal LaserWriter NT and NTR Owner's Guides* for the proper rotary switch settings.

SC I/O Board

The SC board communicates with a host computer via the small computer system interface (SCSI). When the SC board ships from Apple, the SCSI priority switch is on "4."

Installing the I/O Board

1. Remove the I/O board from its packing box, but do not remove the antistatic bag.

2. Power off the printer and unplug the power cord.

CAUTION: Installing the I/O board when the printer is powered on can cause permanent damage to the Apple Personal LaserWriter and the I/O board.

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3. To discharge any static electricity you may have accumulated, touch a finger to one of the three prongs (below the power switch) where the power cord attaches to the printer.

4. Remove the I/O board from the antistatic bag.

5. Holding the I/O board by the metal connector panel, **turn the board so that the component side faces down.**

6. Carefully slide the board (component-side down) into the I/O board opening at the rear of the printer **(Figure 6-1)**.

Slide Tracks

I/O Board

Component-side down
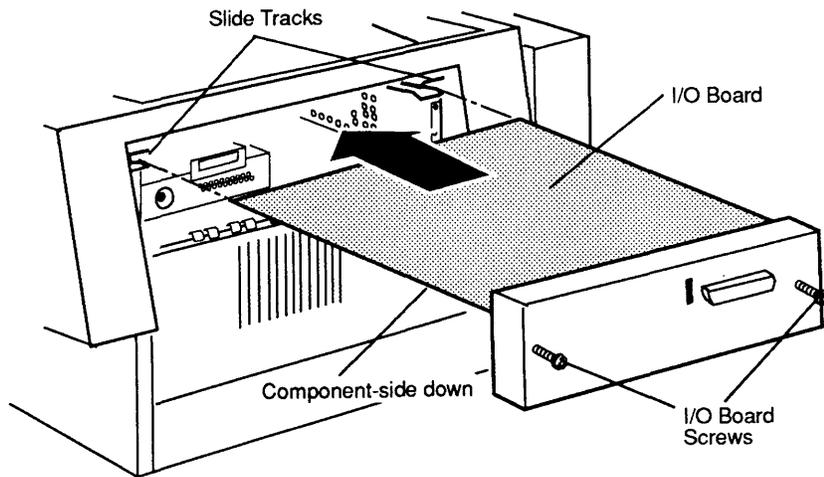
I/O Board
Screws

Figure 6-1 Installing the I/O Board

7. Using a Phillips screwdriver, tighten the two screws, one on each side of the I/O board connector panel.

**Checking
the Installation**

Before delivering the printer to the customer, verify the I/O board installation by connecting the printer to a Macintosh computer and printing a test document.

Note: The SC, NT, and NTR I/O boards use different cables to connect to the Macintosh computer.

Materials Required

Apple Personal LaserWriter with I/O board installed
Macintosh Plus, SE, SE/30, Classic, Classic II, LC, LC II,
II, IIx, IIsi, IIfx, IIcx, IIci, Quadra 700, or Quadra 900
Paper cassette
Paper
Power cord
Toner cartridge

For the SC:
SCSI system cable
SCSI terminator
Personal LaserWriter SC Installation disk

For the NT and NTR:
LocalTalk connector box for the Macintosh computer
LocalTalk connector box with mini DIN-8 connector
    for the printer
A LocalTalk cable
Personal LaserWriter NT or *NTR Installation* disk

NT and NTR
I/O Boards

1. Make sure the Apple Personal LaserWriter and
   the Macintosh computer are powered off.

2. Connect a LocalTalk connector box to the printer
   port on the Macintosh computer.

3. Connect a LocalTalk connector box to the LocalTalk
   port on the LaserWriter printer.

4. Attach the two-meter LocalTalk cable between the
   connector boxes.

5. Plug in the power cord, switch on the LaserWriter
   printer, and wait for the user test print to appear.

   If the user test print is not delivered, refer to
   "Troubleshooting Procedure" in Section 4,
   Troubleshooting.

6. Switch on the Macintosh computer and insert the
   Personal LaserWriter NT or *NTR Installation Disk*
   into the internal disk drive.

7. Click on the *Personal LaserWriter NT* or *NTR Installation Disk* icon.

8. Copy the LaserWriter and LaserPrep files to the System Folder on the Macintosh startup disk.

9. Click on the Namer icon on the *Personal LaserWriter NT* or *NTR Installation Disk.*

10. When the Namer dialog box appears, perform the following steps to name the LaserWriter printer:

    a) Click on the LaserWriter icon to select the device type.

    b) Click on the current name of the printer.

    c) Enter a new name for the printer and click on **Rename.**

    d) Click on **Quit** when you are finished.

11. Select **Chooser** from the menu.

12. Click on the LaserWriter icon to select the Personal LaserWriter NT or NTR as the device type.

13. When the LaserWriter name appears, select it.

14. Close the Chooser.

15. Select **Print Directory** from the File menu.

    If a directory prints, the installation is complete.

    If a directory does not print, refer to "Troubleshooting Procedure" in Section 4, Troubleshooting.

SC I/O Board

1. Make sure both the Apple Personal LaserWriter and the Macintosh computer are powered off.

2. Connect the small end of the SCSI system cable to the SCSI port on the Macintosh computer.

3. Connect the large end of the SCSI system cable to either SCSI port on the LaserWriter printer.

4. Attach the cable terminator to the other SCSI port on the LaserWriter printer.

5. Make sure the SCSI select switch is set to the correct SCSI ID number.

6. Connect a power cord to the LaserWriter printer and power on the printer. After about one minute the green "ready" light will glow steadily.

   If the green "ready" light does not glow steadily after one minute, refer to "Troubleshooting Procedure" in Section 4, Troubleshooting.

7. Power on the Macintosh computer and insert the *Personal LaserWriter SC Installation Disk* into the internal disk drive.

8. Click on the *Personal LaserWriter SC Installation Disk* icon.

9. Copy the Personal LaserWriter SC icon to the System Folder on the Macintosh computer startup disk.

10. Select **Chooser** from the menu.

11. Click on the Personal LaserWriter SC icon to select the device type.

12. Close the Chooser.

13. Select **Print Directory** from the File menu.

    If a directory is printed, the installation is complete.

    If a directory is not printed, refer to "Troubleshooting Procedure" in Section 4, Troubleshooting.

❏ 110 V AND 220 V CONVERSIONS

Introduction

Apple Personal LaserWriters manufactured for the United States or Japan operate at line voltages of 110-115 volts; Apple Personal LaserWriters manufactured for Europe or Australia operate at line voltages of 220-240 volts. Follow the procedures below to convert the operating voltage of an Apple Personal LaserWriter.

All procedures contained within the *Apple Personal LaserWriter Technical Procedures* can be used to troubleshoot and repair both the 110 V and 220 V versions of the Apple Personal LaserWriter.

110V to 220V Conversion

To convert a 110 V Apple Personal LaserWriter to 220 V:

1. Remove the top cover, the I/O board, the I/O shield, and the end plate.

2. Remove the 110 V power supply unit and replace it with a 220 V power supply unit.

3. Remove the 110 V fuser assembly and replace it with a 220 V fuser assembly.

4. Replace the end plate, the I/O shield, the I/O board, and the top cover.

220V to 110V Conversion

To convert a 220 V Apple Personal LaserWriter to 110 V:

1. Remove the top cover, the I/O board, the I/O shield, and the end plate.

2. Remove the 220 V power supply unit and replace it with a 110 V power supply unit.

3. Remove the 220 V fuser assembly and replace it with a 110 V fuser assembly.

4. Replace the end plate, the I/O shield, the I/O board, and the top cover.

❏ CASSETTE FEEDER TRAY INSTALLATION (LASERWRITER NTR, LS, AND LS/L

Introduction

The Apple Personal LaserWriter NTR, LS, and LS/L ship from Apple without a cassette feeder tray installed. Follow the instructions below to install the cassette feeder tray.

Materials Required

Apple Personal LaserWriter NTR, LS, or LS/L
#2 Phillips screwdriver
Cassette feeder tray

Procedure

1. Carefully place the printer upside down.

2. Remove the four screws that secure the bottom cover to the printer base.

3. Remove the bottom cover and set it aside.

4. Install the cassette feeder tray into position on the base of the printer and align the 9-pin connector with its receptacle.

5. Use the four bottom cover screws to secure the cassette feeder tray to the printer base.

6. Turn the printer right-side up.

❏ MEMORY UPGRADE (LASERWRITER LS AND LS/L)

Introduction

You can upgrade the memory on the Apple Personal LaserWriter LS and LS/L I/O board from 512K to 1 MB.

Materials Required

Apple Personal LaserWriter LS or LS/L
#2 Phillips screwdriver
Four 256K x 4, 150 ns (or faster) DRAM chips
An ESD-safe workstation

CAUTION: DRAMs are very susceptible to damage from ESD and skin acid. Follow all ESD precautions.

**LaserWriter LS
Upgrade Procedure**

1. Remove the top cover and the I/O shield.

2. Place the four 256K x 4, 150 ns (or faster) DRAM chips in position as shown in **Figure 6-2**.

3. Position jumper JP801 over the two pins nearest the **1M** marking on the I/O board **(Figure 6-2)**.
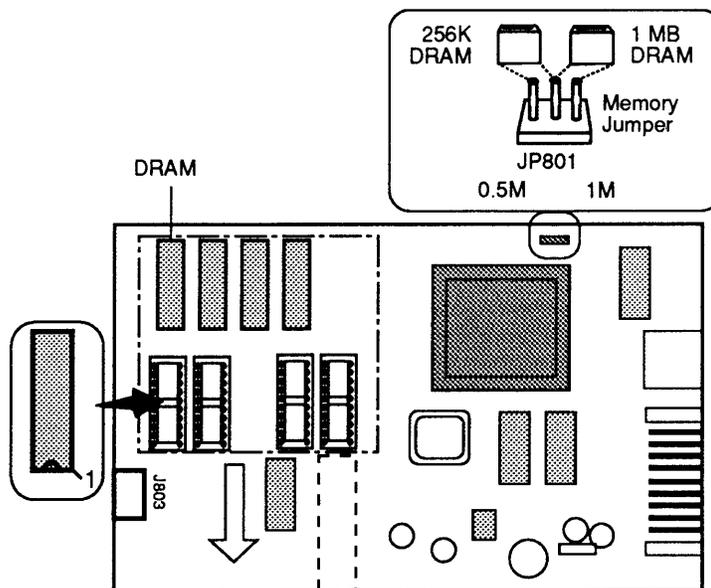
Figure 6-2 LaserWriter LS Memory Upgrade

4. Replace the I/O shield and the top cover.

**LaserWriter LS/L
Upgrade Procedure**

1. <u>Remove the top cover</u> and <u>the PCB shield</u>.

2. Place the four 256K x 4, 150 ns (or faster) DRAM chips in position as shown in **Figure 6-3**.

3. Position jumper JP204 over the two pins nearest the **1M** marking on the serial controller **(Figure 6-3)**.
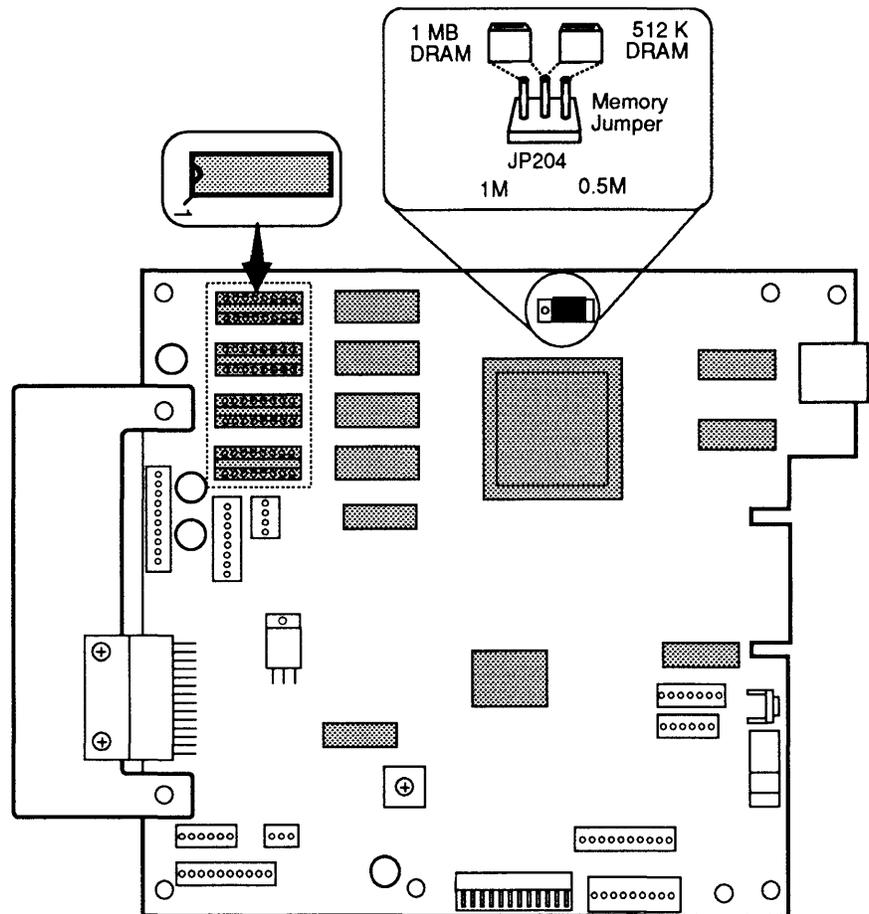
Figure 6-3 LaserWriter LS/L Memory Upgrade

4. <u>Replace the PCB shield</u> and <u>the top cover</u>.

É Apple Technical Procedures

Apple Personal LaserWriter

Illustrated Parts List

❏ CONTENTS

This section includes all piece parts that can be purchased separately from Apple. Refer to your *Apple Service Programs* manual for prices.

