LG12
Text and Graphics Printer

Maintenance Manual

digital™

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FCC USER STATEMENT

NOTICE:

This equipment generates, uses, and may emit radio frequency. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such radio frequency interference. Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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Replacement Procedures

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1 Overview

Chapter Contents

About This Manual

This is a field service maintenance manual for the LG12 Text and Graphics printer.

This manual does not explain how to operate or configure the printer. For that information, refer to the *User's Manual.*

How to Use This Manual

This manual is designed so that you can quickly find the information you need to service the printer. You can locate maintenance information three ways:

- Use the **Table of Contents** at the front of the manual.
- Use the **Chapter Contents** listed at the front each chapter.
- Use the **Index** at the back of the manual.

Read the entire procedure before beginning any maintenance task.

Gather all required tools and make sure you understand all warnings, cautions, and notes before you begin working on the printer.

Warnings and Special Information

Always comply with information printed under the following headings:

WARNING

Conditions that can harm you and damage the printer.

CAUTION

Conditions that can damage the printer.

IMPORTANT

Information vital to proper operation of the printer.

NOTE: Information important enough to emphasize.

Printing Conventions in This Manual

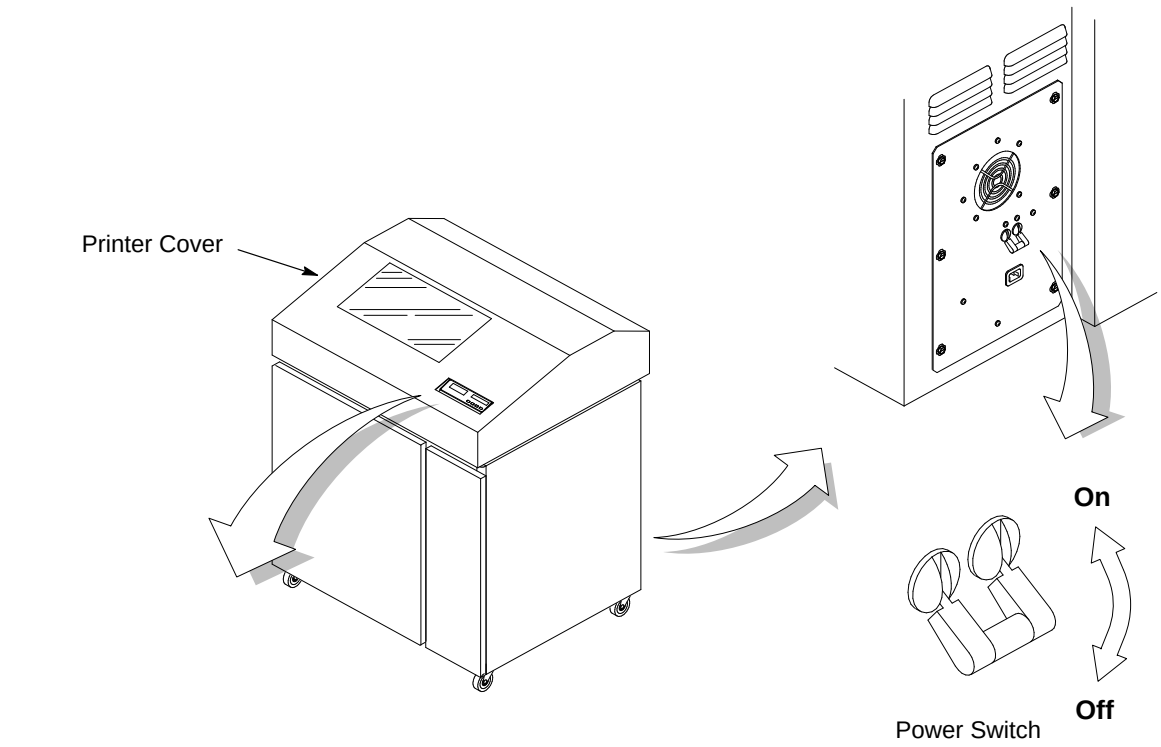
Switches, indicators, and switch positions that are labeled on the printer are printed in uppercase letters.
Example: Press the CLEAR switch.

Messages that appear on the liquid crystal display of the control panel are printed in quotation marks.
Example: Press the CLEAR switch. “Off–Line Emulation” appears on the LCD.

Controls and Indicators

Electrical Controls and Indicators (Figure 1–1)

Switch or Indicator	Function
NOTE: ON LINE is the only switch that operates when the printer is on–line. All other switches operate only in the off–line state.	
Power Switch	Turns printer on and off. Is also a circuit breaker.
Status lamps	Illuminate when printer is on–line. Flash alternately to indicate fault or warning. Off when printer is off–line.
LCD	Liquid Crystal Display. Shows printer status and error messages.
ON LINE	Toggles the printer on–line and off–line.
FF	Advances paper to top of form on next page.
LF	Advances paper to top of next print line. When pressed with ▶ switch, micro–steps paper vertically.
VIEW	Advances paper for viewing through cover window, then returns paper to print position.
▲ (UP)	Displays configuration menus, submenus, and diagnostic tests. Locks and unlocks ENTER switch when pressed simultaneously with ▼ switch.
▼ (DOWN)	Displays configuration menus, submenus, and diagnostic tests. Locks and unlocks ENTER switch when pressed simultaneously with ▲ switch.
◀ (PREV)	Displays previous parameter in a configuration or diagnostic test menu.
▶ (NEXT)	Displays next parameter in a configuration or diagnostic test menu.
CLEAR	Clears printer after a fault is corrected. Returns printer to off–line state from within a configuration menu. When pressed simultaneously with R/S switch, resets printer to most recently saved configuration.
R/S	Runs and stops configuration and self tests. Runs and stops hex dump. Resets printer to most recently saved configuration when pressed simultaneously with CLEAR switch.
SET TOF	Sets location of first line of print on a page.
ENTER	Enters displayed parameter into printer nonvolatile memory. Must be unlocked before using.



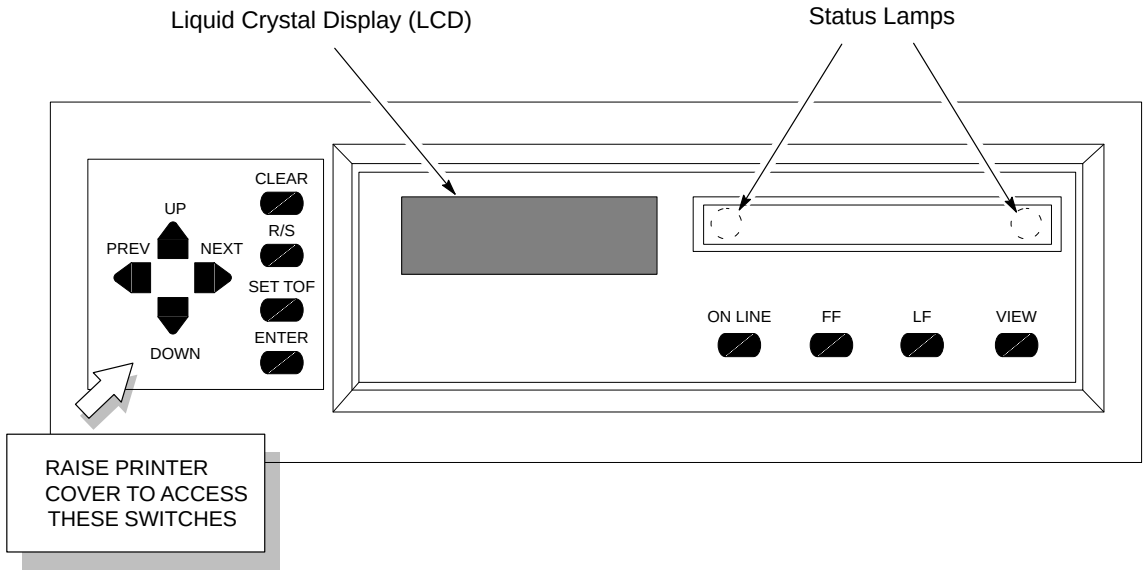


Figure 1–1. Electrical Controls and Indicators

Mechanical Controls (Figure 1–2)

Control or Indicator	Function
Forms thickness lever	Sets platen for paper and forms of different thicknesses. Must be raised to load paper.
Forms thickness pointer and scale	Indicates relative thickness of paper. Set the forms thickness lever at A for thin (single–part) forms, B for thicker forms, and so on.
Tractors (2)	Hold and feed paper. Also used to set left side margin.
Tractor locks (2)	Lock tractors in position.
Horizontal adjustment knob	Allows fine positioning of left print margin. Moves paper left or right.
Vertical adjustment knob	Used to set top of form or first line to be printed. Rotate to move paper vertically.