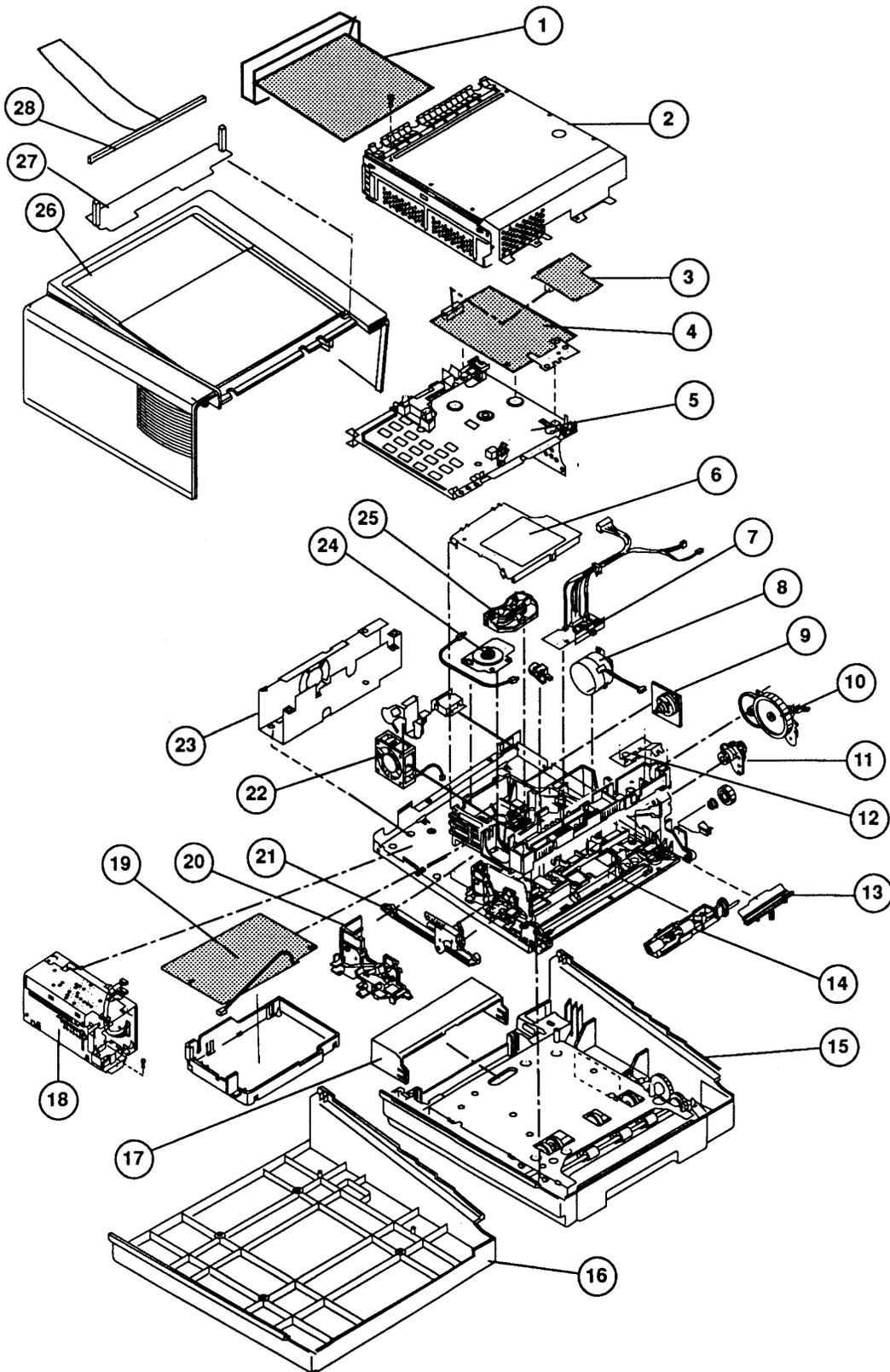
Figure 1A

❏ EXPLODED VIEW – LW NT/SC/NTR (Figure 1A)

Item	Part No.	Description
1	—	I/O Board (See Figures 25, 26, and 27)
2	—	I/O Shield (See Figure 4)
3	982-0048	Interconnect PCB
4	661-0567	DC Controller PCB
5	948-0138	DC Controller Mounting Plate
6	971-0040	Scanner Cover Assembly
7	982-0039	Density-Adjusting PCB Assembly
8	890-0426	Stepping DC Motor
9	661-0571	Laser Assembly
10	890-0608	Drive Assembly
11	890-0609	Drum Drive Assembly
12	890-1200	Sensor Mounting Plate
13	860-0295	Separation Pad
14	971-0044	Feeder Assembly
15	—	Cassette Feeder Assembly (See Figure 10)
16	949-0313	Bottom Cover, Platinum (LaserWriter NTR)
17	949-0274	Cassette Stop Cover
18	—	Power Supply Unit (See Figure 11)
19	661-0573	High-Voltage Power Supply
20	890-8608	High-Voltage Contact Assembly
21	971-0046	Rod Assembly
22	720-0513	Fan
23	949-0272	End Plate (B)
24	661-0572	Scanner Assembly
25	971-0041	Lens Assembly
26	—	Covers (See Figure 2)
27	949-0273	Paper Support Plate
28	949-0261	Stackability Guide (LaserWriter NT and SC)
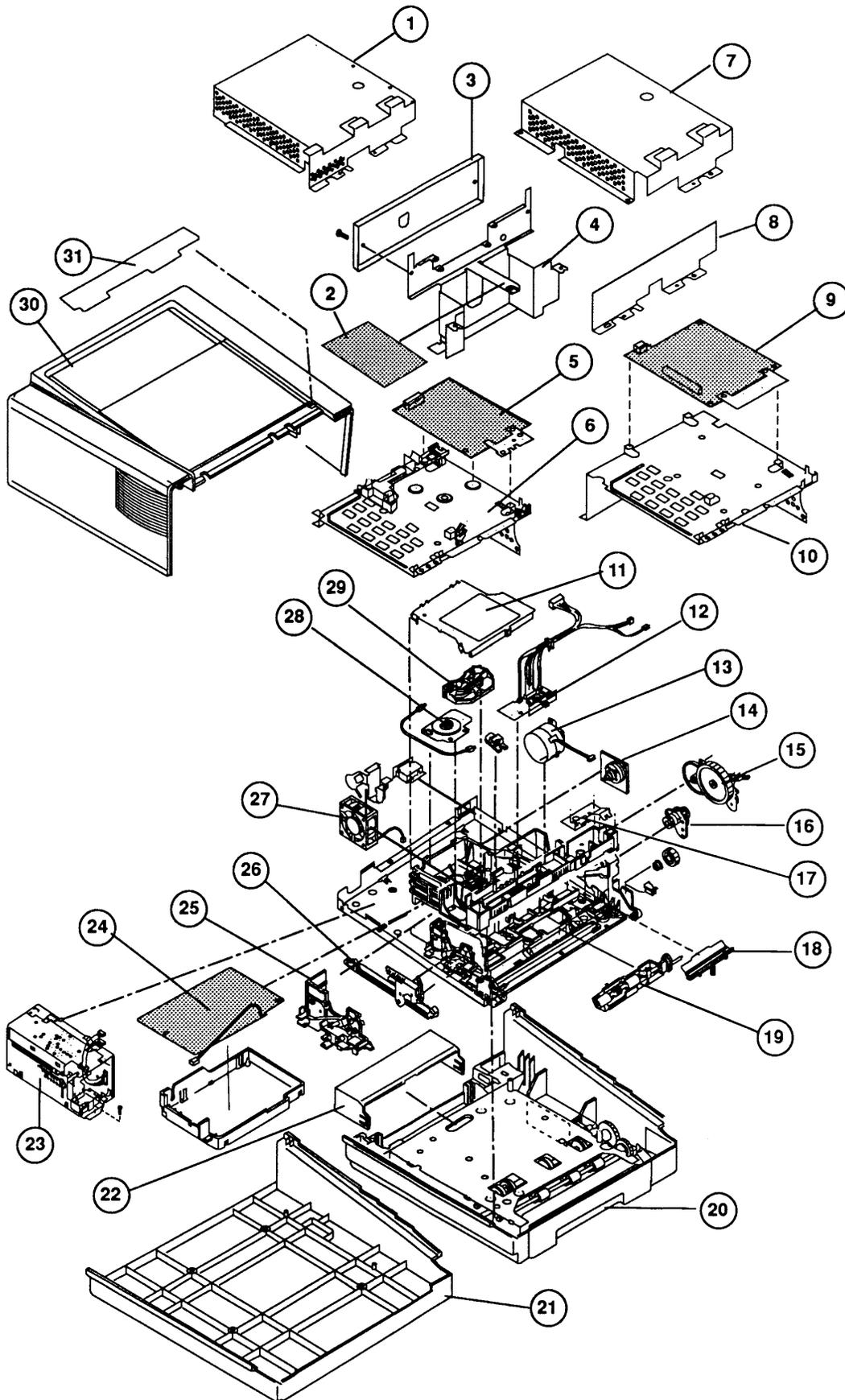
Figure 1B

❏ EXPLODED VIEW – LW LS AND LS/L (Figure 1B)

Item	Part No.	Description
1	—	I/O Shield (See Figure 5)
2	—	I/O Board (See Figures 28)
3	949-0314	Bracket, I/O Board (LaserWriter LS)
4	949-0328	End Plate (LaserWriter LS)
5	661-0650	DC Controller PCB (LaserWriter LS)
6	949-0327	DC Controller Mounting Plate (LaserWriter LS)
7	949-0379	PCB Shield (See Figure 6)
8	948-0155	PCB Duct Plate (See Figure 6)
9	661-0669	Serial Controller (LaserWriter LS/L)
10	948-0048	PCB Mounting Plate (LaserWriter LS/L)
11	971-0040	Scanner Cover Assembly
12	982-0039	Density-Adjusting PCB Assembly (LaserWriter LS)
	981-0030	Fan-and-Sensor PCB (LaserWriter LS/L)
13	890-0426	Stepping DC Motor
14	661-0571	Laser Assembly
15	890-0608	Drive Assembly
16	890-0609	Drum Drive Assembly
17	890-1200	Sensor Mounting Plate
18	860-0295	Separation Pad
19	971-0044	Feeder Assembly
20	—	Cassette Feeder Assembly (See Figure 10)
21	949-0313	Bottom Cover, Platinum
22	949-0274	Cassette Stop Cover
23	—	Power Supply Unit (See Figures 12 and 13)
24	661-0573	High-Voltage Power Supply
25	890-8608	High-Voltage Contact Assembly
26	971-0046	Rod Assembly
27	720-0513	Fan
28	661-0572	Scanner Assembly
29	971-0041	Lens Assembly
30	—	Covers (See Figure 2)
31	949-0332	Paper Support Plate
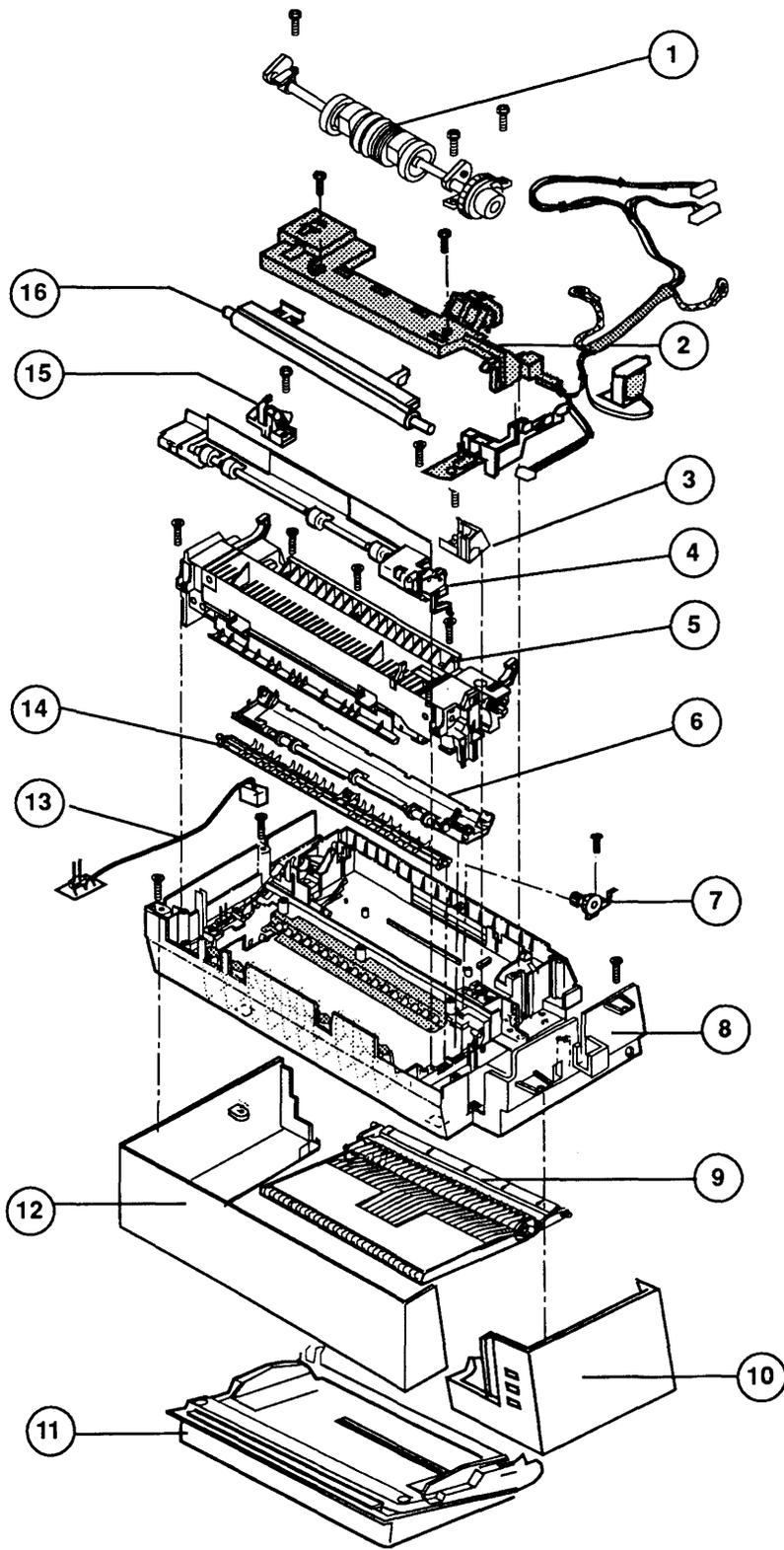
Figure 1C

❑ EXPLODED VIEW – FRONT ACCESS DOOR (Figure 1C)

Item	Part No.	Description
1	971-0045	Pickup Roller Assembly
2	890-8605	Multipurpose Cable Assembly
3	890-0607	Transfer Roller Mount Assembly, Right Side
4	971-0043	Face-Down Delivery Assembly
5	661-0568	Fuser Assembly, 110/115 V
	661-0575	Fuser Assembly, 220/240 V
6	949-0276	Face-Up Cover Assembly
7	971-0049	Face-Up Delivery Drive Assembly
8	949-0295	Front Access Door
9	—	Face-Up Tray Assembly (See Figure 17)
10	949-0294	LED Cover
11	949-0279	Multipurpose Tray Assembly, 50 sheet
	949-0341	Multipurpose Tray Assembly, 70 sheet
12	949-0293	Front Cover
13	569-0049	Fuser AC Connector Cable
14	971-0048	Deflector
15	890-8603	Transfer Roller Mount Assembly, Left Side
16	870-0103	Transfer Roller
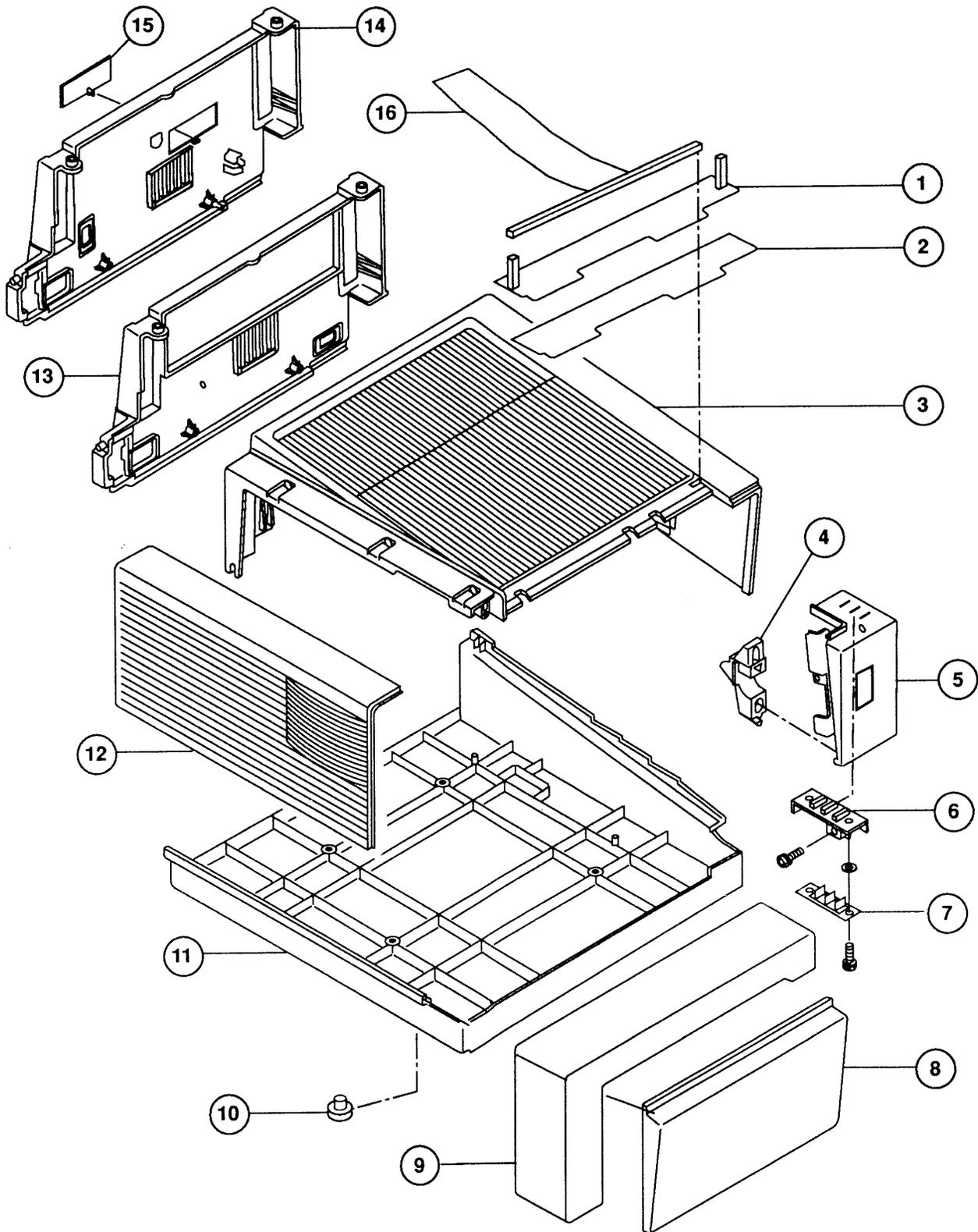
Figure 2

❑ EXTERNAL COVERS (Figure 2)

Item	Part No.	Description
1	949-0273	Paper Support Plate (LaserWriter NT and SC)
2	949-0332	Paper Support Plate (LaserWriter LS and LS/L)
3	949-0283	Top Cover
4	949-0278	Release Lever
5	949-0294	LED Cover
6	949-0269	LED Holder
7	949-0282	Status Panel
8	949-0279	Multipurpose Tray Assembly, 50 sheet
	949-0341	Multipurpose Tray Assembly, 70 sheet
9	949-0293	Front Cover
10	956-0022	Rubber Foot
11	949-0313	Bottom Cover, Platinum (LaserWriter NTR, LS and LS/L)*
12	949-0281	Left Cover
13	949-0280	Rear Cover (LaserWriter NT, SC, LS, and NTR)
14	949-0381	Rear Cover (LaserWriter LS/L)
15	949-0382	Engine Test Button Cover (LaserWriter LS/L)
16	949-0261	Stackability Guide

* Some Personal LaserWriter LS printers have a solid
bottom cover and some have a hollow-center or
"picture frame" bottom cover. Use the solid bottom
cover, part number 949-0313, to replace either
version of the bottom cover. The solid bottom cover
fits all Personal LaserWriter LS printers; the "picture
frame" version does not.
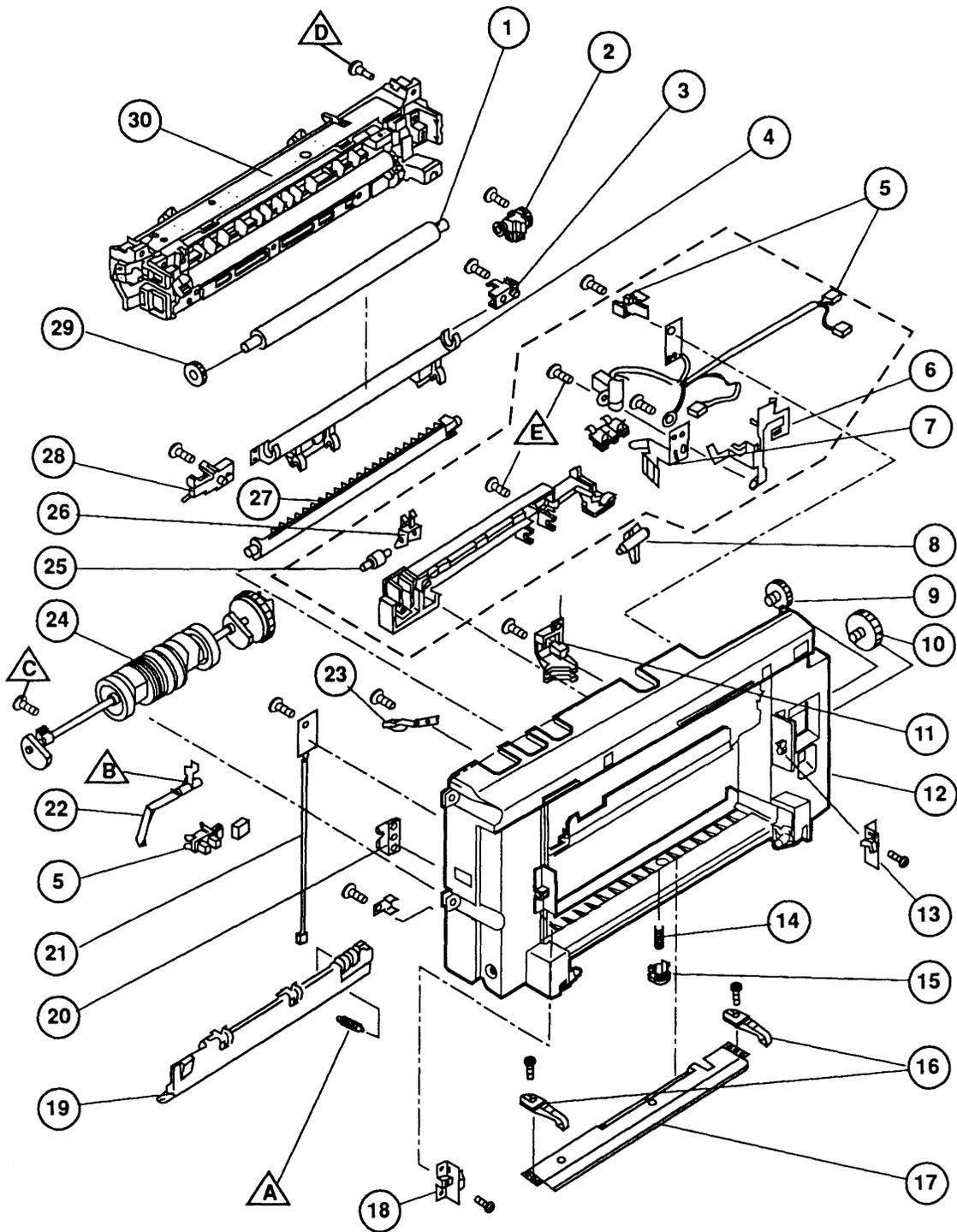
Figure 3

❏ FRONT ACCESS DOOR ASSEMBLY (Figure 3)

Item	Part No.	Description
1	870-0103	Transfer Roller
2	971-0049	Face-Up Delivery Drive Assembly
3	890-0607	Transfer Roller Mount Assembly, Right Side
4	971-0042	Transfer Guide Assembly
5	890-8605	Multipurpose Cable Assembly
6	890-1205	Ground C Plate
7	948-0156	Ground A Plate
8	815-1209	Paper Sensor Lever
9	880-0049	Gear, 20-Tooth, Front Cover
10	880-0050	Gear, 30-Tooth, Front Cover
11	815-1207	Front Cord Cover
12	949-0295	Front Access Door
13	949-0290	Face-Up Tray Support, Right Side
14	076-0443	Spring, Paper Guide Plate, 10/pk
15	949-0299	Access Door Cap
16	949-0275	Paper Pickup Arm
17	949-0296	Paper Guide Plate
18	949-0291	Face-Up Tray Support, Left Side
19	949-0276	Face-Up Cover Assembly
20	890-0424	Rod Mount
21	982-0045	Fuser PCB Assembly
22	949-0277	Sensing Arm
23	870-0104	Passive Delivery Roller
24	971-0045	Pickup Roller Assembly (See Figure 16)
25	971-0047	Roller, Face-Up Passive Delivery
26	959-0045	Holder, Face-Up Passive Delivery Roller
27	971-0048	Deflector
28	890-8603	Transfer Roller Mount Assembly, Left Side
29	880-0051	Gear, 27-Tooth, Transfer Roller
30	661-0568	Fuser Assembly, 110/115 V
	661-0575	Fuser Assembly, 220/240 V

Note: Apple sells the following parts in Figure 3 as part of the Spring Kit:

A Paper Compression Spring
B Sensing Arm Spring

Note: Apple sells the following parts in Figure 3 as part of the Screw Kit:

C Screw, Pan Head, Machine, 3 x 8 mm Black 10/pk)
D Screw, Machine, Stepped, 3 x 8 mm (10/pk)
E Screw, Pan Head, Machine, 3 x 6 mm (10/pk)

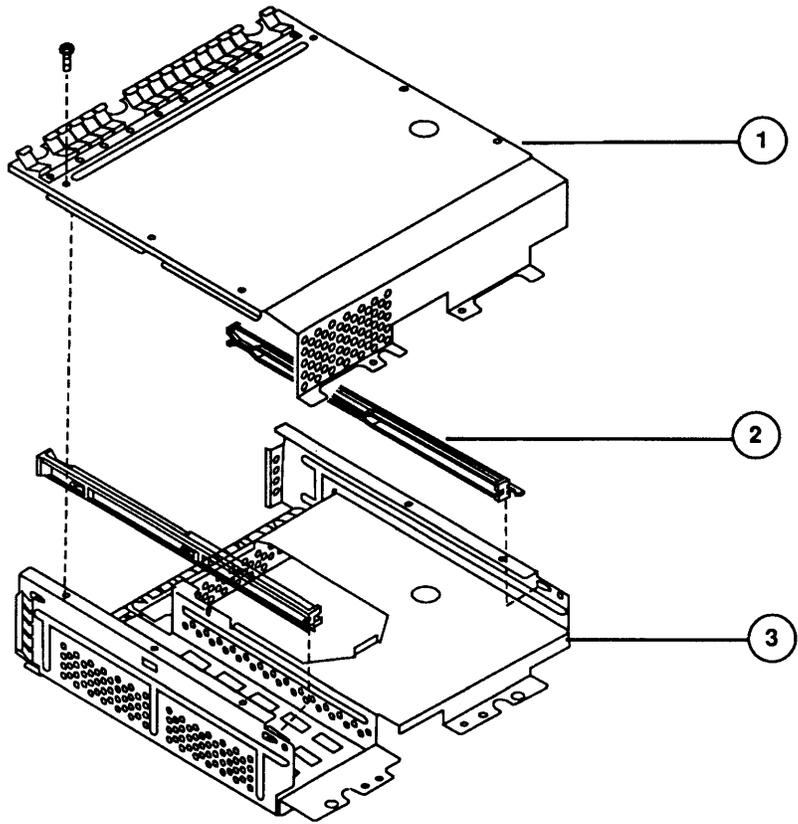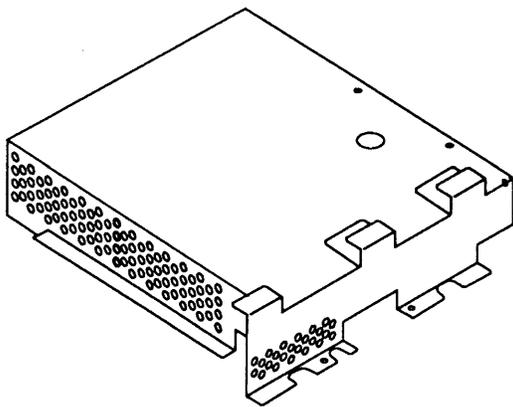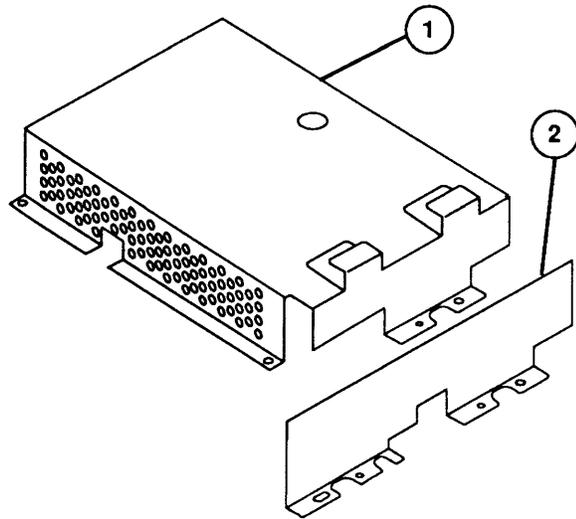**Figure 4**

Figure 5

Figure 6

❏ I/O SHIELD – LW NT/SC/NTR (Figure 4)

Item	Part No.	Description
1	949-0267	Upper I/O Shield
2	949-0292	I/O Board Rail
3	949-0268	Lower I/O Shield

❏ I/O SHIELD – LW LS (Figure 5)

Item	Part No.	Description
–	949-0326	I/O Board Shield

❏ PCB SHIELD – LW LS/L (Figure 6)

Item	Part No.	Description
1	949-0379	PCB Shield
2	948-0155	PCB Duct Plate
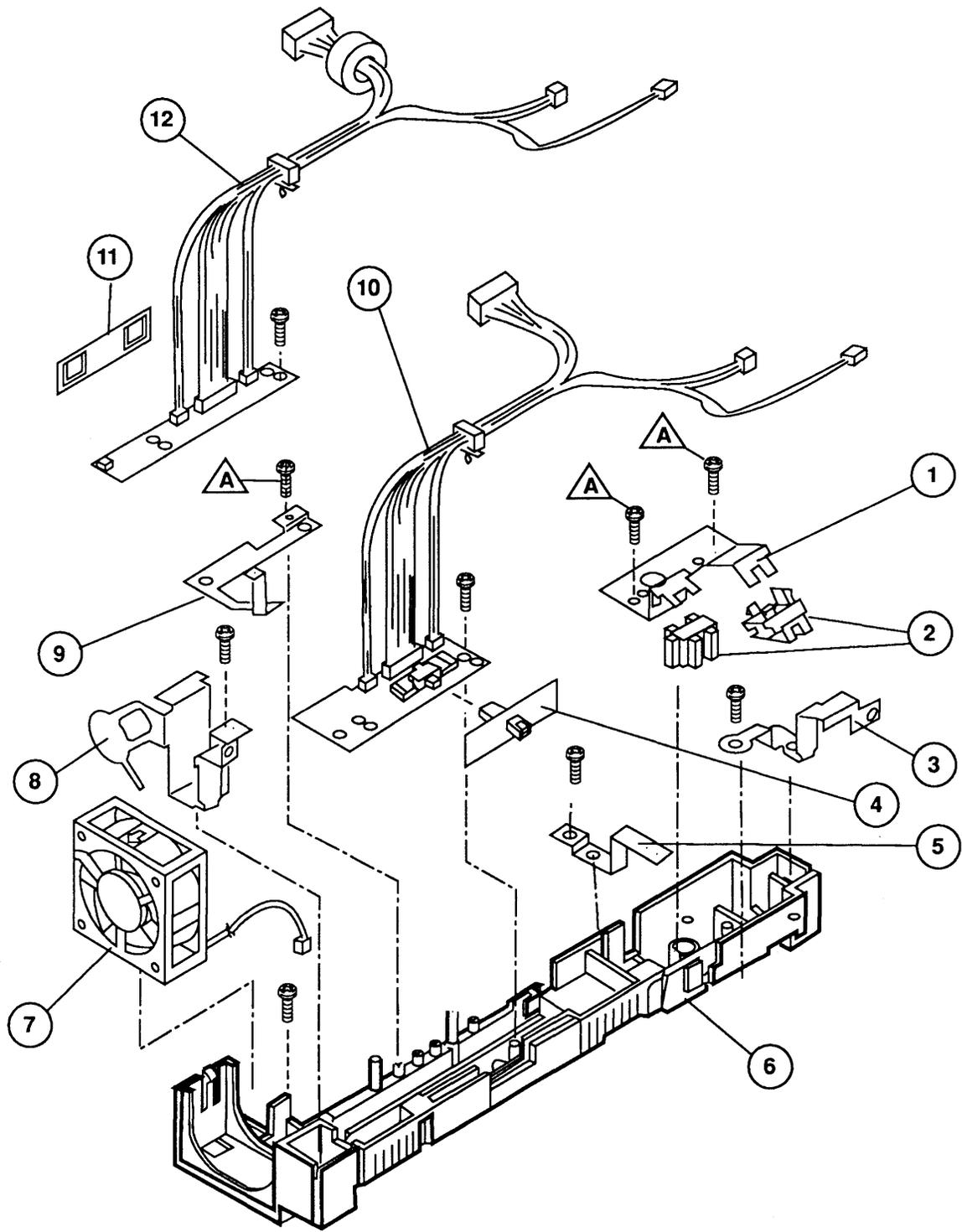
Figure 7