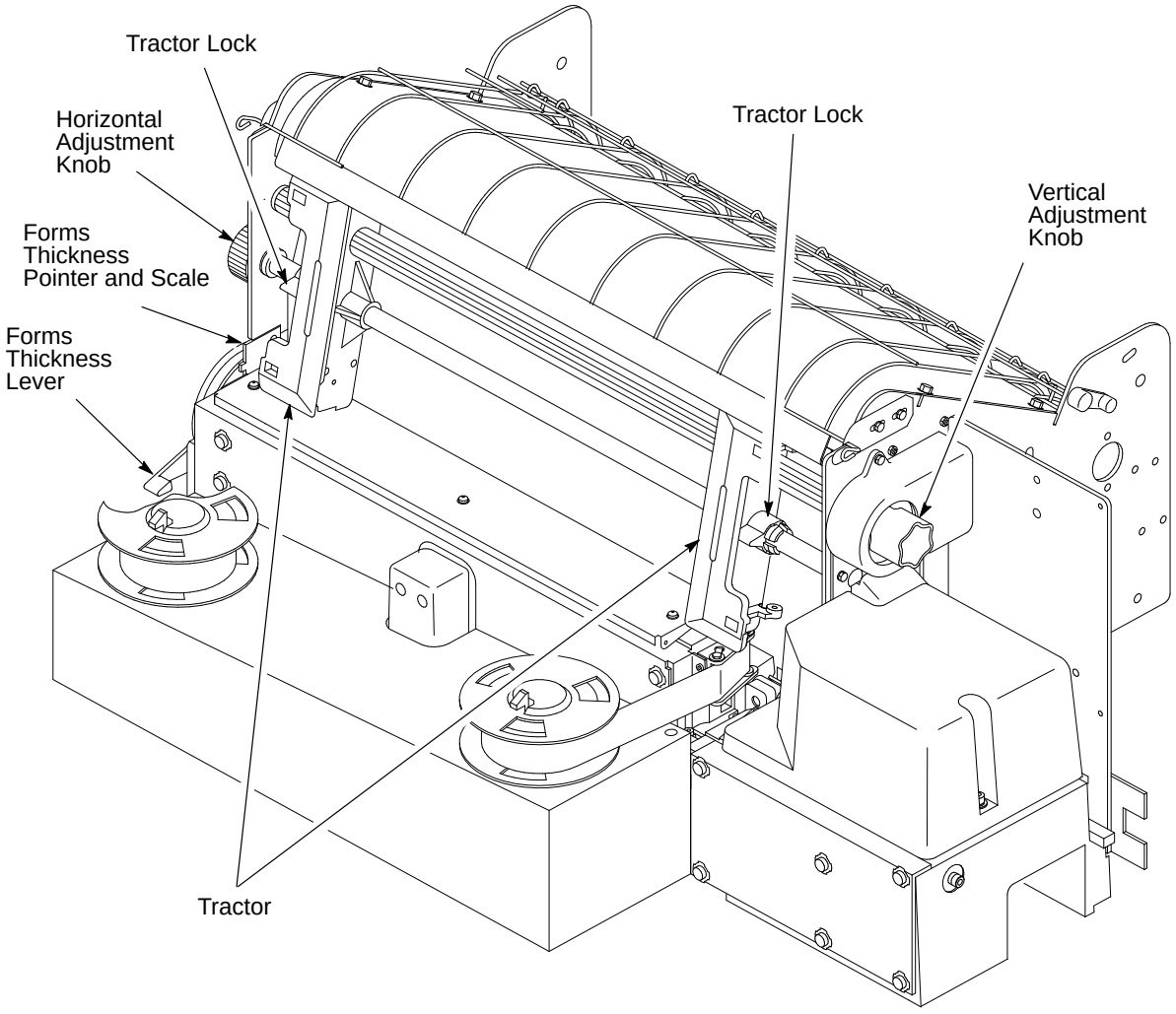


Figure 1–2. Mechanical Controls

Tools, Test Equipment, and Supplies

The tools, test equipment, and supplies required for field level maintenance of LG12 printers are listed below.

Item	Part Number	Recommended Item
Adjustable Wrench	—	Utica 91–4C
Alcohol, Anhydrous	—	—
Anti–Static Workstation, Pocket	29–26246–01	—
Diagonal Cutters	—	Erem 91EH
Digital Voltmeter	—	—
Extension, 3 in., 3/8 Drive	—	—
Feeler Gauge Set	—	Proto 000AA
Force Gauge	29–24411–00	—
IC Insertion/Extraction Tool	29–24015–00	—
Kimwipes	—	—
Lubricant, Bearing	29–30945–01	—
Nut Driver Set	—	Xcelite P2120
Oscilloscope and Probes (≥ 35 MHz)	—	—
Packaging Kit	134742–001	—
Pliers, Grip Ring	—	Truarc 1120
Pliers, Chain Nose	—	Erem 11DH
Ratchet, 3/8 in. Drive	—	—
Rule, Steel, 6 in.	—	General 616
Scale, Spring, 0 to 40 lbs.	—	—
Driver, Torque Screwdriver	29–17381–00	Utica TS35
Adapter, Torque Screwdriver	29–24723–00	Utica HW–18
Extension, 6 in., Torque Screwdriver	—	—
Hex Bit, 3/16 in., Torque Screwdriver	29–20995–00	Utica W–8
Hex Bit, 3/32 in., Torque Screwdriver	29–18505–00	Utica HW–4
Hex Bit, 5/32 in., Torque Screwdriver	24–18504–00	Utica HW–6
Hex Bit, 5/64 in., Torque Screwdriver	—	—
Hex Key Set, 15 PC	—	McMaster–Carr Supply, Cat. No. 7125A11
Screwdriver, Allen Hex	—	Xcelite 99PS40
Screwdriver, Phillips	—	Xcelite X100
Screwdriver, Phillips	—	Xcelite X102

Item	Part Number	Recommended Item
Screwdriver, Slot	—	Xcelite A184
Screwdriver, Slot	—	Xcelite R3164
Screwdriver, Stubby, 1.5 in shank, 0.25 in tip–width	—	—
Shim, Antirotation (0.010 in.)	29–30943–01	—
Shim, Antirotation (0.005 in.)	29–30944–01	—
Shims, Counterweight	29–24417–00	—
Shims, Shuttle Spring	29–24420–00	—
Socket, 7/16 in., 3/8 in. Drive	—	—
Soldering Iron and Tips	—	—
Tool, Antirotation	29–30905–01	—
Tool, Hammer Alignment	FD–28262–01	—
X–acto™ Knife and Blades	—	—

2 Principles of Operation

Chapter Contents

Line Matrix Printing

The LG12 creates characters and graphics by a printing technique called *line matrix printing*. Line matrix printing consists of printing patterns of ink dots on paper, an entire line at a time.

Each text character is stored in memory as a pattern of dots on a logical grid called the *dot matrix*. (See Figure 2–1.) The actual ink dots are made by a row of hammer springs mounted on a shuttle that sweeps rapidly back and forth. Printer logic divides every printable line into horizontal dot rows. The hammer springs put dots at the required positions for the entire line by striking a moving ink ribbon and the paper.

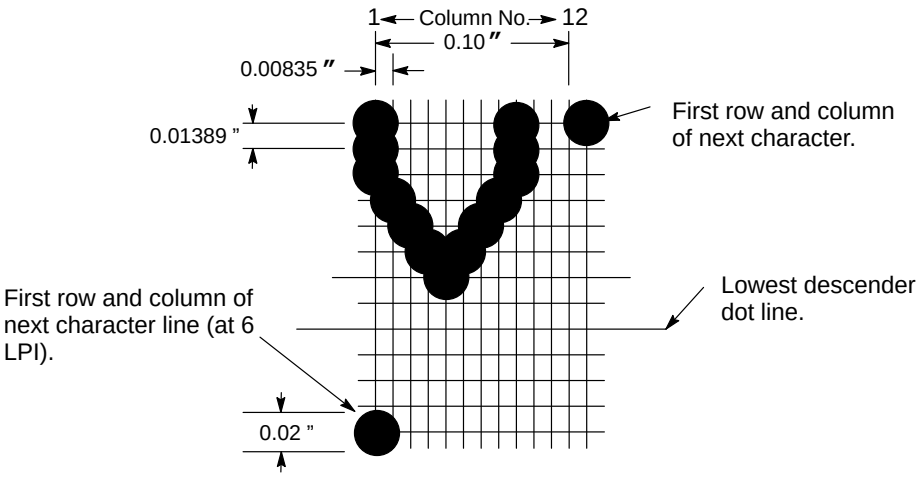


Figure 2–1. A Dot Matrix

When the shuttle reaches the end of a sweep, it reverses direction, the paper is advanced one dot row, and the hammer springs print the next row of dots as the shuttle sweeps in the opposite direction. After a line of characters is printed, hammer action stops and the paper advances to the first dot row of the next print line. The number of dot rows allowed for line separation depends on the vertical line spacing the user selects.

The dot patterns of characters vary according to the font selected. For example, in the data processing (DP) font at a line spacing of six lines per inch (lpi), the dot matrix contains 12 dot rows from the top of one character line to the top of the next. (See Figure 2–1 and Figure 2–2.) At eight lpi there are nine dot rows per character line, at nine lpi eight dot rows per character line, and so on.

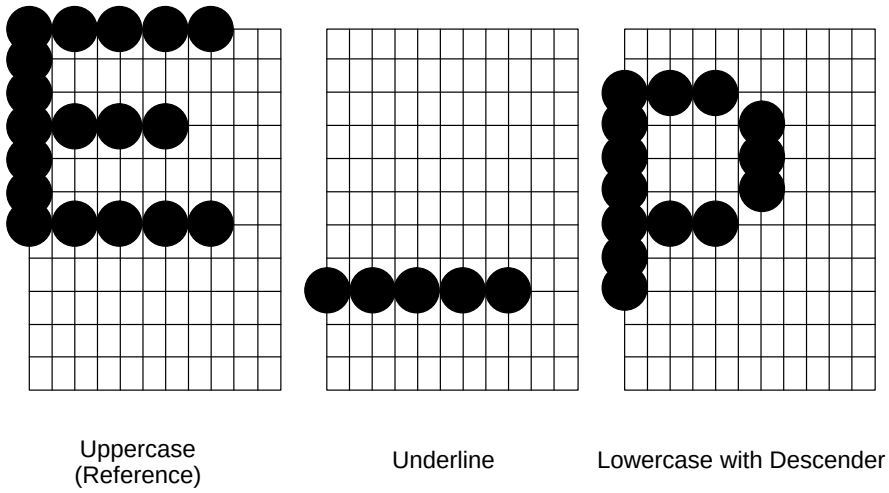


Figure 2–2. Typical Characters

The Hammer Bank

The LG12 uses a hammer bank to print dots. The hammer bank consists of 88 hammer springs mounted on a shuttle that moves horizontally back and forth. The hammer bank prints one horizontal line of dots during each horizontal sweep of the shuttle.

A hammer spring is a stiff leaf spring with a hardened steel tip at the upper end, and is attached to the hammer bank at the lower end. (See Figure 2–3.)

A permanent magnet keeps the hammer springs retracted and under tension. Behind every hammer is a pair of magnetic coils which, when energized, neutralize the field of the permanent magnet. This releases the hammer, which springs forward and strikes the ribbon and paper, leaving a dot. The hammer is recaptured by the permanent magnet as it rebounds. (See Figure 2–4.)