❏ UPPER ENGINE ASSEMBLY (Figure 7)

Item	Part No.	Description
1	890-1200	Sensor Mounting Plate
2	353-7816	Photo-Interrupter (PS11, toner cartridge sensor; and PS12, delivery unit paper sensor)
3	890-1196	Right Nut Plate
4	870-0095	Print Density Slider (LaserWriter NT, SC, LS, and NTR)
5	890-0193	Inner Cover Ground Plate, Right Side
6	949-0286	Inner Cover
7	720-0513	Fan
8	890-1199	Left Nut Plate
9	890-0194	Inner Cover Ground Plate, Left Side
10	982-0039	Density-Adjusting PCB Assembly (LaserWriter NT, SC, LS, and NTR)
11	949-0383	Density Adjustment Cover (LaserWriter LS/L)
12	981-0030	Fan-and-Sensor PCB (LaserWriter LS/L)

Note: The following part shown in this diagram is available as part of the Screw Kit:

A   Screw, Pan/Washer Head, 3 x 6 mm (10/pk)
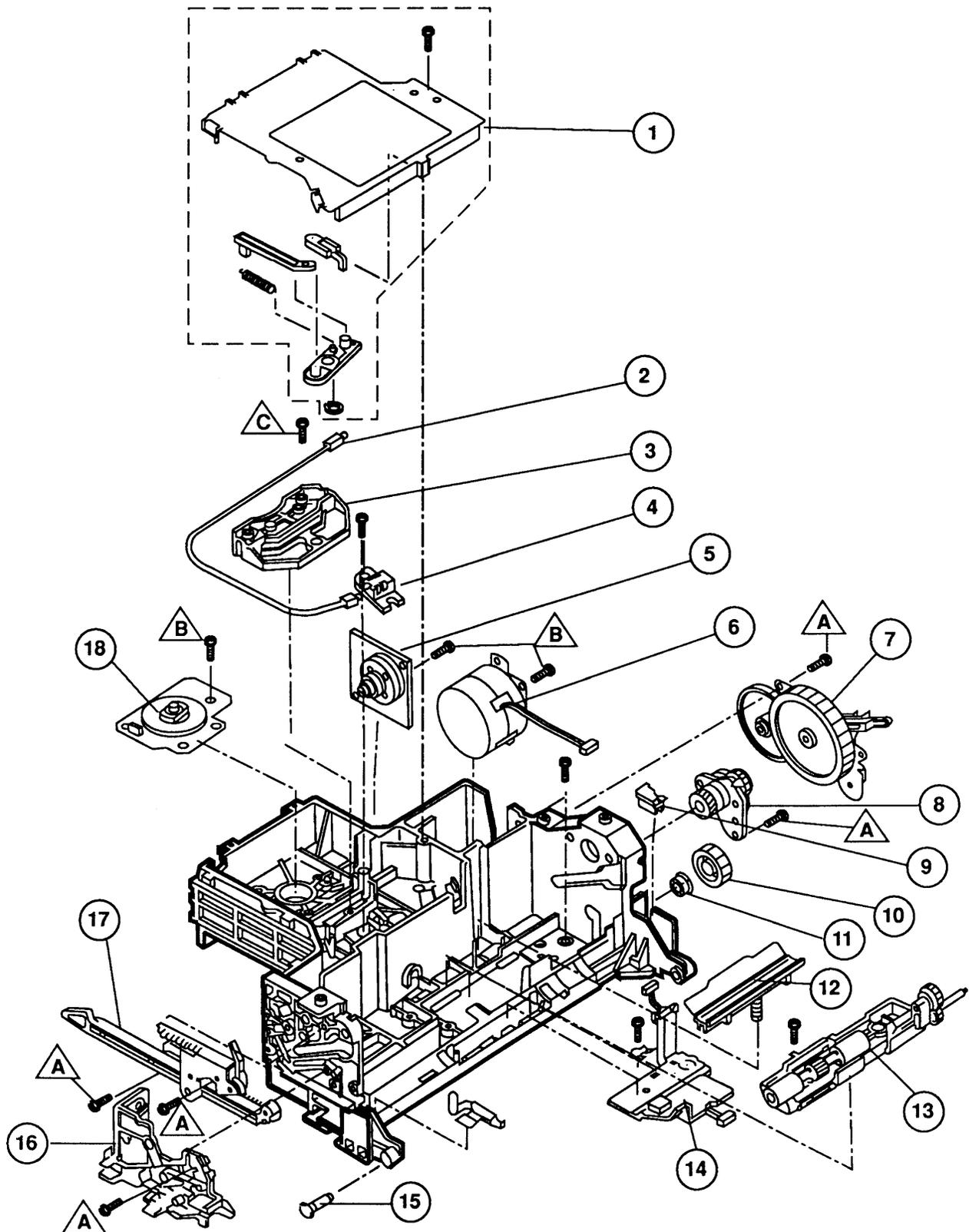
Figure 8

❏ INTERNAL ENGINE ASSEMBLY (Figure 8)

Item	Part No.	Description
1	971-0040	Scanner Assembly Cover
2	569-0048	Optical Fiber Cable
3	971-0041	Lens Assembly
4	890-0423	Fiber Holder Block
5	661-0571	Laser Assembly
6	890-0426	Stepping DC Motor
7	890-0608	Drive Assembly
8	890-0609	Drum Drive Assembly
9	815-1206	Cord Cover
10	880-0052	Gear 30-Tooth, Feeder
11	860-0297	Feeder Assembly Bushing
12	860-0295	Separation Pad
13	971-0044	Feeder Assembly
14	890-0606	Pickup Cable Assembly
15	949-0270	Door Pivot
16	890-8608	High-Voltage Contact Assembly
17	971-0046	Rod Assembly
18	661-0572	Scanner Assembly

Note: The following parts shown in this diagram are available as part of the Screw Kit:

A   Screw, Pan Head, Self-Tapping, 4 x 10 mm (10/pk)

B   Screw, Pan Head, 3 x 16 mm, Black (10/pk)

C   Screw, Pan Head, 3 x 10 mm, Black (10/pk)
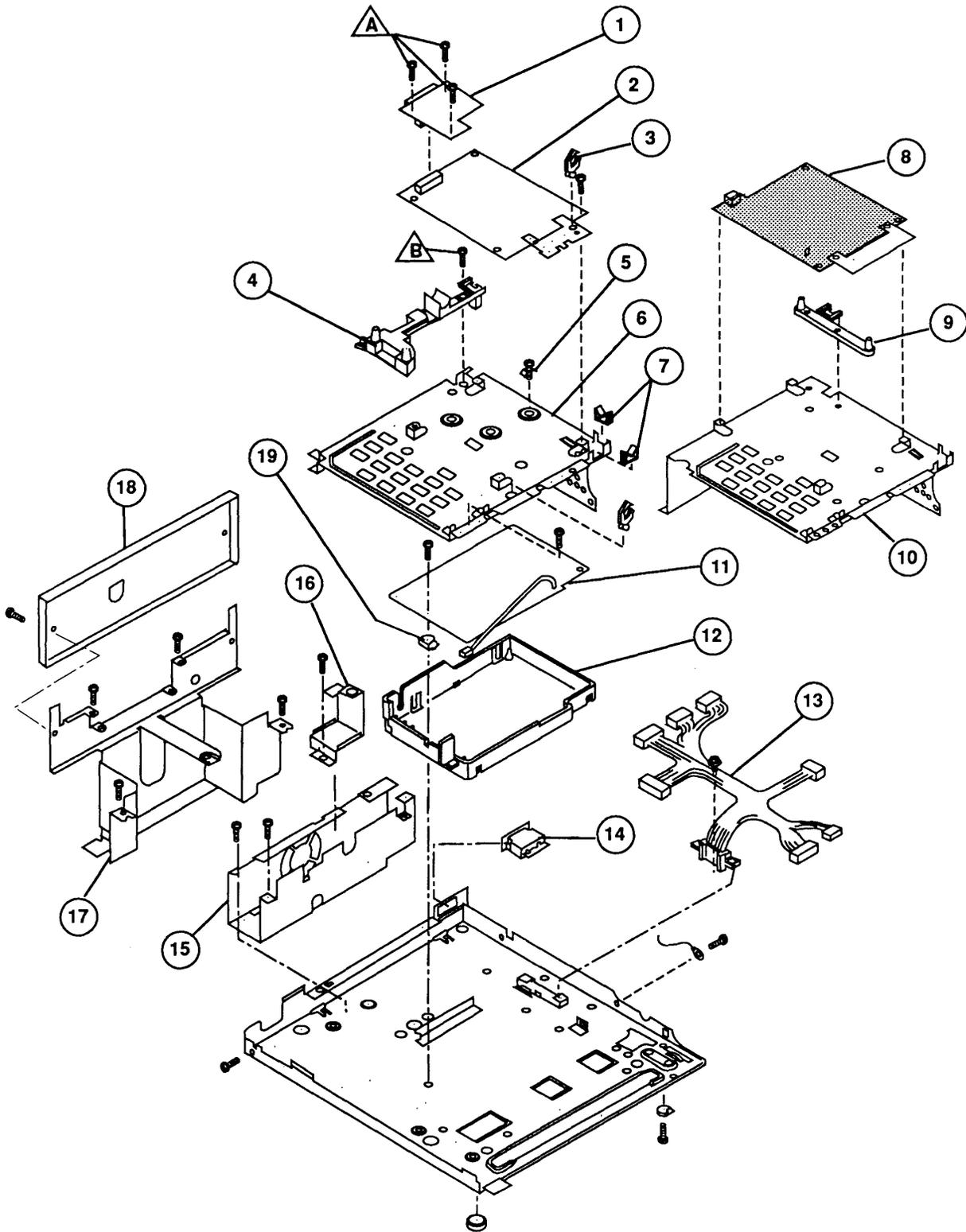
Figure 9

❏ BOTTOM PLATE ASSEMBLY (Figure 9)

Item	Part No.	Description
1	982-0048	Interconnect PCB (LaserWriter NT, SC, and NTR)
2	661-0567	DC Controller PCB (LaserWriter NT, SC, and NTR)
	661-0650	DC Controller PCB (LaserWriter LS)
3	830-0262	Cable A Clip
4	949-0271	DC Controller Interconnect Mount
5	815-1210	Support DC Controller
6	948-0138	DC Controller Mounting Plate, (LaserWriter NT and SC)
	949-0327	DC Controller Mounting Plate, (LaserWriter LS)
7	830-0263	Cable B Clip
8	661-0669	Serial Controller (LaserWriter LS/L)
9	949-0380	PCB Controller Mount (LaserWriter LS/L)
10	948-0048	PCB Mounting Plate (LaserWriter LS/L)
11	661-0573	High-Voltage Power Supply
12	949-0259	High-Voltage Cover
13	890-8604	Bottom Assembly Cable
14	705-1025	Rocker Switch
15	948-0139	End Plate (LaserWriter NT, SC, and NTR)
16	949-0272	End Plate (B) (LaserWriter NT, SC, and NTR)
17	949-0328	End Plate (LaserWriter LS)
18	949-0314	Bracket, I/O Board (LaserWriter LS)
19	948-0141	High-Voltage Ground Plate

Note: The following parts shown in this diagram are available as part of the Screw Kit:

A   Screw, Pan Head, Self-Tapping, 3 x 8 mm,
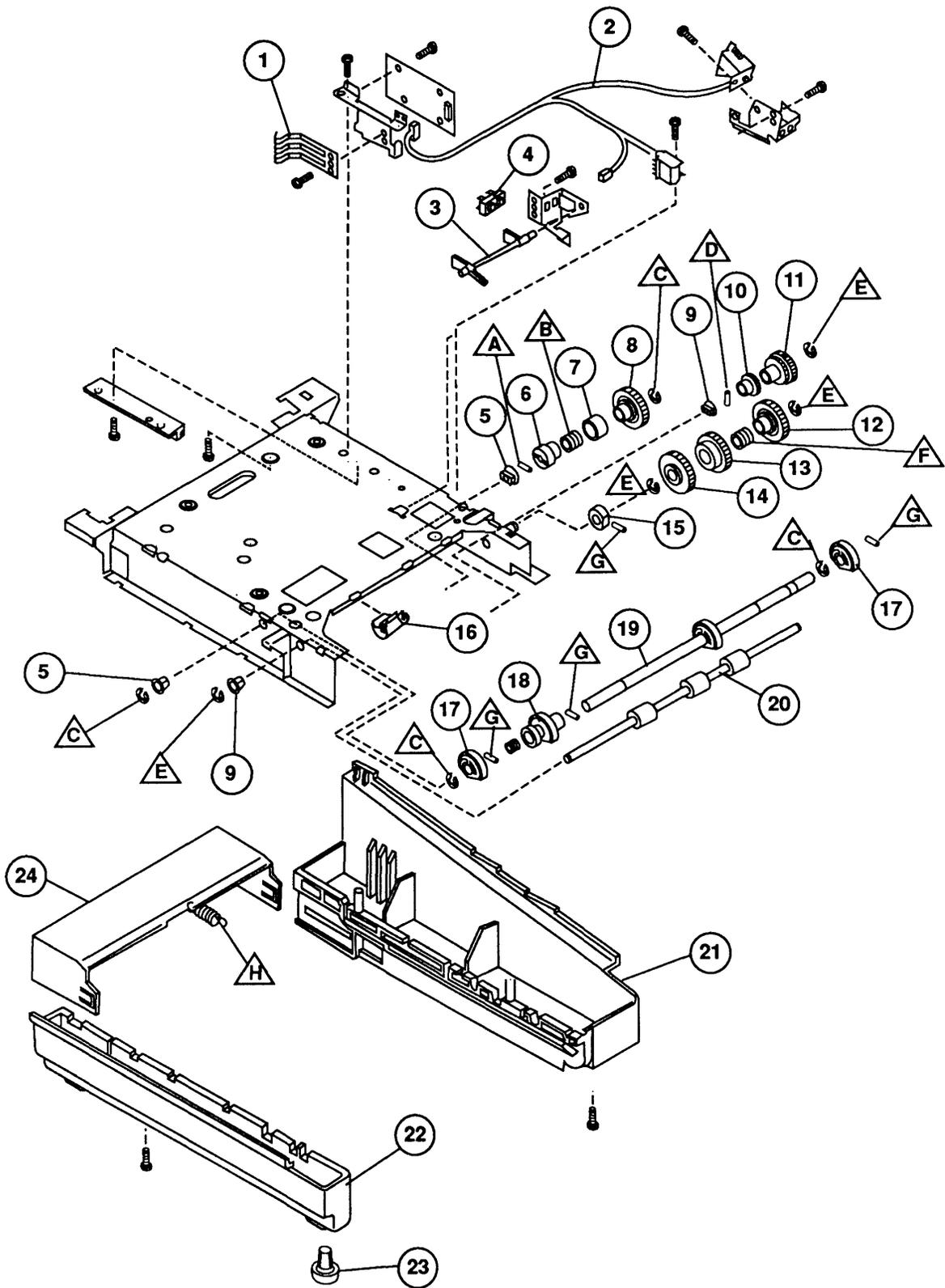   Black (10/pk)
B   Screw, Pan Head, Machine, 3 x 6 mm (10/pk)

Figure 10

❏ CASSETTE FEEDER ASSEMBLY (Figure 10)

Item	Part No.	Description
1	870-0044	Cassette Leaf Spring
2	569-0047	Cassette Sensor Cable
3	815-1198	Paper Sensing Arm
4	353-7816	Photo-Interrupter (PS901, paper cassette sensor)
5	860-0296	Pickup Bushing
6	875-0084	Paper Pickup Ring
7	875-0085	Ratchet B Ring
8	880-0044	Cassette Gear 34-Tooth
9	860-0298	Feeder Bushing
10	880-0048	Cassette Gear 17-Tooth
11	880-0047	Cassette Gear 33-Tooth/19-Tooth
12	880-0046	Cassette Gear 37-Tooth
13	875-0086	Ratchet A Ring
14	880-0045	Cassette Gear 39-Tooth
15	815-1197	Retaining Collar
16	815-1193	Feed Roller Guide
17	870-0096	Pickup Roller
18	870-0101	Cassette Pickup Roller
19	870-0094	Shaft, Cassette Pickup Roller
20	870-0097	Cassette Feeder Roller Shaft
21	949-0285	Bottom Right Cover
22	949-0284	Bottom Left Cover
23	956-0022	Rubber Foot
24	949-0274	Cassette Stop Cover

Note: The following parts shown in this diagram are available as part of the Dowel and Ring Kit:

A Dowel Pin, 2 x 12 mm (10/pk)
C E-Ring, 6.4 mm dia. (10/pk)
D Dowel Pin, 1.6 x 8 mm (10/pk)
E E-Ring, 5 mm dia. (10/pk)
G Dowel Pin, 2 x 14 mm (10/pk)

Note: The following parts shown in this diagram are available as part of the Spring Kit:

B Clutch B Spring (10/pk)
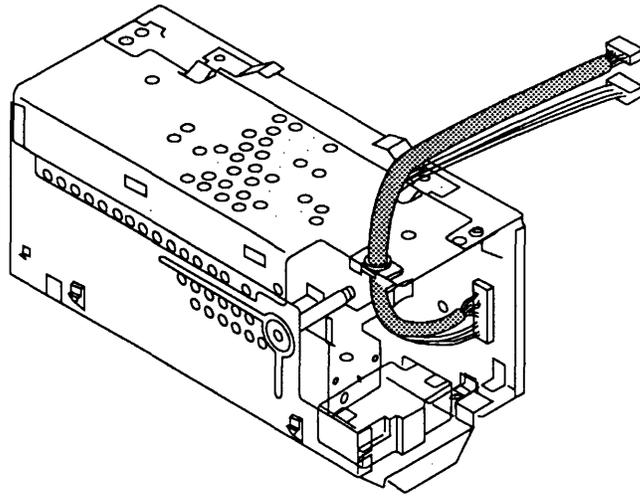F Clutch A Spring (10/pk)
H Cassette Stop Cover Spring (10/pk)

Figure 11
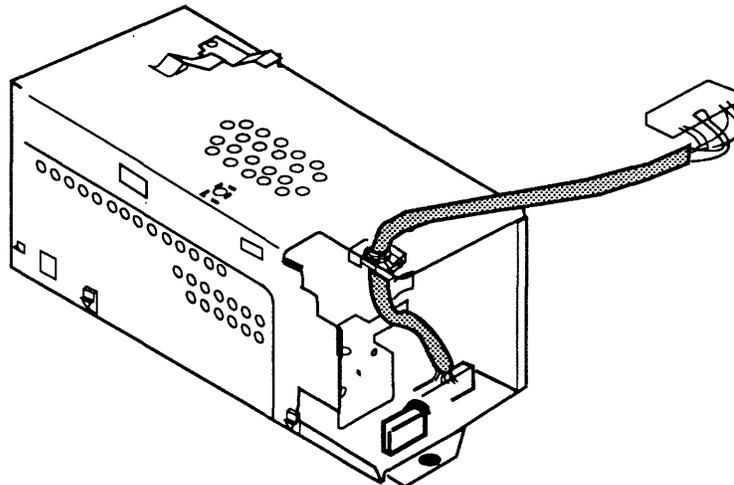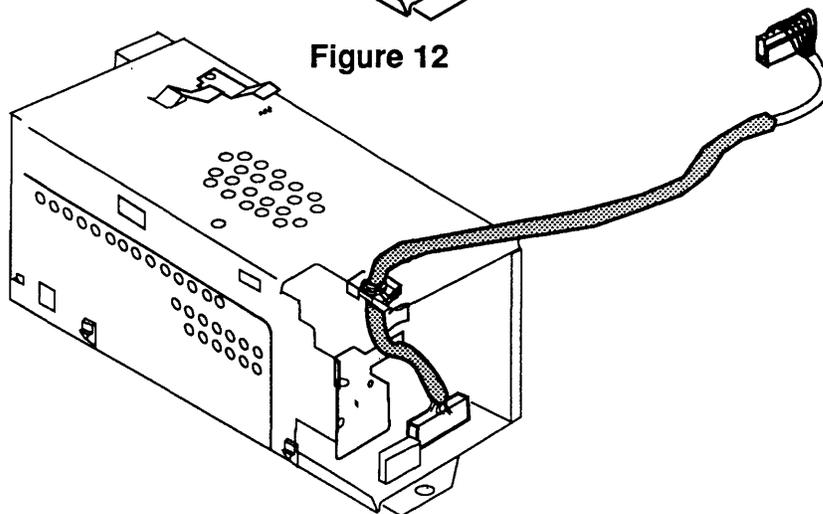
Figure 12

Figure 13

❏ POWER SUPPLY UNIT – LW NT/SC/NTR (Figure 11)

Item	Part No.	Description
–	661-0569	Power Supply Unit, 110/115 V
	661-0574	Power Supply Unit, 220/240 V

❏ POWER SUPPLY UNIT – LW LS (Figure 12)

Item	Part No.	Description
–	661-0636	Power Supply Unit, 110/115 V
	661-0637	Power Supply Unit, 220/240 V

❏ POWER SUPPLY UNIT – LW LS/L (Figure 13)

Item	Part No.	Description
–	661-0668	Power Supply Unit, 110/115 V
	661-0667	Power Supply Unit, 220/240 V
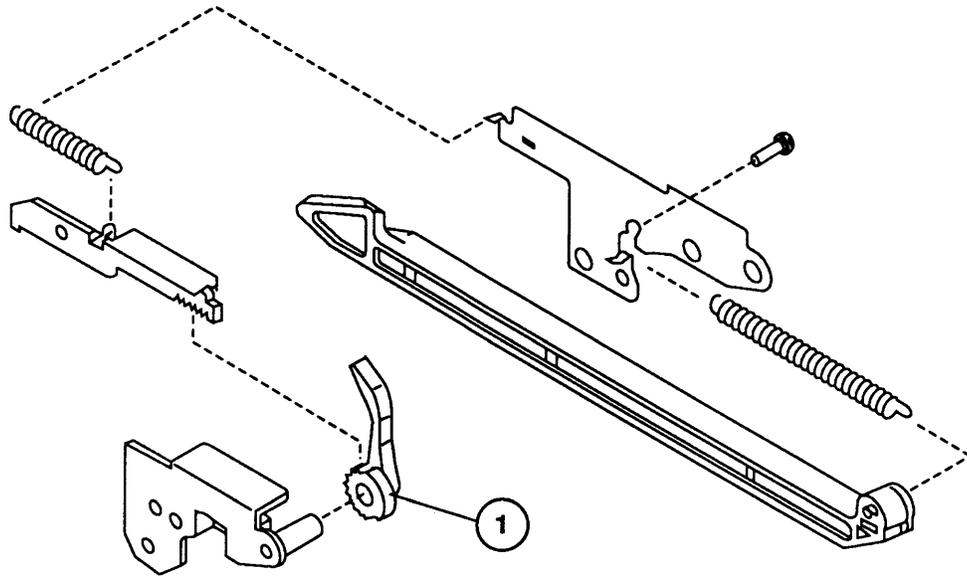
Figure 14
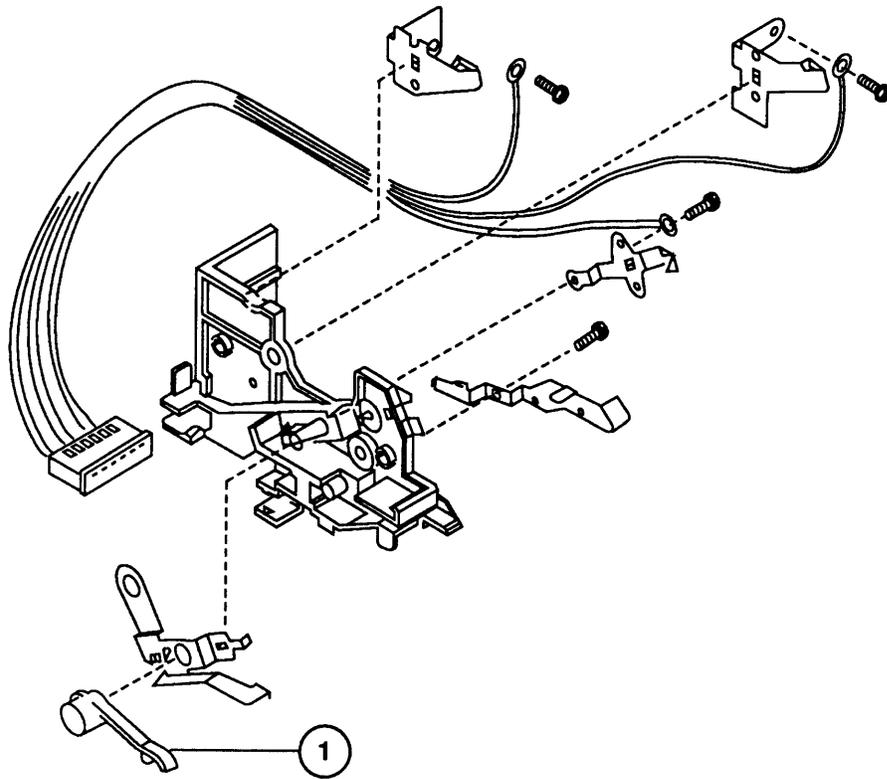
Figure 15

❑ ROD ASSEMBLY (Figure 14)

Item	Part No.	Description
–	971-0046	Rod Assembly
1	815-1203	Shutter Lever

❑ HIGH-VOLTAGE CONTACT ASSEMBLY (Figure 15)

Item	Part No.	Description
–	890-8608	High-Voltage Contact Assembly
1	815-1202	High-Voltage Contact Lever
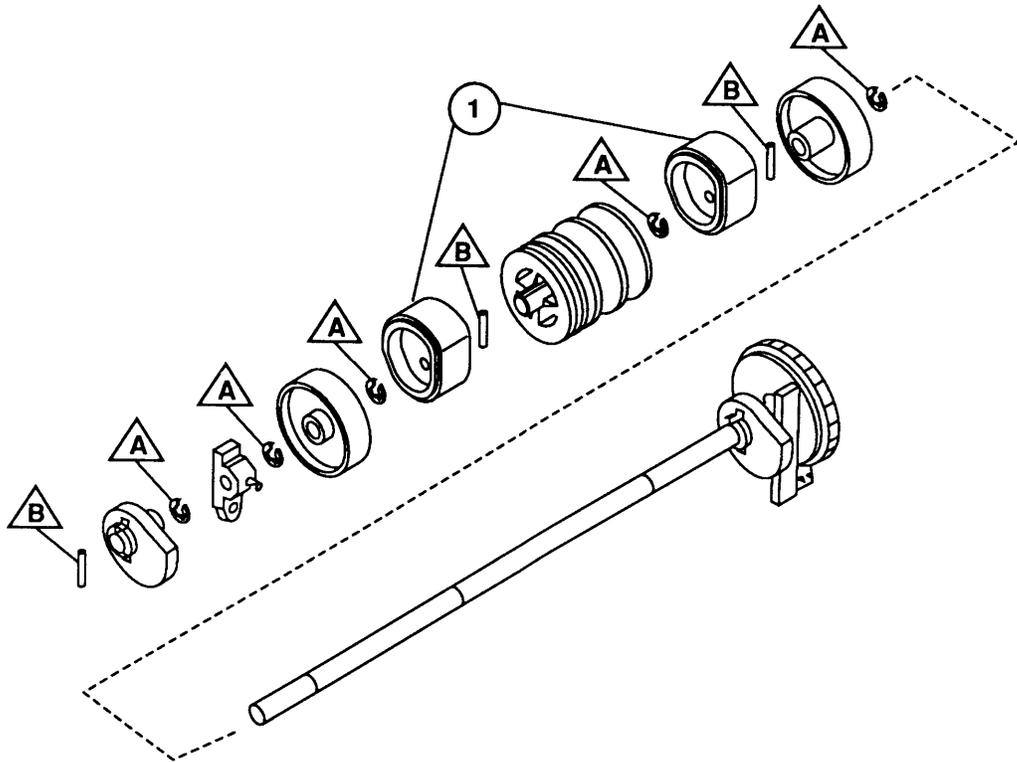
Figure 16

❏ PICKUP ROLLER ASSEMBLY (Figure 16)

Item	Part No.	Description
–	971-0045	Pickup Roller Assembly
1	870-0100	Pickup Roller

Note: The following parts shown in this diagram are available as part of the Dowel and Ring Kit:

A E-Ring, 5.0 mm dia. (10/pk)
B Dowel Pin, 2 x 14 mm (10/pk)
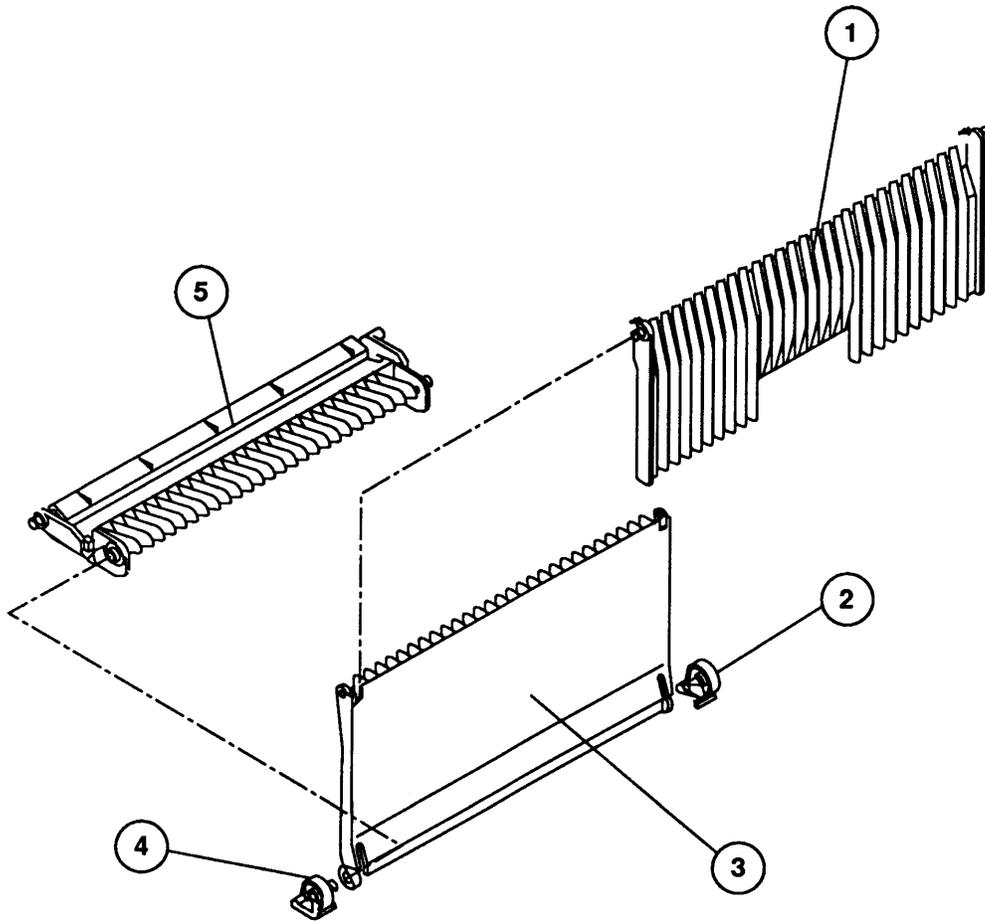
Figure 17