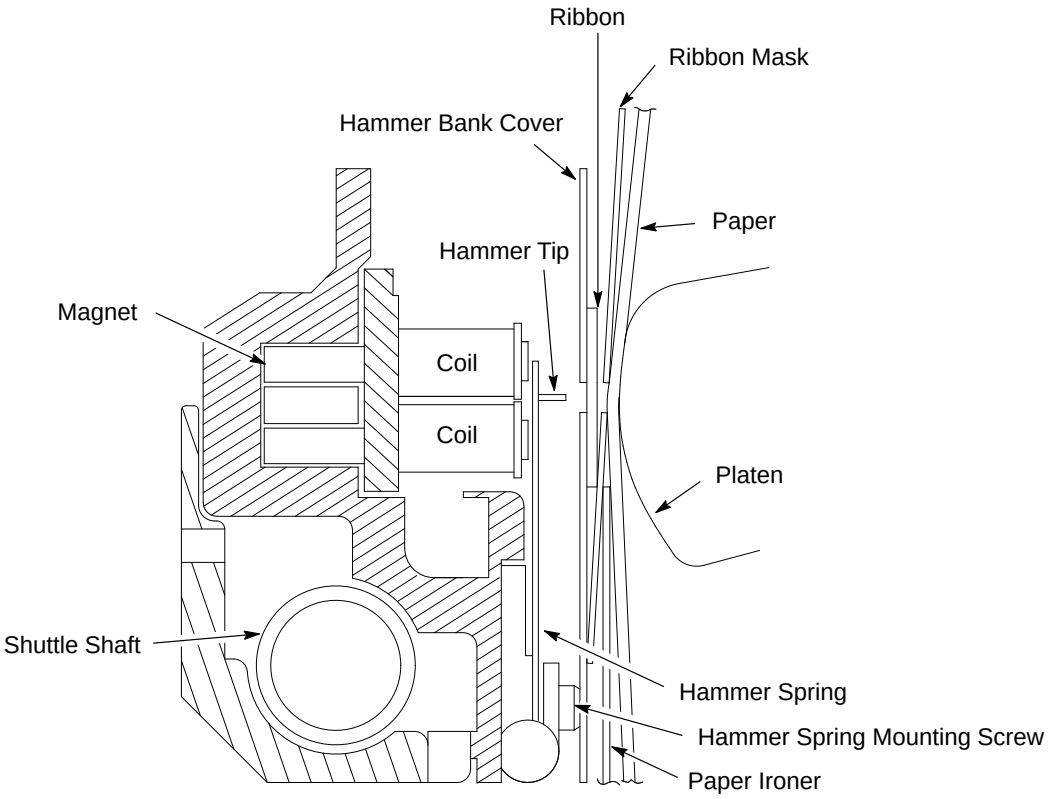


Figure 2–3. Hammer Spring and Shuttle Arrangement

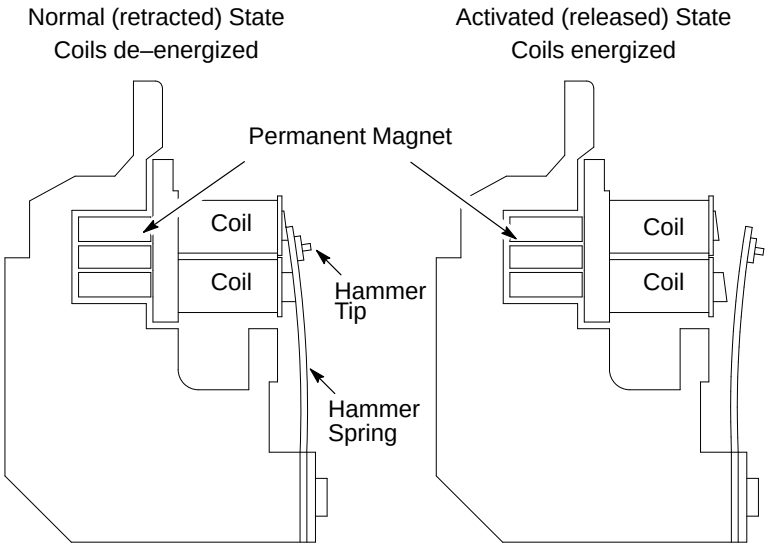


Figure 2–4. Hammer Spring Action

Character Generation

Paper advances one dot row after each horizontal sweep of the shuttle. (See Figure 2–5 and Figure 2–6.)

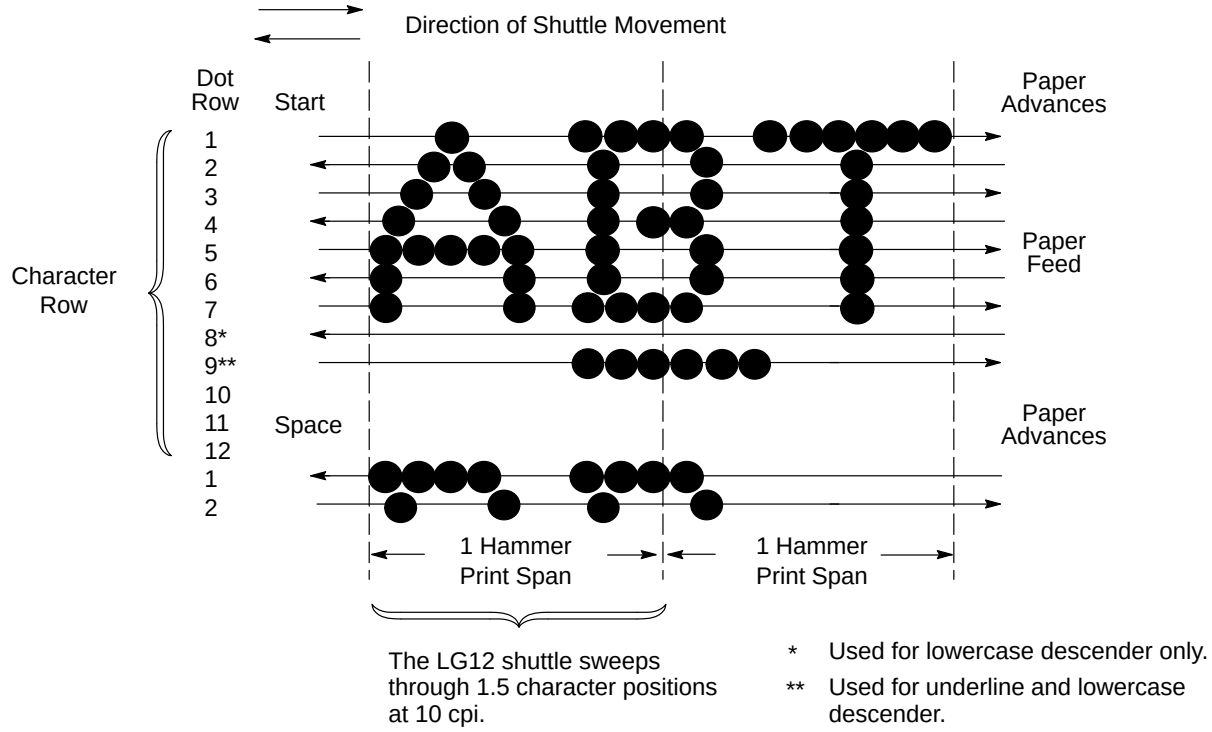


Figure 2–5. Standard Character Formation

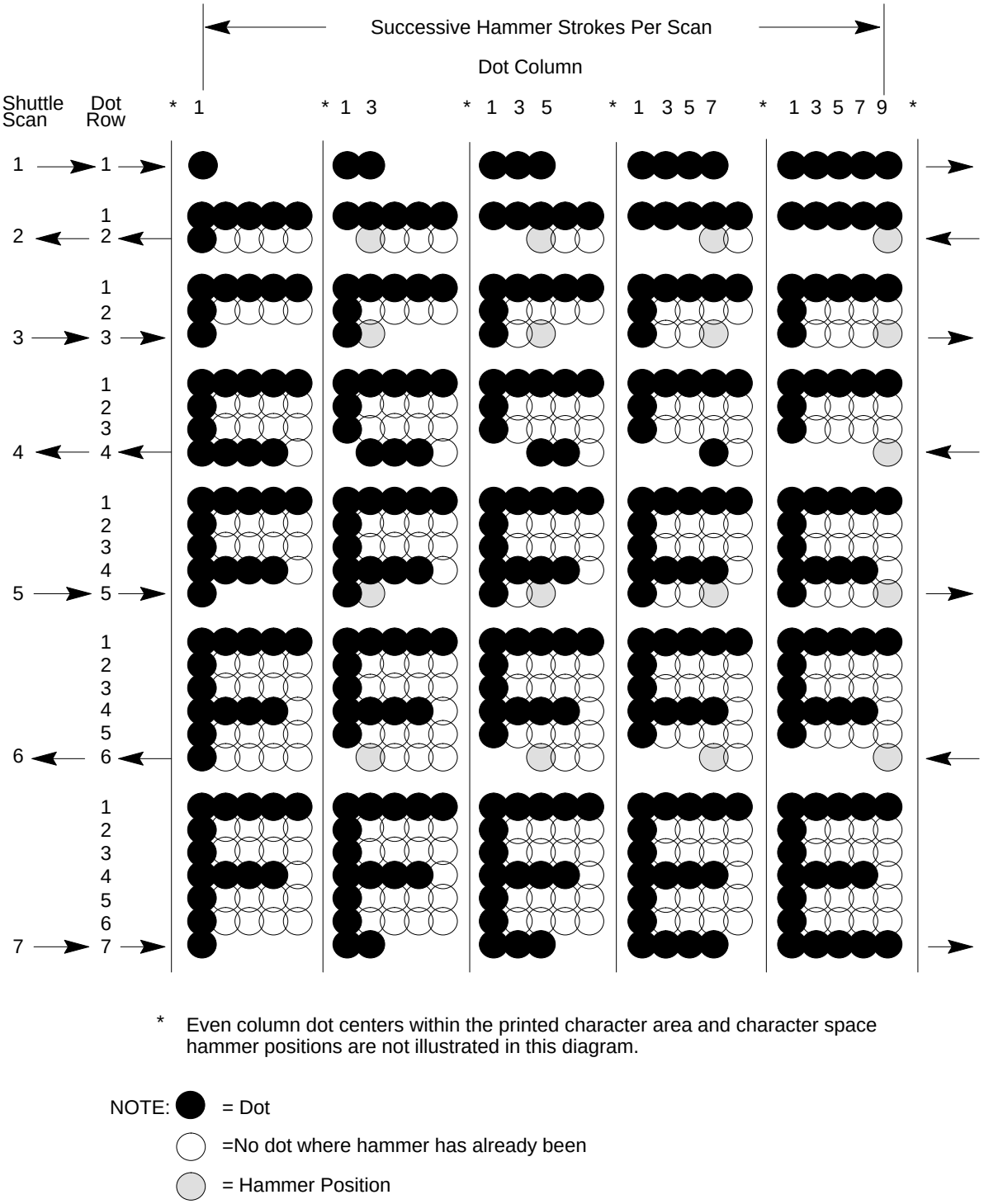


Figure 2–6. Character Formation by One Hammer

Normal Operation

In normal operation, the user presses a switch on the control panel to put the printer on–line. Host computer data are then read into the input buffer as ASCII data. The data in the input buffer are compared to tables stored in memory to determine the matrix and location of each character The characters are then built in the dot image buffer.

Information from the dot image buffer is synchronized with printer requirements using the magnetic pickup signal, then shifted to the hammer drivers. The selected hammers are fired.

When all dots in a row are printed, the paper advances one dot row and the next dot row of data from the dot image buffer are synchronized then shifted to the hammer drivers. Vertical paper movement is delayed to allow double printing if adjacent dot printing is required. (See Figure 2–7.)

During self–tests, data stored in ROM are used to build the dot image buffer. Operation then proceeds as in normal printing.

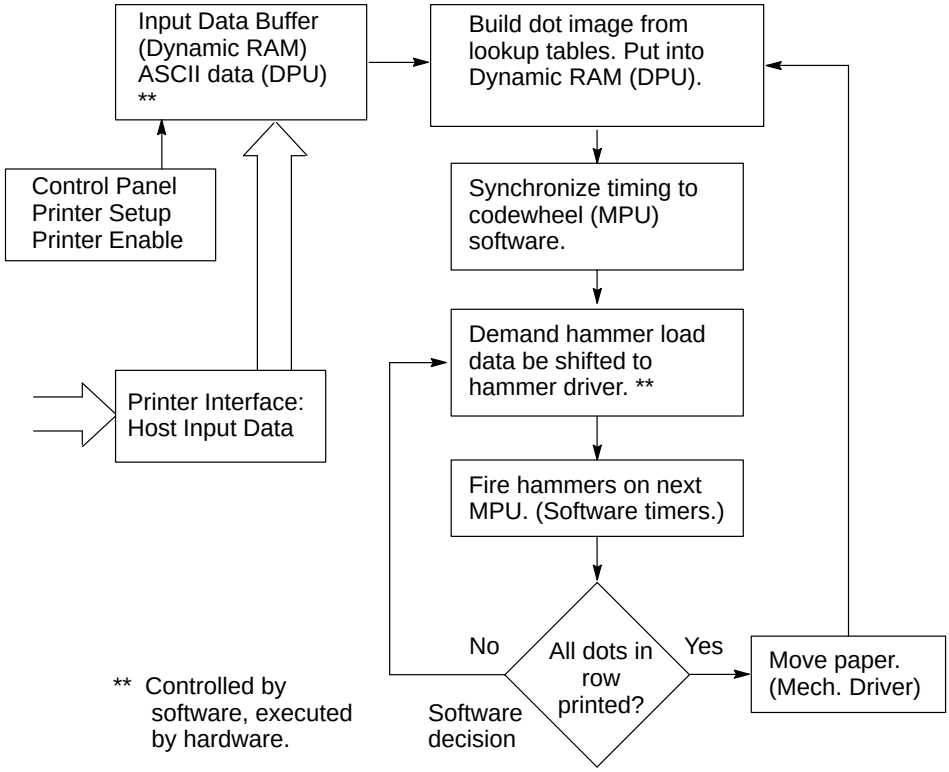


Figure 2–7. The Print Cycle

Functional Elements of the Printer

The printer consists of six functional elements:

- Control panel
- Common controller board (CCB)
- Mechanism driver board
- Hammer driver board
- Auto–ranging power supply
- Print mechanism

Figure 2–8 is a block diagram of these elements.

The rest of this chapter discusses these systems in more detail.

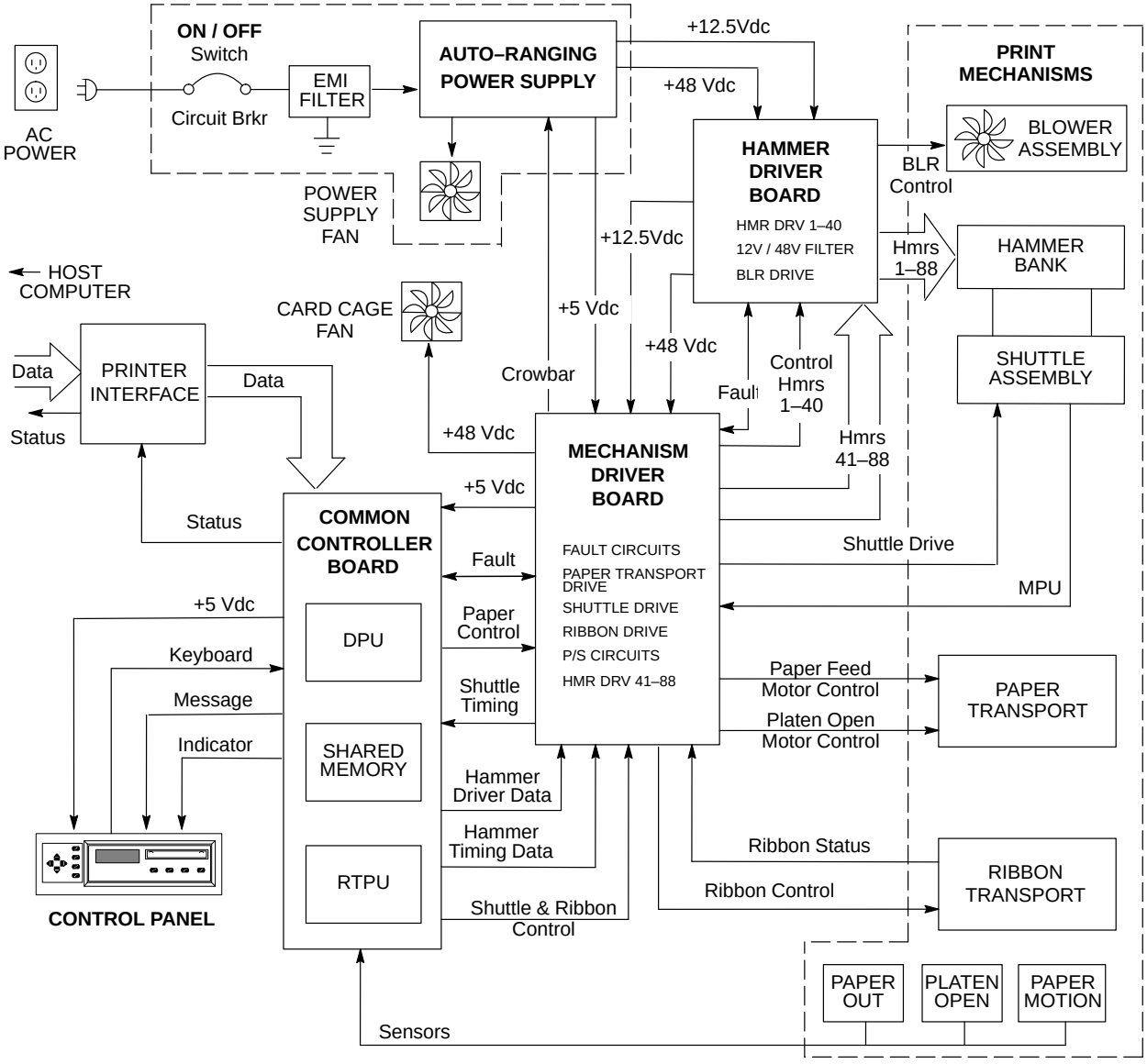


Figure 2–8. Functional Elements of the LG12 Printer

Control Panel

The control panel consists of indicator lamps, LEDs, contact switches, and a liquid crystal display (LCD).

The control panel processes and sends switch closure information to the controller board and receives status information.

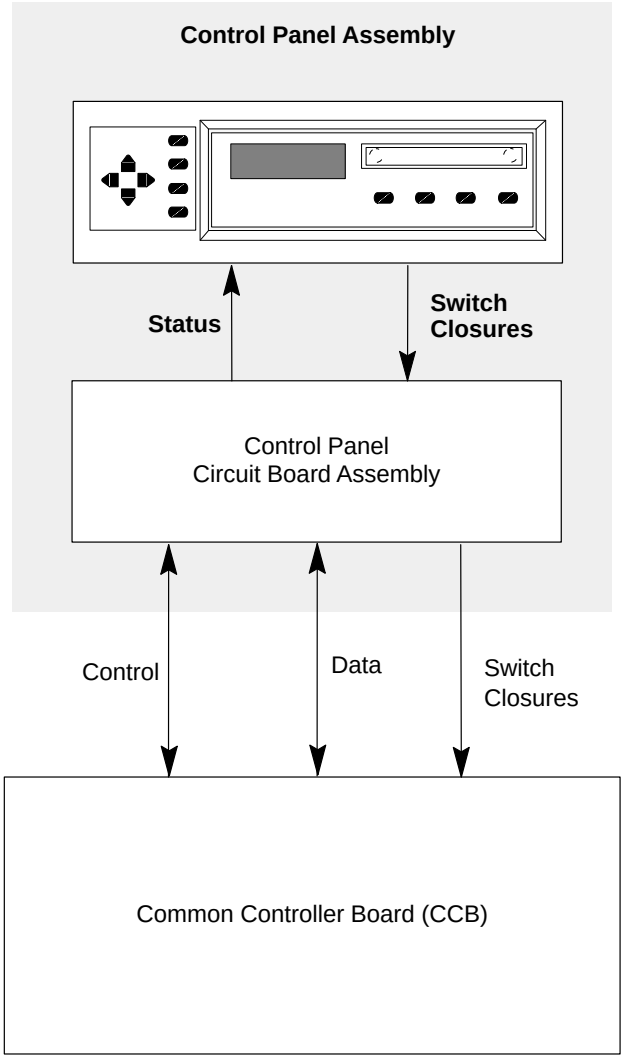


Figure 2–9. Control Panel Block Diagram

Common Controller Board (CCB)

The Common Controller Board (CCB) oversees and coordinates all printer functions. It is functionally two units: the data processing unit (DPU) and the real–time processing unit (RTPU). The DPU converts all character data into printable dot images. The DPU is the high–level logical controller of the printer; it is not involved in real–time or hardware–dependent printer operation. The RTPU operates the host interfaces, operator control panel, and the print mechanism. The RTPU also monitors the fault circuitry in the mechanism.

The DPU and RTPU communicate by means of shared memory. The DPU gets host and operator input from buffers in shared memory which are filled by the RTPU, and returns dot images and operator messages to buffers in memory which the RTPU empties. Figure 2–10 summarizes the architecture of the CCB.

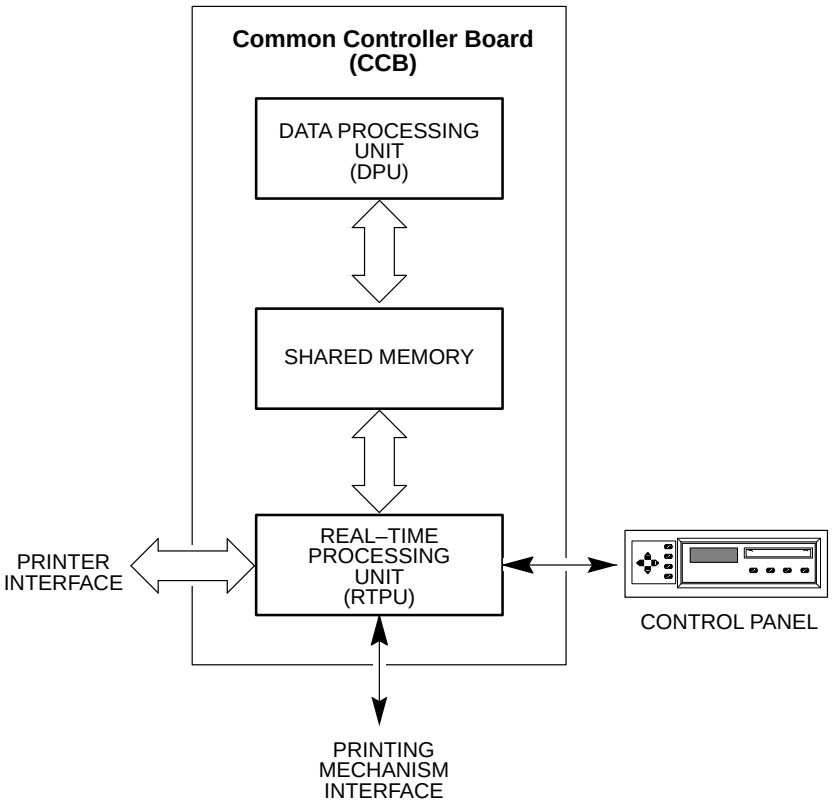


Figure 2–10. Architectural Overview of the CCB

Controller Communication with the Host Computer and Operator

The controller board processes three kinds of computer input: Centronics parallel, DataProducts parallel, and RS–232 serial data. The RTPU operates all three interfaces. The parallel interfaces are similar, and the RTPU contains direct–memory–access (DMA) hardware which loads parallel data directly into shared memory. The serial interface requires byte–by–byte intervention by the processor, since ACK/NACK and XON/XOFF protocols require that every byte be examined as it is received. The universal asynchronous receiver/transmitter (UART) is internal to the RTPU, which processes any protocol requirements then puts the data in shared memory, where the DPU can read it. To the DPU, all input data look the same, regardless of the interface used to receive the data.