❑ FACE-UP TRAY ASSEMBLY (Figure 17)

Item	Part No.	Description
1	949-0287	Face-Up Tray (C)
2	949-0266	Right Tray Lock
3	949-0288	Face-Up Tray (B)
4	949-0265	Left Tray Lock
5	949-0289	Face-Up Tray (A)
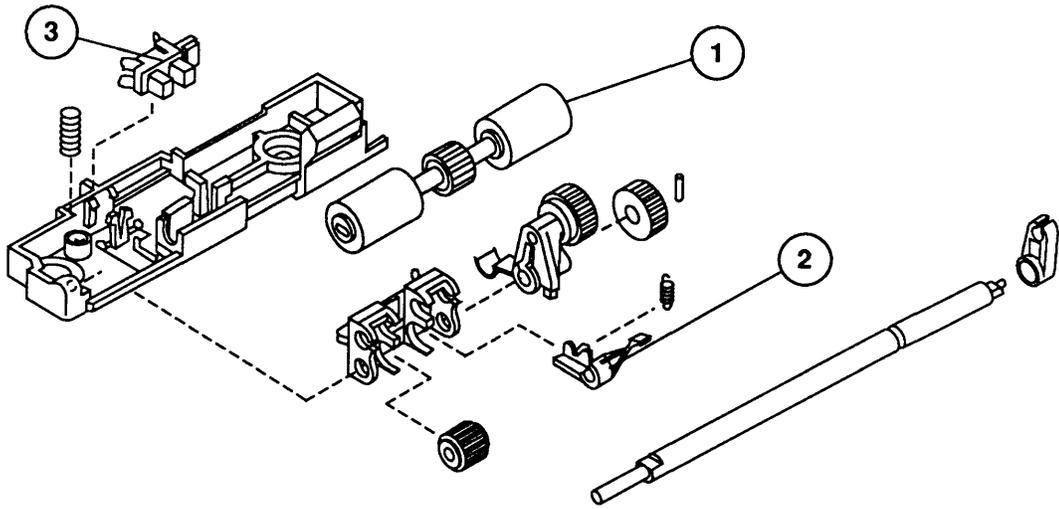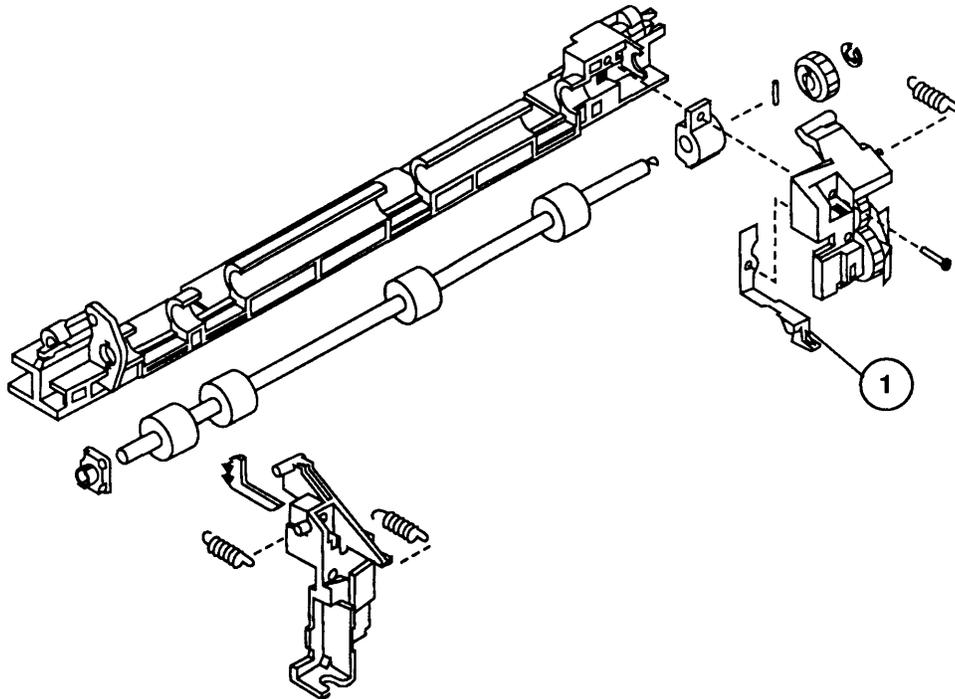
Figure 18

Figure 19

❏ FEEDER ASSEMBLY (Figure 18)

Item	Part No.	Description
–	971-0044	Feeder Assembly
1	971-0039	Roller Paper Feed
2	815-1204	Feeder Assembly Lever
3	353-7816	Photo-Interrupter (PS13, the pickup unit paper sensor)

❏ FACE-DOWN DELIVERY ASSEMBLY (Figure 19)

Item	Part No.	Description
–	971-0043	Face-Down Delivery Assembly
1	949-0300	Face-Up Tray Latch
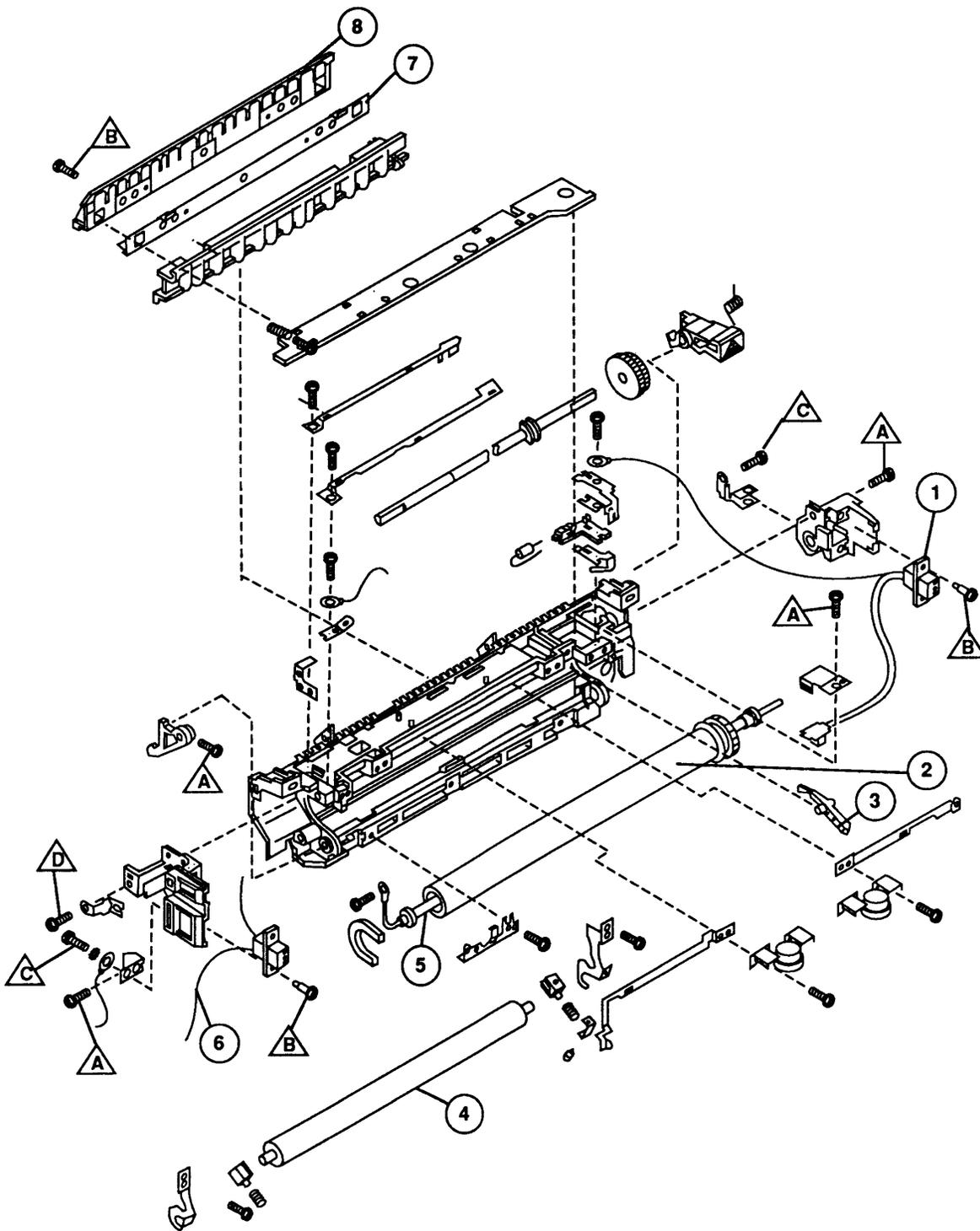
Figure 20

❑ FUSER ASSEMBLY (Figure 20)

Item	Part No.	Description
1	569-0060	Thermistor Cable
2	870-0099	Upper Fuser Roller
3	815-1201	Delivery Sensor Lever
4	870-0098	Lower Fuser Roller
5	890-0427	Halogen Heater 110/115 V
	890-0428	Halogen Heater 220/240 V
6	569-0049	Fuser AC Connector Cable
7	948-0145	Fuser Static Eliminator
8	949-0260	Fuser Entrance Guide

Note: The following parts shown in this diagram are available as part of the Screw Kit:

A Screw, Pan Head with Cap, Helical/Plain
      Whr., 3 x 6 mm (10/pk)
B Screw, Machine, Stepped, 3 x 7.5 mm (10/pk)
C Screw, Pan Head with Cap, Helical/Plain
      Whr., 3 x 8 mm (10/pk)
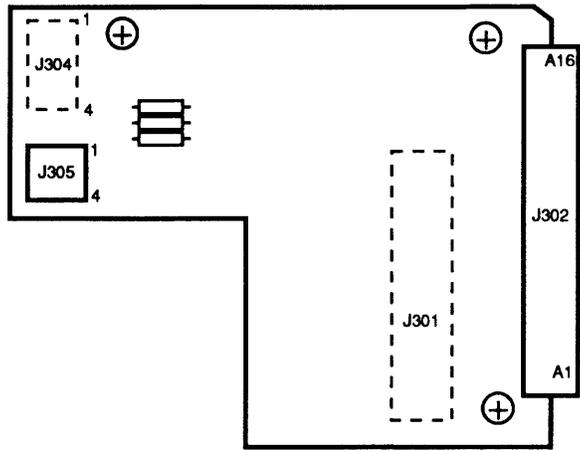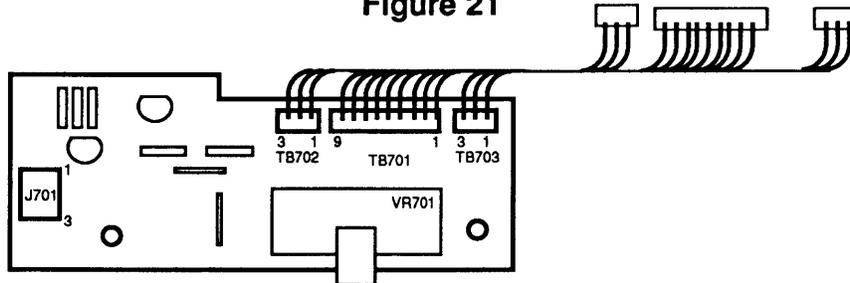D Screw, Pan Head, Machine, 3 x 16 mm
      (10/pk)
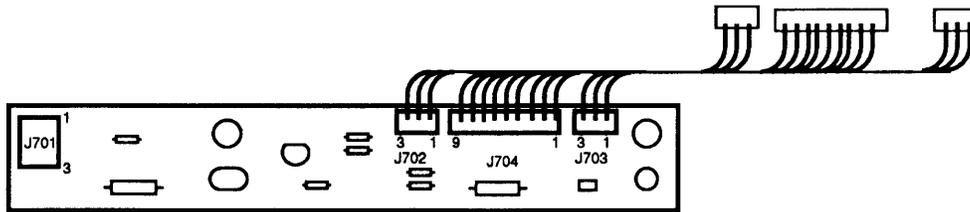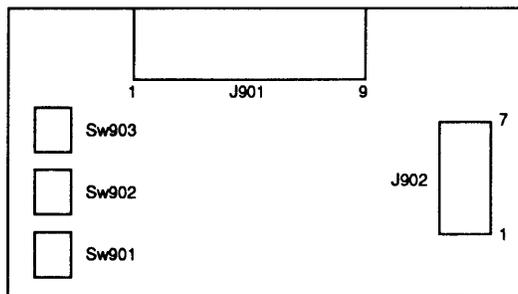
Figure 21

Figure 22

Figure 23

Figure 24

❏ INTERCONNECT PCB – LW NT/SC/NTR (Figure 21)

Item	Part No.	Description
–	982-0048	Interconnect PCB (LaserWriter NT, SC, and NTR)

❏ DENSITY-ADJUSTING PCB ASSEMBLY (Figure 22)

Item	Part No.	Description
–	982-0039	Density-Adjusting PCB Assembly (LaserWriter NT, SC, LS, and NTR)

❏ FAN-AND-SENSOR PCB – LW LS/L (Figure 23)

Item	Part No.	Description
–	981-0030	Fan-and-Sensor PCB (LaserWriter LS/L)

❏ CASSETTE FEEDER PCB ASSEMBLY (Figure 24)