Control Panel

The RTPU handles the control panel interface requirements of shifting and clocking control panel data, but the DPU processes the data.

Printing

The RTPU coordinates printing of the dot images sent from the DPU. Printing is a complex process requiring many control functions, but is logically divided into two groups:

- Hammer driver interface functions
- Mechanical interface functions

Hammer Driver Interface Functions

In order to print a dot image, two things must happen. First, the dots must get to the hammers one dot row at a time and in the correct sequence. Second, the hammers must be fired at the appropriate time in the stroke of the shuttle. The RTPU microprocessor controls both of these functions, but each is actually performed by an application–specific integrated circuit (ASIC) containing hardware dedicated to the function. These ASICs are the Dot Plucker Memory Controller (DPMC) and the Fire Timer IC (FTIC). The hammer driver interface functions of the RTPU are summarized in Figure 2–11.

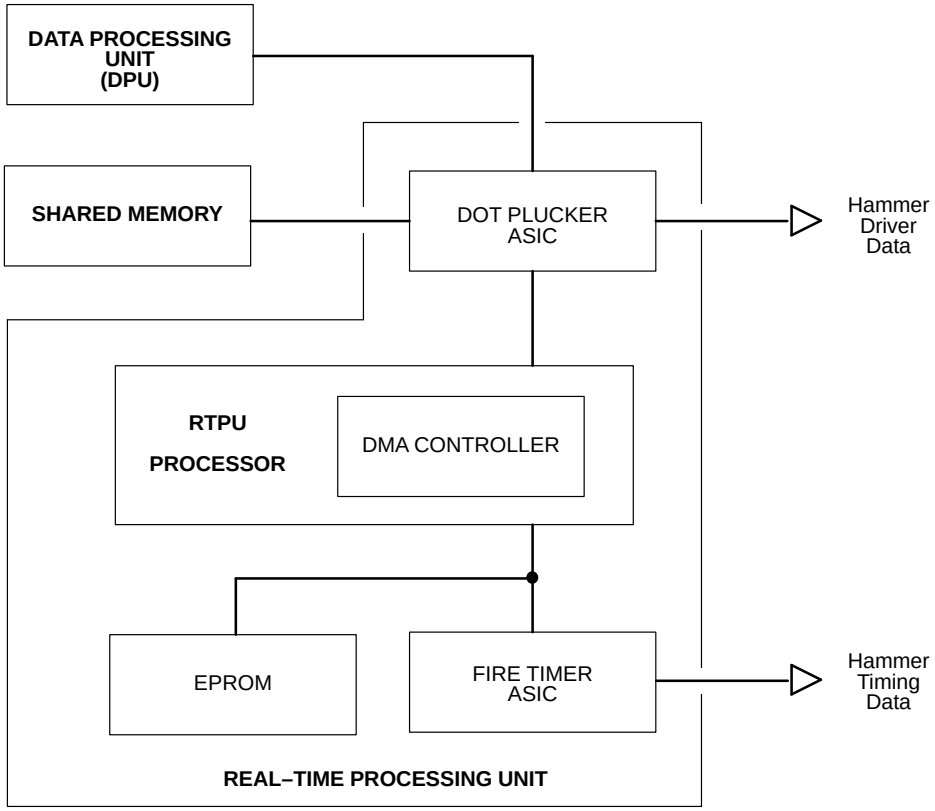


Figure 2–11. Hammer Driver Interface Functions of the RTPU

Getting Dots to the Hammers Getting dots to the hammers consists of going into the shared memory and pulling bits out in a given order and shifting them to the hammer driver at the correct time. This process is called “dot plucking.” The order in which dots are plucked from memory depends on the dot density, the number of dots per hammer, the number of hammers on the hammer bank, the number of phases, and other factors. These factors are all considered by the RTPU processor as it programs the dot plucker and the FTIC for each dot row.

Synchronizing Dot Plucking and Hammer Firing Transfer of dots to the hammer driver must be synchronized with hammer firing. Dots are transferred to the hammer driver in bursts, serial streams of dots that tell which hammers will print when their phase is next fired. The bursts are timed precisely; they must occur neither too early nor too late. Synchronization is performed by having the FTIC request bursts from the dot plucker. The FTIC reads the magnetic pick–up unit (MPU) to determine when to request a burst. The time at which the burst request is made is contained in the fire timing tables.

Mechanical Interface Functions

Three mechanical operations are coordinated in printing: paper motion, ribbon motion, and shuttle motion. Virtually all digital handling of paper motion is contained in the RTPU. The ribbon and shuttle are controlled by logic on the mechanism driver board, under the direction of the RTPU. Figure 2–12 shows the mechanical interface section of the RTPU.

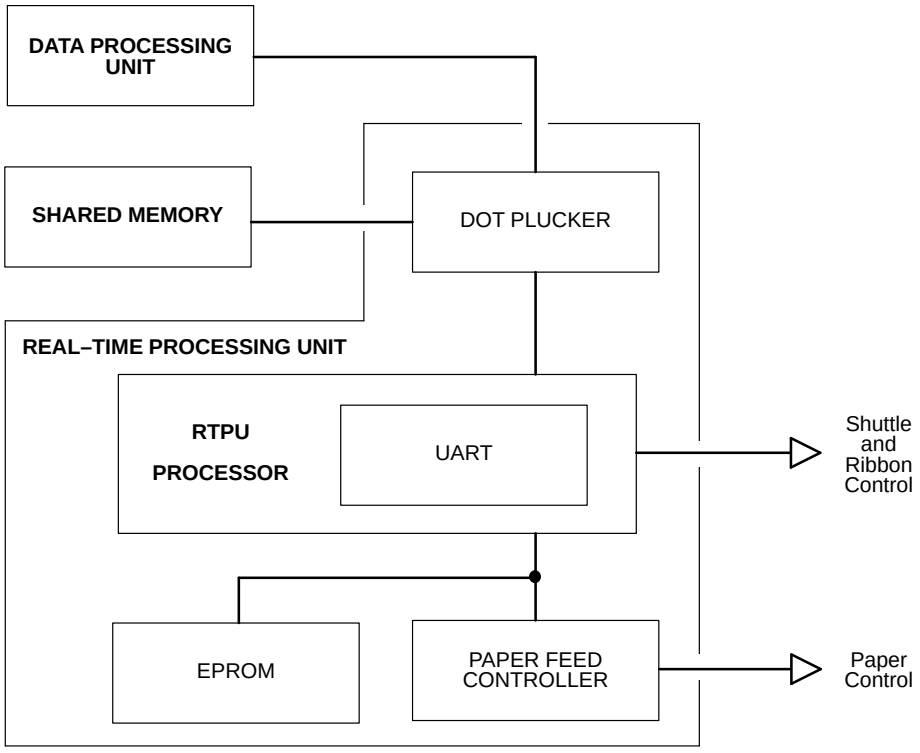


Figure 2–12. Mechanical Interface Functions of the RTPU

Paper Motion The DPU determines when paper must be moved and how far to move it. It communicates this to the RTPU through the shared memory. The RTPU processor performs some paper handling operations (such as holdback on slews), but most RTPU paper handling is done by a dedicated microcontroller called the paper feed controller (PFC).

The PFC moves paper by looking up motion profiles and driving a sequence of motor positions to the mechanism driver board. If the motion is a dot row or interline advance, it is synchronized to hammer firing by a signal from the FTIC that tell the PFC when to move.

Ribbon and Shuttle Motion The ribbon and shuttle motors are controlled by a microcontroller on the mechanism driver board. The RTPU interface to

the ribbon/shuttle processor (RSP) is a 2400 baud asynchronous serial line. A message protocol is used to communicate ribbon and shuttle information.

Fault Monitoring

The RTPU also monitors the hammer driver, mechanism driver, and the electro–mechanical sensors for fault conditions. Fault conditions are reported to the DPU.

Hammer Bank and Hammer Driver Faults

The FTIC works with the hammer driver ASIC to monitor coil shorts, opens, average upper driven phase current, and temperature conditions. The RTPU reads the FTIC registers to determine out–of–range conditions, and these are passed on to the DPU.

Paper Faults

Two kinds of paper faults can occur: paper out and paper jammed. Both of these conditions are monitored through optical sensors. The paper feed controller watches the paper out and paper motion sensors and reports errors to the RTPU. The RTPU passes this information on to the DPU.

Ribbon and Shuttle Faults

The mechanism driver ribbon and shuttle controller monitors fault conditions in the drive circuits and notifies the RTPU if it finds errors. The RTPU can also use the FTIC to measure time between magnetic pick–up (MPU) pulses, enabling it to monitor shuttle speed and thus detect some shuttle faults.

CCB Hardware Summary

A Motorola 68010 microprocessor performs the DPU functions, a 64180 microprocessor handles the RTPU functions, and an 8032 microcontroller serves as the paper feed controller (PFC), which is part of the RTPU. Actual implementation of this hardware blurs the distinctions between the DPU and RTPU, since the 68010 has access to the parallel port and the real–time functions of the dot plucker, which are RTPU resources, while the 64180 has access to the nonvolatile memory (NVRAM), which is a resource of the DPU. These possibilities exist because of efficiencies in the hardware design; software maintains the functional differences between the DPU and RTPU.

The CCB has four data buses:

- The 68010 has a local sixteen bit bus.
- The 64180 uses a local bus eight bits wide.
- The DPU and RTPU share a sixteen bit bus arbitrated on a cycle–by–cycle basis.
- The 8032 chip has its own eight bit local bus.

The manner in which the CCB implements this hardware is depicted in Figure 2–13.

The 64180 IC that oversees the RTPU processor contains a Z80 microprocessor with extended memory management, two DMA controllers, two asynchronous and one synchronous serial port, two counter timers, and an interrupt controller.

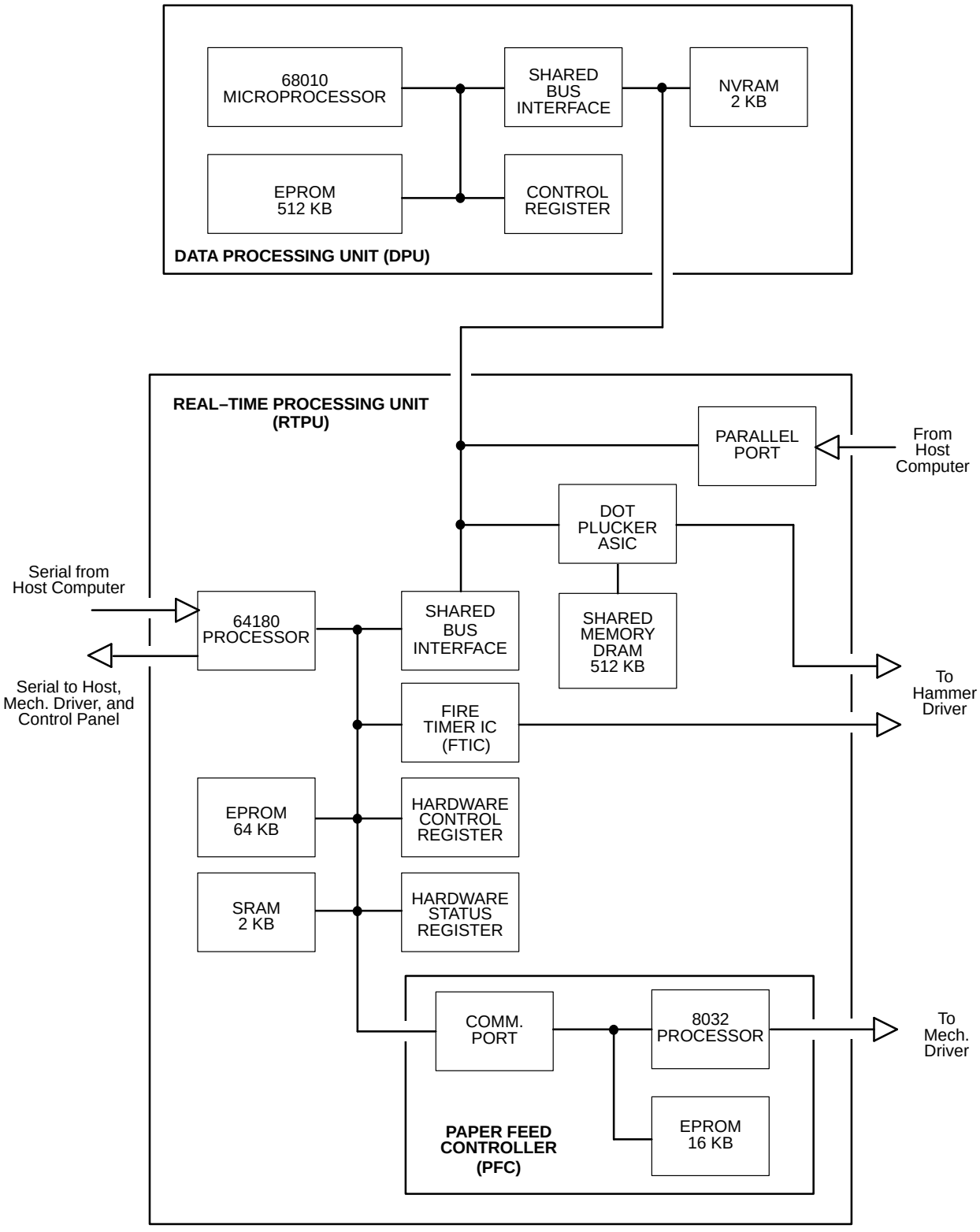


Figure 2–13. Hardware Implementation of the CCB

Communicating with the Host Computer

The 64180 processor runs both the parallel and serial interfaces.

Parallel Input Parallel input data is nine bits wide, and is transferred in one cycle from the parallel port to shared memory over the shared sixteen bit bus. Using the internal DMA controller of the 64180 to transfer parallel data requires some manipulation. The eight bit DMA controller in the 64180 performs either eight or sixteen bit DMA cycles, while the eight bit processor in the 64180 performs only eight bit memory access cycles. Sixteen bit DMA is achieved by hardware shifting of the DMA addresses one bit (effectively multiplying the address by two and changing the DMA auto–increment from byte to word) and by manipulating the control strobe. Software adjusts the addresses provided to the DMA controller when it is programmed for sixteen bit DMA. This manipulation saves both the added cost of a sixteen bit DMA controller and the second cycle that an eight bit transfer would require.

Serial Input One of the 64180 UARTs handles serial communication with the host. Additional modem control lines are provided in the 64180 hardware control register.

Communicating with the Operator

The synchronous serial port in the 64180 shifts data in and out of the operator control panel. The control register in the RTPU contains three other control panel bits: one samples the switches, one strobes the liquid–crystal display, and one strobes a light–emitting diode (LED) holding register.

Printing

Hammer Driver Interface The 64180 programs the dot plucker ASIC and the FTIC every stroke, after which the FTIC uses a DMA request line to control the movement of tables from EPROM to FTIC. The second DMA controller in the 64180 performs this transfer.

Mechanism Driver Interface The paper feed controller (PFC) directs all paper motion. During printing, it usually moves paper in response to a trigger from the FTIC, which synchronizes paper motion with shuttle motion. The 64180 programs the PFC 8032 at the beginning of each dot row, telling the PFC how far to move when the trigger is received. The PFC sets up for the move, waits, then moves when the trigger occurs. The other method of starting paper motion is with a command to move paper immediately. This

results in immediate movement. Other paper commands and status signals are also passed through this port.

Ribbon and Shuttle Motion The 64180 interfaces through its second UART to the ribbon / shuttle processor (RSP) on the mechanism driver board. The 64180 begins all transactions on the serial interface.

Fault Monitoring

The RTPU 64180, the PFC 8032, and the RSP monitor different functions for faults. The 64180 looks for hammer driver faults, shuttle stalls, and an open platen. The PFC 8032 monitors paper out and the paper motion detector. The RSP watches for faults in the motor drive circuits. The PFC and RSP report errors to the 64180, which collates fault status and passes it on to the DPU 68010 processor.

Hammer Bank and Hammer Driver Faults The 64180 and FTIC check the hammer driver and hammer bank for faults on every shuttle stroke. Faults are detected by circuits on the mechanism driver and hammer driver boards and relayed to the CCB. Fault circuitry can detect rising temperatures in the coils. One coil is checked on every shuttle stroke; therefore, 88 shuttle strokes are required to check all coils. When the RTPU is notified of a fault, it sends a message to the 68010. The hammer driver and mechanism driver boards also continuously monitor for shorts in hammer driver circuits and cables. If they detect currents that can harm the hammer bank, the +48 volt power supply is shut down by “crowbar” circuitry within 70 milliseconds.

Paper Faults The PFC 8032 monitors paper faults and reports them to the 64180 through the eight bit parallel port they share. The PFC works with a friction wheel paper motion detector and a reflective (optical) paper out sensor. The sensors interface directly to the CCB; analog circuits on the CCB condition the sensor inputs.

Ribbon and Shuttle Faults The RSP monitors ribbon and shuttle faults and reports them to the 64180 over the serial interface.

Mechanism Driver Board

The mechanism driver board, acting on timing and control signals from the CCB, controls real–time operation of the electromechanical printer systems. Functionally, the board consists of the following subsystems:

- An 8032 microcontroller controls ribbon, shuttle, and platen drives, and communication with the controller board. This 8032 is called the RSP (Ribbon/Shuttle/Platen) controller.
- The interface to the power supply.
- Pulse–width modulator (PWM) current mode / voltage mode full–bridge power amplifiers connected directly to the shuttle, ribbon, paper feed, and platen open motors. Current mode is used for the paper feed motor, voltage mode is used for the ribbon and shuttle motors.
- The paper feed controller (PFC) accepts control codes from the controller board for each motor phase to vector–control the paper feed motor.
- The shuttle drive controller receives speed commands from the controller board through the 8032 microcontroller and commands the speed of the three–phase brushless DC shuttle motor.
- The ribbon drive controller, based around the 8032 microcontroller, receives commands from the controller board and drives two DC stepper motors, regulating the speed and tension of the ribbon and monitoring the end of ribbon sensors.
- The platen drive controller for reverse paper feed receives commands from the 8032 microcontroller (RSP).
- Fault detection circuitry samples and senses heat sink temperature, ribbon speed, shuttle speed, hammer driver circuitry, hammer bank coil temperatures, power supply voltages, and fault communication with the controller board.
- Circuitry that registers magnetic pick–up unit (MPU) output, processes it for the logic interface, and sends it to the controller board for timing hammer fire.

Figure 2–14 summarizes mechanism driver board operation in block diagram form.