Item	Part No.	Description
–	982-0035	Cassette Feeder PCB Assembly
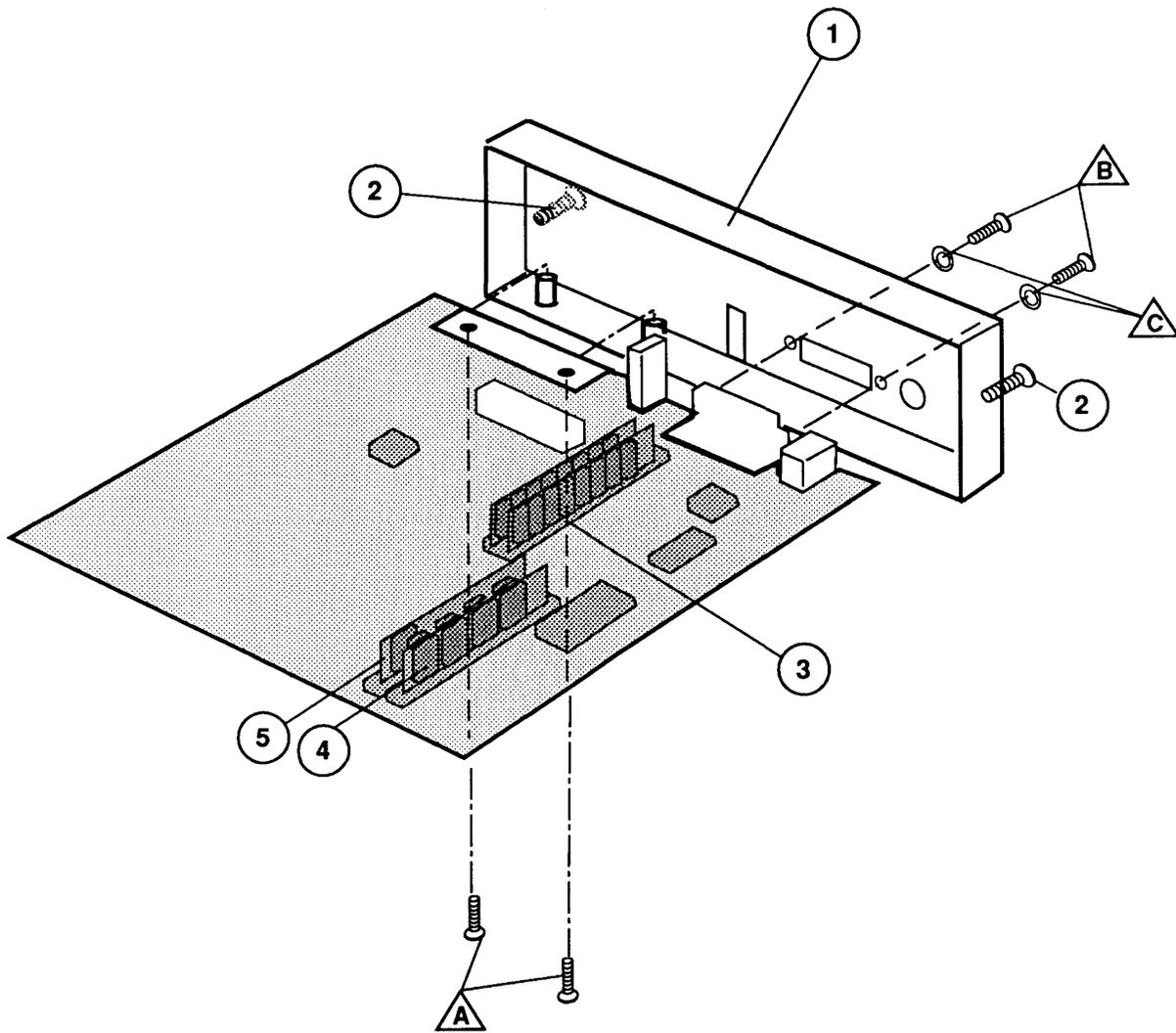
Figure 25

❏ I/O BOARD – LW NT (Figure 25)

Item	Part No.	Description
–	661-0565	I/O Board, LaserWriter NT
1	640-5022	Bracket, I/O Board, LaserWriter NT
2	931-0030	Screw, Capt. Shoulder, 3 x 0.5 mm (10/pk)
3	661-0520	RAM SIMM, 1 MB
4	661-0570	ROM SIMM, 1 MB (location J2)
5	661-0602	ROM SIMM, 256K (location J3)

IMPORTANT: *Refer to the* ❖ Quick Reference: SIMM Compatibility *chart for a comprehensive list of all compatible SIMMs.*

Note: The following parts shown in this diagram are available as part of the Bracket Hardware Kit:

    A Screw, M 3.0 x 0.5 x 8 mm, PNCRS REC
        (10/pk)
    B Nut, Jack-D Subconnector (10/pk)
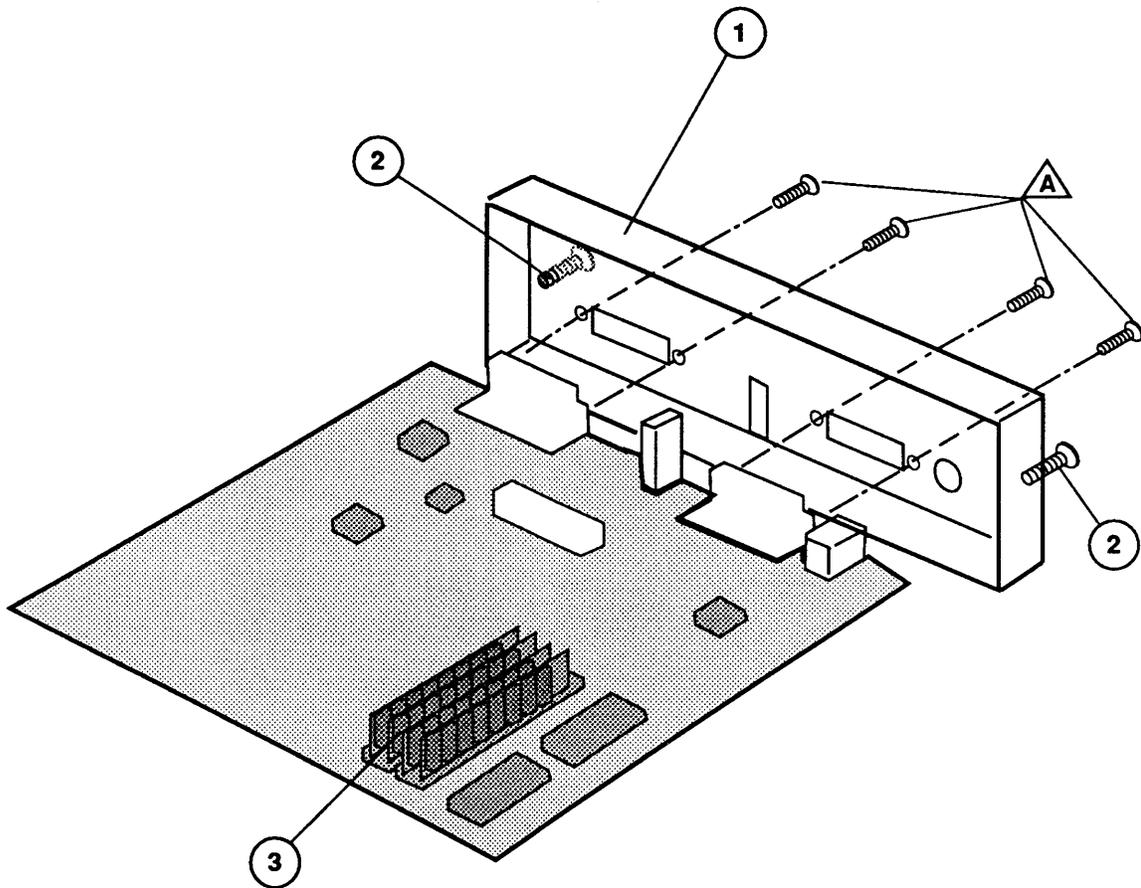   C Washer, Lock, Helical Spring (10/pk)

Figure 26

❏ I/O BOARD – LW SC (Figure 26)

Item	Part No.	Description
–	661-0566	I/O Board, LaserWriter SC
1	640-5020	Bracket, I/O Board, LaserWriter SC
2	931-0030	Screw, Capt. Shoulder, 3 x 0.5 mm (10/pk)
3	661-0402	SIMMs, 256K

IMPORTANT: *Refer to the* ⬤ Quick Reference: SIMM Compatibility *chart for a comprehensive list of all compatible SIMMs.*

Note: The following part shown in this diagram is available as part of the Bracket Hardware Kit:
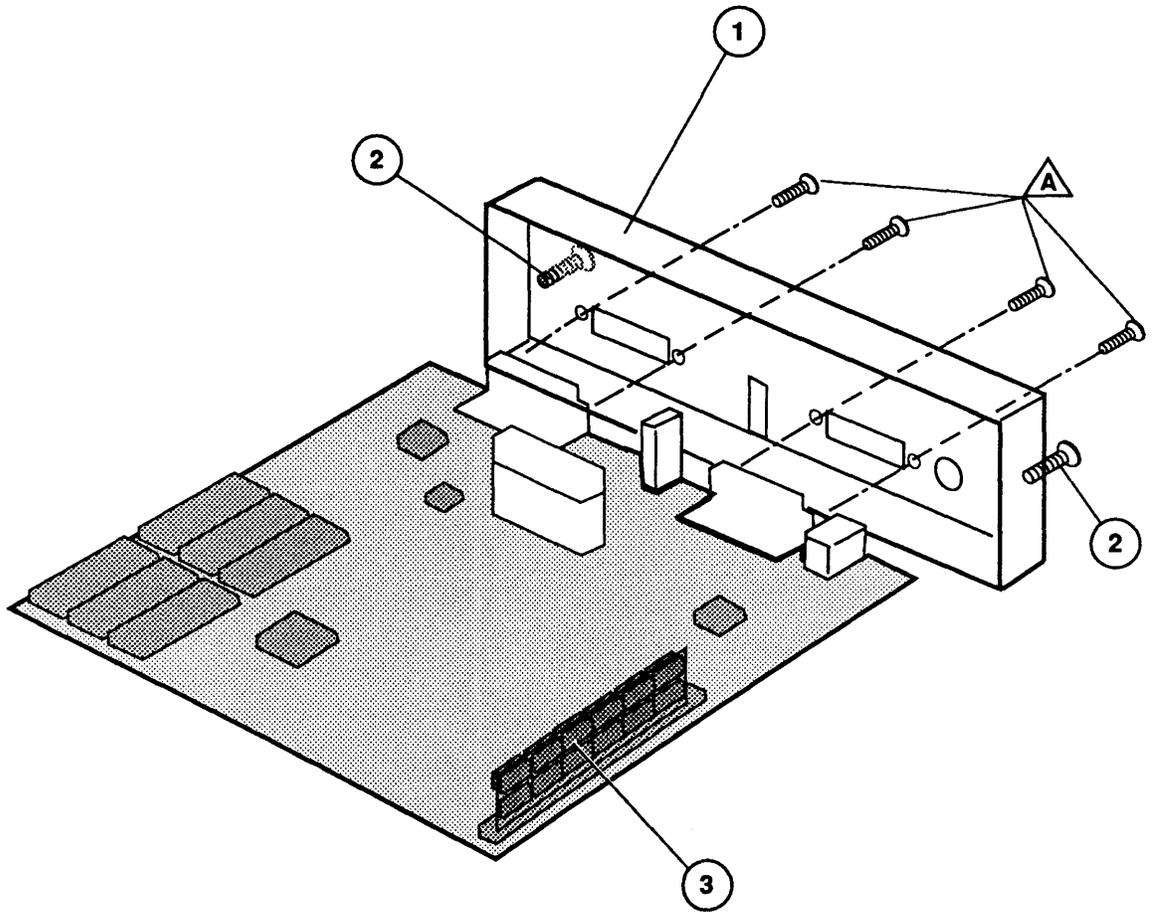
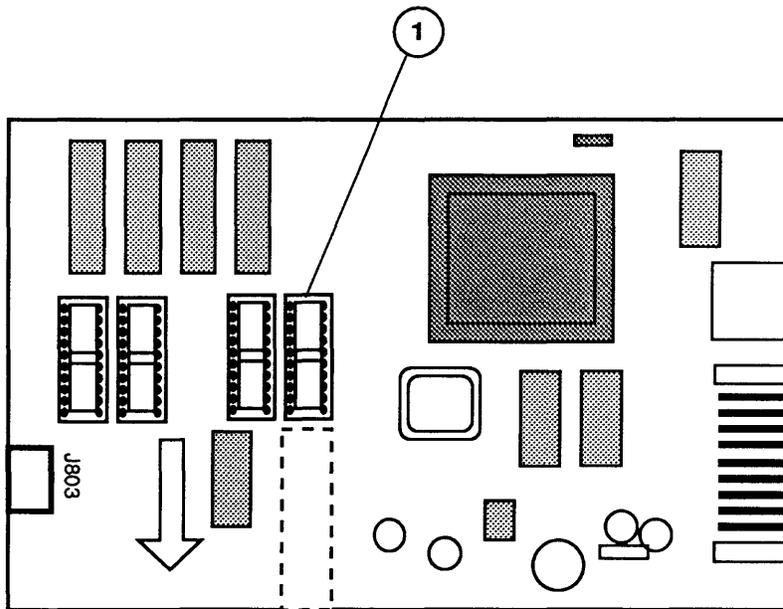   A   Screw, M 3.0 x 0.5 x 8 mm PNCRS REC (10/pk)

Figure 27

❏ I/O BOARD – LW NTR (Figure 27)

Item	Part No.	Description
–	661-0725	I/O Board, LaserWriter NTR
1	948-0153	Bracket, I/O Board, LaserWriter NTR
2	931-0030	Screw, Capt. Shoulder, 3 x 0.5 mm (10/pk)
3	661-0734	SIMM, 1 MB, SOJ, 80 ns, 72 pin

IMPORTANT: *Refer to the ☬ Quick Reference: SIMM Compatibility chart for a comprehensive list of all compatible SIMMs.*

Figure 28

❑ I/O BOARD – LW LS (Figure 28)

Item	Part No.	Description
–	661-0631	I/O Board, LaserWriter LS
1	334-0114	IC, DRAM, 256K x 4, 80 ns (replacing part number 333-1029)
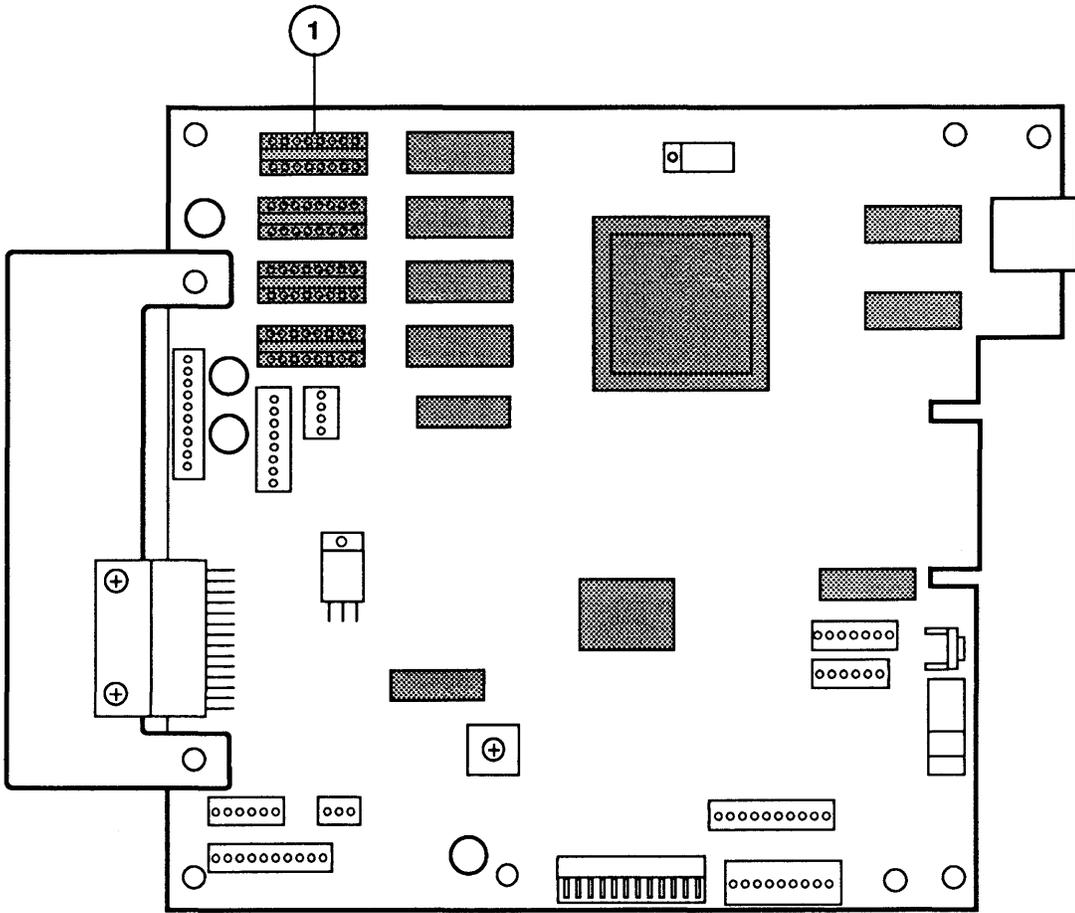
Figure 29