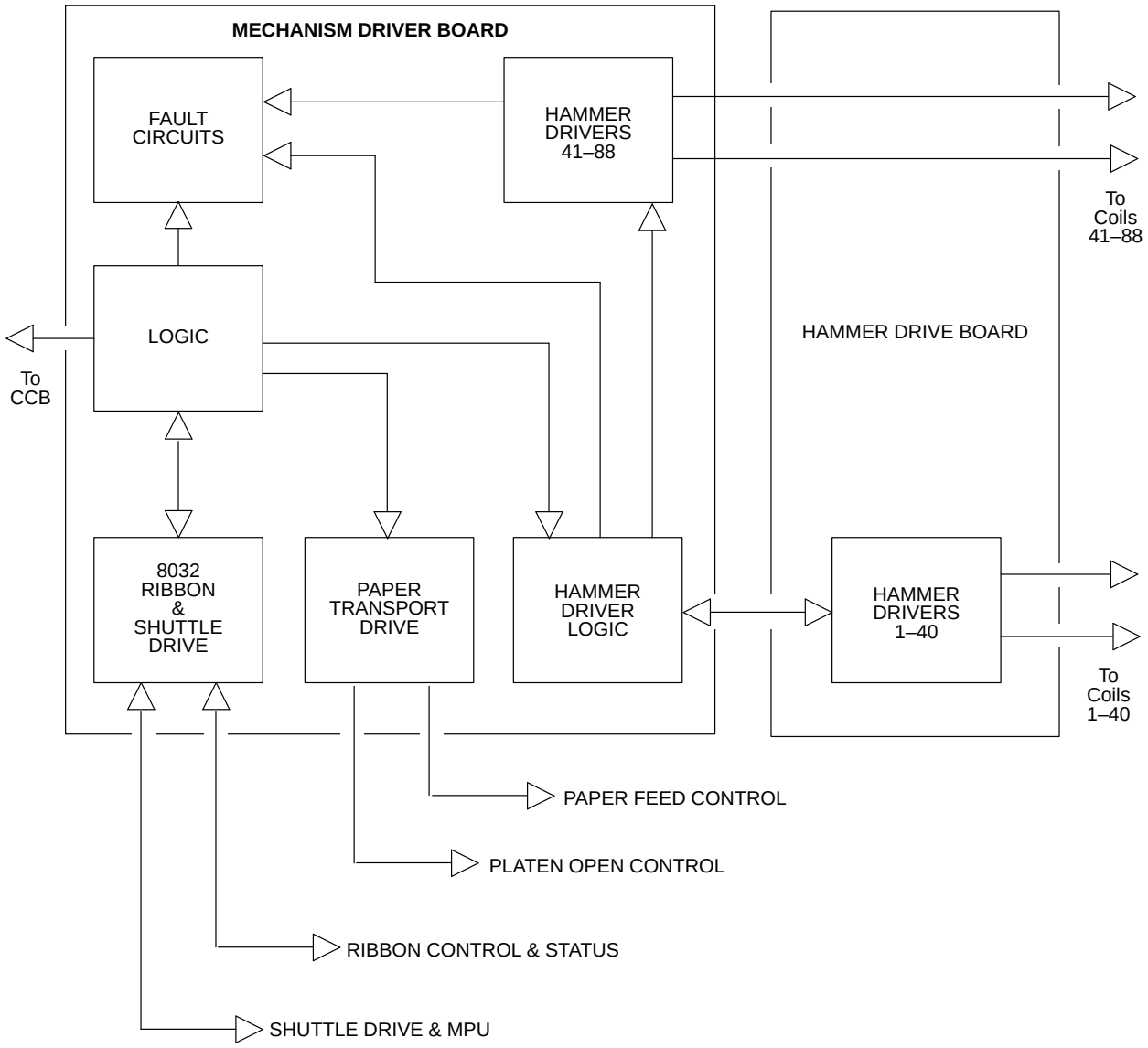


Figure 2–14. Operational Overview of the Mechanism Driver Board

The Ribbon Drive System

The ribbon drive system is controlled by the 8032 microcontroller. The controller board sends commands to the 8032 to start and stop the ribbon, set the ribbon speed, and apply slack or tension to the ribbon. The real–time control functions are done by the 8032, acting in accordance with firmware control algorithms and look–up tables. The 8032 communicates with an ASIC to provide direct digital PWM drive signals for the ribbon motor PWM amplifier. The 8032 drives the ribbon motors through PWM generators in the mechanism driver integrated circuit (MDIC). Nearly all mechanical control functions are carried out through the MDIC ASIC. Digital I/O is done through latches connected to the 8032 I/O ports and MDIC. Ribbon faults are passed to the controller board.

Ribbon Velocity

Ribbon velocity is controlled by means of a closed–loop system that first measures the speed of the two ribbon drive motors. One motor is driven; the other motor is not driven and applies tension to the ribbon through its drag circuitry. The velocity of the driven motor is known, while the velocity of the tensioning motor is measured by converting the zero crossing of the back–EMF signal to a digital pulse signal. This signal is processed by the 8032 to determine the radius of the ribbon on the take–up reel. The processor monitors this information and adjusts the velocity of the driven motor to maintain constant linear speed. The roles of the two motors reverse at the end of ribbon travel, when a metallic strip crosses the ribbon guide of the emptying reel and closes a circuit that causes the RSP to reverse motor functions.

The four PWM amplifiers in the ribbon drive system are voltage mode to aid in system damping (as opposed to current mode). The 8032 input to the PWM amplifiers maintains a constant voltage/frequency ratio at the motor. The ribbon drive is protected from over current.

Ribbon Tension

The 8032 processor regulates tension in three discrete steps by using information gathered by the zero–crossing circuitry and ribbon information. Tension is adjusted by controlling the load on the drag motor back emf. This load generates drag torque on the ribbon hub that maintains tension.

Start / Stop Ribbon

The ribbon motors are started and stopped by a digital signal from the controller board. After a stop signal is received, the ribbon is locked to maintain tension. If the controller board sends a slack signal, the PWM amplifiers are tri–stated.

The Shuttle Drive System

The shuttle drive system is an analog closed–loop speed controller that accepts commands from the controller board through the 8032 microcontroller and MDIC ASIC. The controller board writes a word containing start, stop, and speed data to the 8032, which in turn writes a word to the MDIC. The MDIC generates a clock signal based on this word.

The shuttle is protected from overspeed and over current.

The Paper Feed System

Dot row advance and slew tables are stored in the controller board The paper feed drive circuit takes commands directly from the controller board to control the two–phase DC paper feed stepper motor. A controller board paper feed command is a digital word containing a value proportional to the desired current level in the paper feed motor, enabling the motor to be quarter–stepped. Two PWM current mode amplifiers, protected against overloads and short circuits, drive the paper feed motor. The paper feed motor is usually energized whenever printer power is on in order to maintain tension and position of the paper. The paper feed motor is disabled in a platen open, paper jam, or paper out fault condition.

The Reverse Paper Feed System

To reverse paper motion, the printer must open the platen, move the paper backwards vertically, close the platen, and remove the slack in the paper. A platen open or close command is generated on the controller board and communicated to the RSP 8032 processor. The RSP generates control and step clock signals for the platen driver circuitry. The platen driver circuitry is connected to a stepper motor that drives the platen through a toothed belt. The platen motor is only energized during the open and close cycles. The platen driver is protected from over current.

Hammer Driver Board

The hammer driver board consists of three functional elements: hammer driver logic and control circuits, blower drive and monitoring circuits, and filter capacitors for the +48 V and +12.5 V power supplies.

Hammer Driver Logic and Control

Each hammer spring is controlled by two electromagnetic coils, a driver, and a logic circuit. The hammer logic circuits perform the following functions:

- Convert serial data bits on the COM line into parallel data bits.
- Control the energizing of hammer coils to print dots in accordance with the parallel data.
- Provide safety features to prevent coils from energizing under conditions that could damage the coils and hammer drivers.

The buffered hammer shift clock (BHSC) pulses load data from the COM DATA line into the hammer driver shift register. Every bit on the COM line is clocked into the shift register by the rising edge of BHSC, containing dot information for the characters to be printed by each hammer.

After the last bit is clocked into the shift register, the FIRE signal causes the contents of the shift register to be loaded into the data latches. These latches drive the gates of each lower drive MOSFET (Metal Oxide Semi–conductor Field Effect Transistor).

The FIRE signal also turns the upper drive transistors on. When FIRE is high and a lower driver is on, 48 volts are applied across the hammer coil. This causes the coil current to rise rapidly, cancelling the magnetic field holding the hammer retracted. With the magnetic field cancelled, the hammer starts to fly forward. The FIRE signal drops, disabling the upper drivers. The coil current is sustained by the upper driver diodes and the lower driver MOSFETs. This combination applies 12.5 volts across the coil, keeping the magnetic field cancelled until hammer impact.

After the dot is printed, the NLD_RST signal resets the lower driver MOSFETs. The remaining coil current returns to the 48 volt supply through flyback diodes. The magnetic field is restored and the permanent magnet captures the hammer. (See Figure 2–15.)

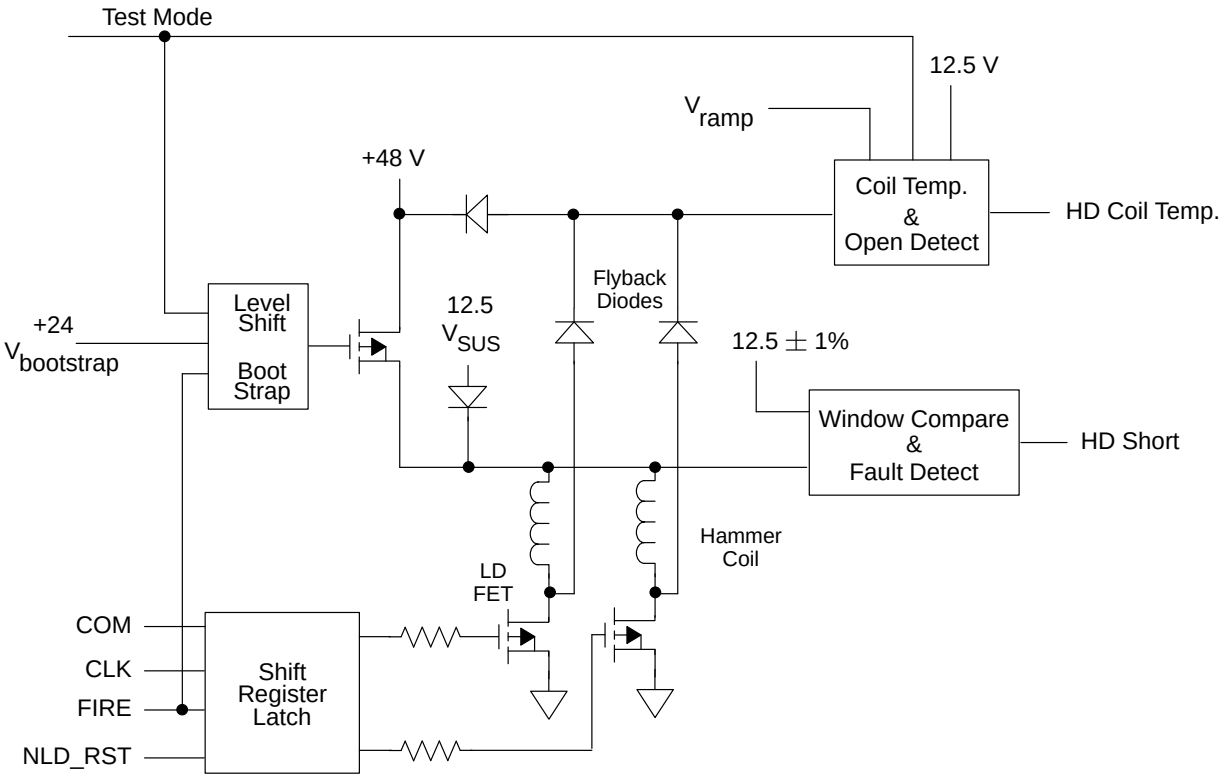


Figure 2–15. Hammer Driver Logic

Power Filtering

The power supply is housed in a protected and independently cooled steel module separate from the card cage containing the hammer driver and mechanism driver boards. The hammer driver board therefore provides bulk filtering of the +48 and +12.5 (V_{SUS}) supplies. (See Figure 2–16.)

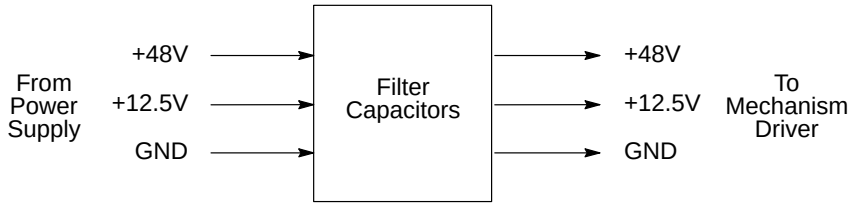


Figure 2–16. Hammer Driver Power Filtering

Hammer Bank Cooling

The hammer driver board also powers a blower fan that cools the hammer bank. A fixed 60/40 signal (PWM) is provided to the hammer driver board to run the blower fan. The hammer driver board demodulates this signal to a binary (on/off) logic signal, then drives a MOSFET that powers the blower. A current monitoring circuit tells the RTPU when the blower is running. If the blower is stalled or not connected, the RTPU declares a fault. (See Figure 2–17.)