❑ SERIAL CONTROLLER – LW LS/L (Figure 29)

Item	Part No.	Description
–	661-0669	Serial Controller, LaserWriter LS/L
1	334-0114	IC, DRAM, 256K x 4, 80 ns
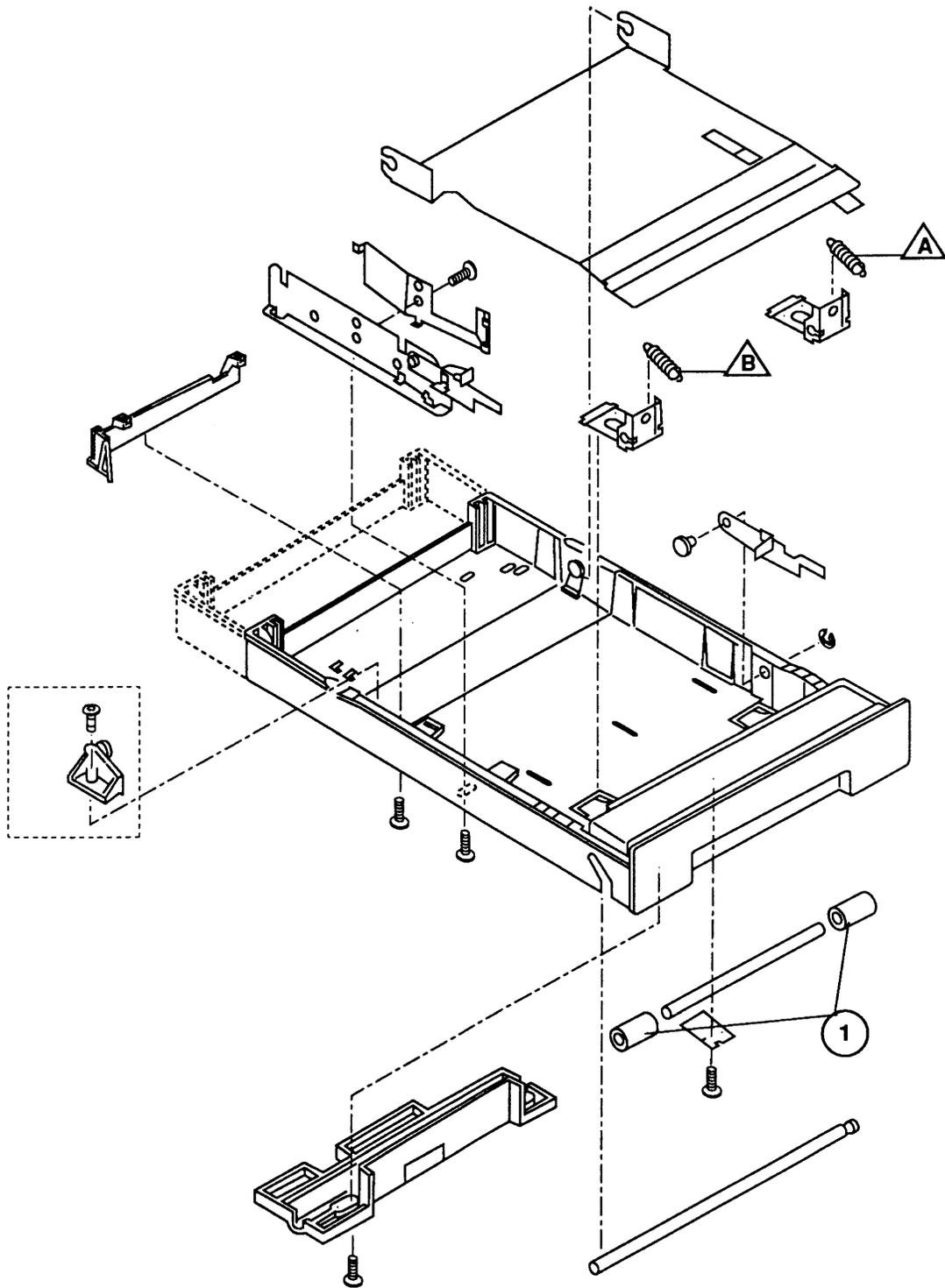
Figure 30

❏ CASSETTES (Figure 30)

Item	Part No.	Description
–	640-8002	Letter Cassette
	640-8003	Legal Cassette
	640-8006	A4 Cassette
	640-8007	B5 Cassette
1	870-0093	Cassette Roller

Note: The following parts shown in this diagram are available as part of the Spring Kit.

- A Right Cassette Spring (10/pk)
  (A4, Letter, and Legal Cassettes)
  Exe Cassette Spring (10/pk) (B5 Cassette)
- B Left Cassette Spring (10/pk)
  (A4, Letter, and Legal Cassettes)
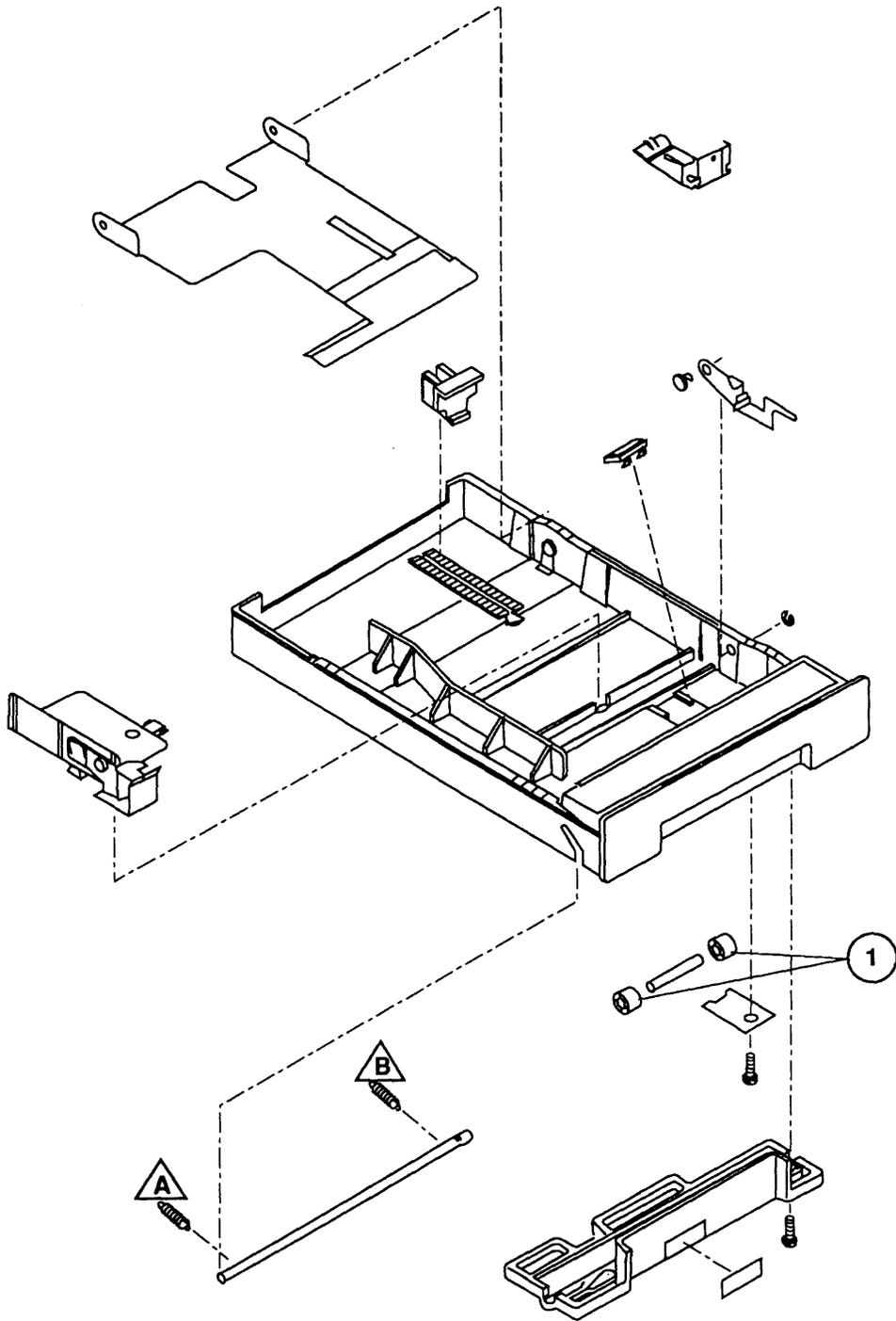 Exe Cassette Spring (10/pk) (B5 Cassette)

Figure 31

❏ ENVELOPE CASSETTE (Figure 31)

Item	Part No.	Description
–	640-8005	Envelope Cassette
1	870-0102	Envelope Cassette Roller

Note: The following parts shown in this diagram are available as part of the Spring Kit:

A   Left Envelope Cassette Spring (10/pk)
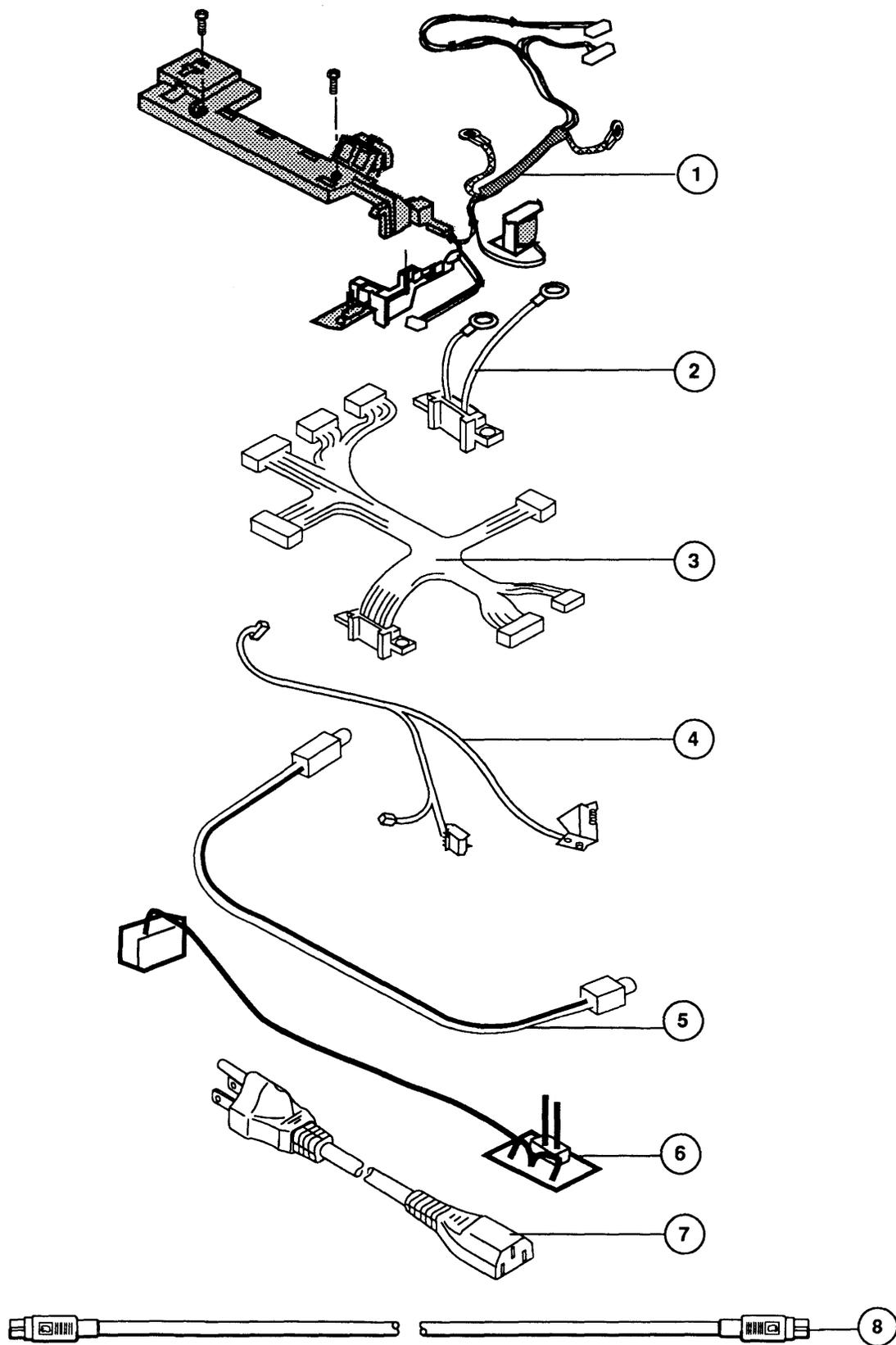B   Right Envelope Cassette Spring (10/pk)

Figure 32

❏ CABLES (Figure 32)

Item	Part No.	Description
1	890-8605	Multipurpose Cable Assembly
2	569-0060	Thermistor Cable
3	890-8604	Bottom Assembly Cable
4	569-0047	Cassette Sensor Cable
5	569-0048	Optical Fiber Cable
6	569-0049	Fuser AC Connector Cable
7	590-0380	Power Cable
8	590-0552	Peripheral—8 Cable (LaserWriter LS)

❑ SPRING KIT

Item	Part No.	Description
–	076-8392	Spring Kit

The parts included in the Spring Kit are listed below:

Right Cassette Spring (10/pk)
Sensing Arm Spring (10/pk)
Exe Cassette Spring (10/pk)
Cassette Stop Cover Spring (10/pk)
Clutch A Spring (10/pk)
Clutch B Spring (10/pk)
Left Cassette Spring (10/pk)
Left Envelope Cassette Spring (10/pk)
Paper Compression Spring (10/pk)
Right Envelope Cassette Spring (10/pk)

❑ SCREW KIT

Item	Part No.	Description
—	076-8382	Screw Kit

The parts included in the Screw Kit are listed below:

Screw, Machine, Stepped, 3 x 7.5 mm (10/pk)
Screw, Machine, Stepped, 3 x 8 mm (10/pk)
Screw, Pan Head w/Cap Ext. Tooth Whr., 3 x 6 mm (10/pk)
Screw, Pan Head w/Cap Ext. Tooth Whr., 3 x 8 mm (10/pk)
Screw, Pan Head w/Cap Helical/Plain Whr., 3 x 6 mm (10/pk)
Screw, Pan Head 2w/Cap Helical/Plain Whr., 3 x 8 mm (10/pk)
Screw, Pan Head, 3 x 10 mm, Black (10/pk)
Screw, Pan Head, 3 x 16 mm, Black (10/pk)
Screw, Pan Head, Machine 3 x 6 mm (10/pk)
Screw, Pan Head, Self-Tapping, 3 x 8 mm, Black (10/pk)
Screw, Pan Head, Self-Tapping, 4 x 10 mm (10/pk)
Screw, Pan Head, Machine, 3 x 8 mm, Black (10/pk)
Screw, Pan/Washer Head, 3 x 6 mm (10/pk)

❑ DOWEL AND RING KIT

Item	Part No.	Description
–	076-8379	Dowel and Ring Kit

The parts included in the Dowel and Ring Kit are listed below:

Packing List, Dowel and Ring Kit
Dowel Pins, 1.6 x 8 mm (10/pk)
Dowel Pins 2.0 x 12 mm (10/pk)
Dowel Pins, 2 x 14 mm (10/pk)
E-Ring, 5.0 mm dia. (10/pk)
E Ring, 6.4 mm dia. (10/pk)

❏ BRACKET HARDWARE KIT

Item	Part No.	Description
–	076-8410	Bracket Hardware Kit

The parts included in the Bracket Hardware Kit are listed below:

Packing List, Bracket Hardware Kit
Screw M 3.0 x 0.5 x 8 mm PNCRS REC (10/pk)
Nut, Jack-D Sub-Connector (10/pk)
Washer, Lock, Helical Spring (10/pk)