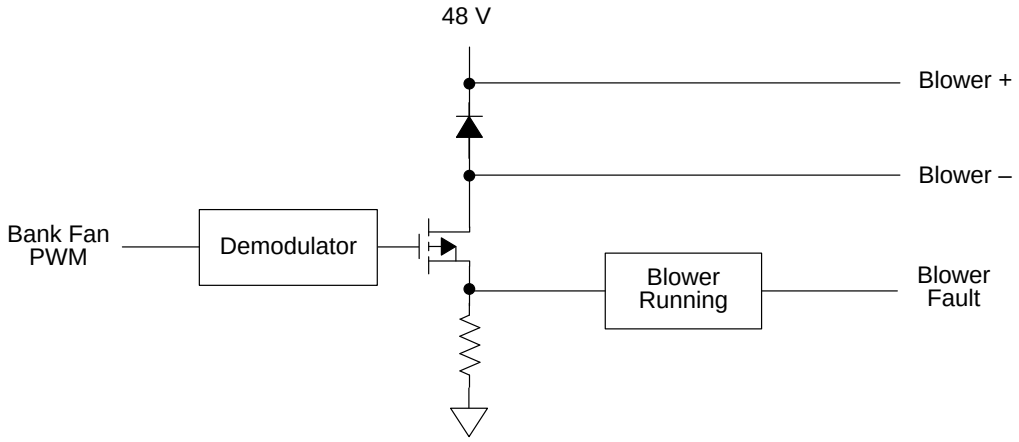


Figure 2–17. Hammer Bank Cooling

Auto–Ranging Power Supply

The power supply board, AC input connector, power switch/circuit breaker, and a cooling fan are contained in a removable steel module at the rear of the printer. The power supply senses and adjusts to any commercial electrical system that provides AC mains potential in 50 or 60 Hertz systems. AC input power is converted to +48 volt and +12.5 volt DC power and sent to the hammer driver board for bulk filtering. The hammer driver board then passes the filtered +48 and +12.5 Vdc to the mechanism driver board for distribution to logic and electromechanical circuits.

AC Power

The power supply operates on AC voltages ranging from 88 to 135 or 176 to 270 volts. It can tolerate variations in frequency of 47 to 63 Hz. The power supply is designed to withstand an AC input overvoltage of 125% of nominal for one second with no degradation of DC output voltage or damage to printer circuits.

DC Power

The power supply board contains two DC power supply systems for the printer. The first is a + 5 volt bus for logic circuits. The second consists of + 48 volt and + 12.5 volt buses for the electromechanical sections of the printer (all drive motors and the hammer bank).

The + 5 volt and + 48/12.5 volt supplies have separate return lines. Both returns are tied together in a single–point ground at the mechanism driver board.

There is an opto–isolated logic level input from the printer that can shut down and latch off the + 48 volt and + 12.5 volt supplies while maintaining the + 5 volt output. The return for this signal is the + 5 volt return. In addition, this shutdown circuit discharges and latches the + 48 volt down to a level lower than 15 volts in less than 300 milliseconds and requires recycling of the power switch/circuit breaker to reset the latch.

The + 5 volt power supply has its own inverter, separate from the + 48 volt and + 12.5 volt outputs to provide logic power if the +48/12.5 volt supply is shut down.

Hammer Bank, Shuttle, and MPU

Printing is synchronized with shuttle movement by signals from the magnetic pickup unit (MPU). The MPU, located next to the flywheel timing disk, is so oriented that timing signals relate precisely to the shuttle position. (See Figure 2–18.) Variations in magnetic reluctance are sensed by the MPU from apertures on the timing disk as it rotates, generating SYNC pulses. Two aperture locations at opposite ends of the disk are of double width (material between two adjacent apertures is removed). These double width apertures separate the 284 single width apertures into two groups and generate a RESYNC signal coincident with the shuttle starting to move from left to right.

One rotation of the disk provides four back–and–forth shuttle cycles, which equals eight printing periods. Each printing period is followed by a turnaround period when the shuttle movement is reversed, paper is advanced a distance determined by the vertical dot density, and no printing occurs.

Typical signal levels received from the magnetic pickup are:

SYNC: 2.5 to 5.5 Vpp
RESYNC: 4 Vpp minimum

Operation of the hammer bank and shuttle is also described on page 2–4.

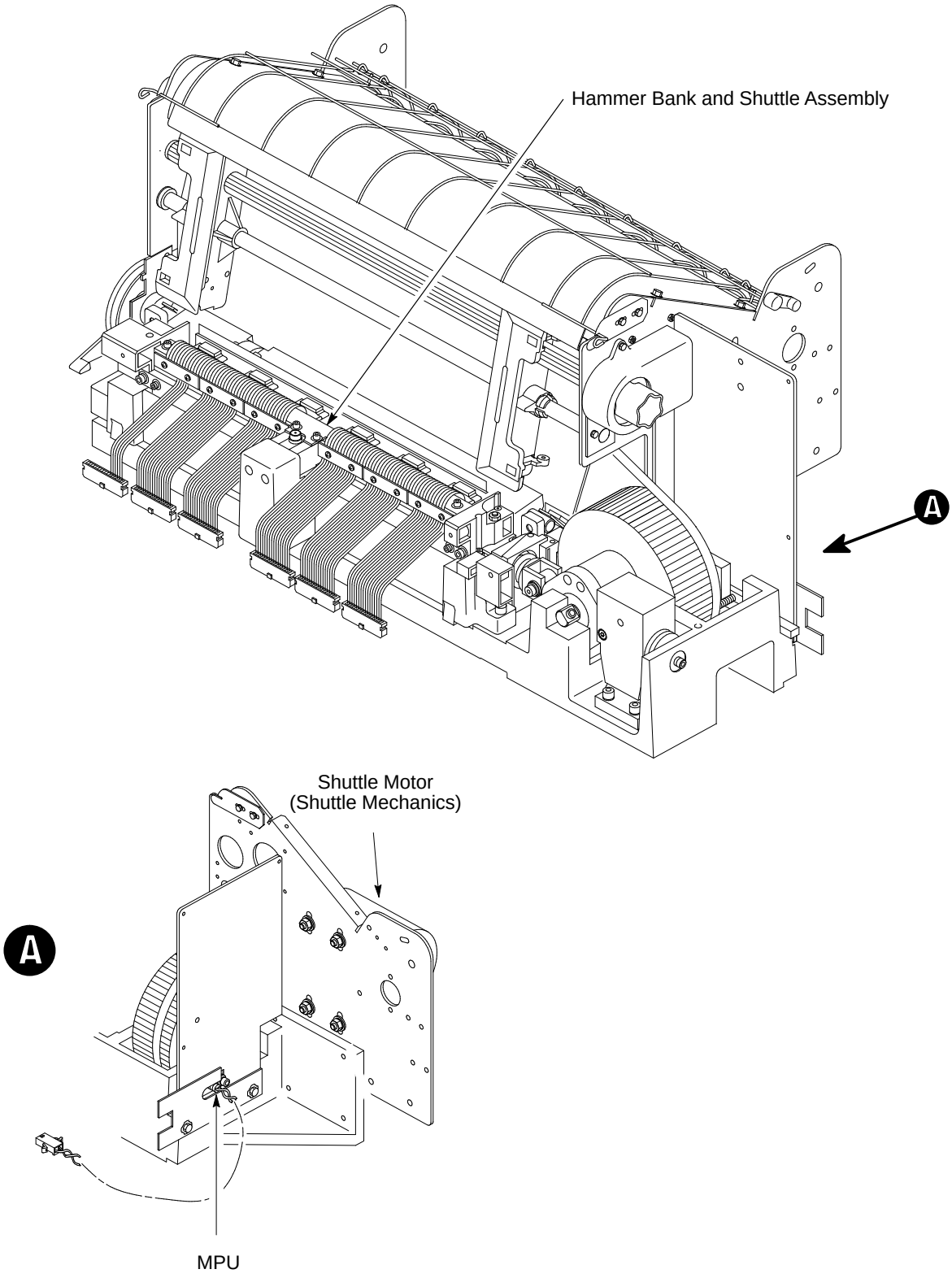


Figure 2–18. Hammer Bank and Shuttle Mechanical Elements

Ribbon Deck

The printer ribbon winds and unwinds continuously on a pair of spools latched to hubs driven by the ribbon motors. The ribbon motors operate only while the hammer bank assembly is running. Ribbon motion reverses when the metal strip at either end of the ribbon crosses the left or right ribbon guide, completing a circuit that causes both motors to reverse direction.

Constant ribbon tension is maintained by controlling each motor with a drive or drag circuit. While the hammer bank assembly is in motion, one motor acts as a driving motor, drawing the ribbon against the resistance exerted by the other motor—the drag motor. This system maintains a constant motor speed and constant ribbon tension.

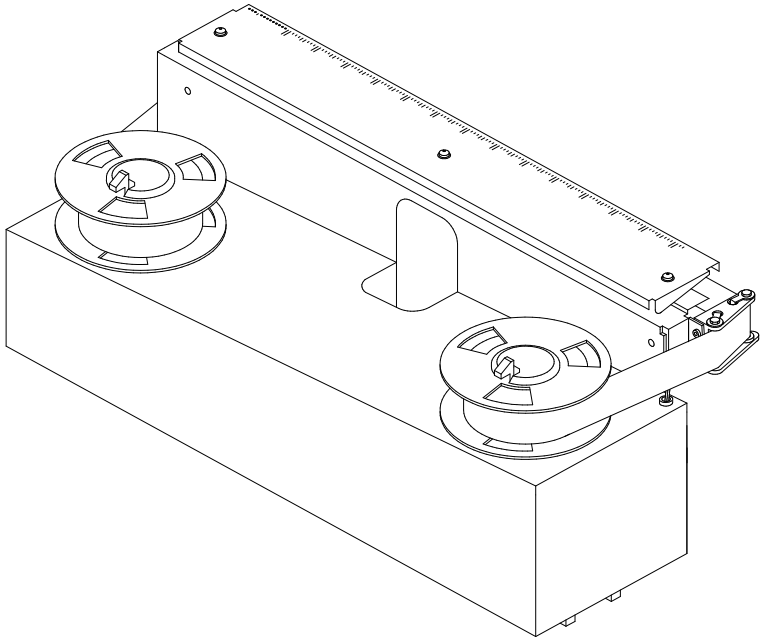


Figure 2–19. Ribbon Deck

Paper Feed Control

The paper transport system accepts continuous, fan–folded, edge–perforated paper from three to 16 inches wide and from one to six sheets thick. (See Appendix F for precise paper specifications.) Horizontal positioning is provided by the horizontal adjustment knob and two tractors. The tractors are laterally adjustable along the splined and support shafts. Each tractor engages paper perforations with eight pins and locks in place with a friction lock. During printing, the paper feed motor drives the splined shaft with a toothed belt. The splined shaft drives the tractors. The paper feed drive motor is a two–phase step motor controlled by the paper feed sections of the mechanism driver board and the paper feed controller on the CCB.

Paper is manually advanced with the vertical adjustment knob.

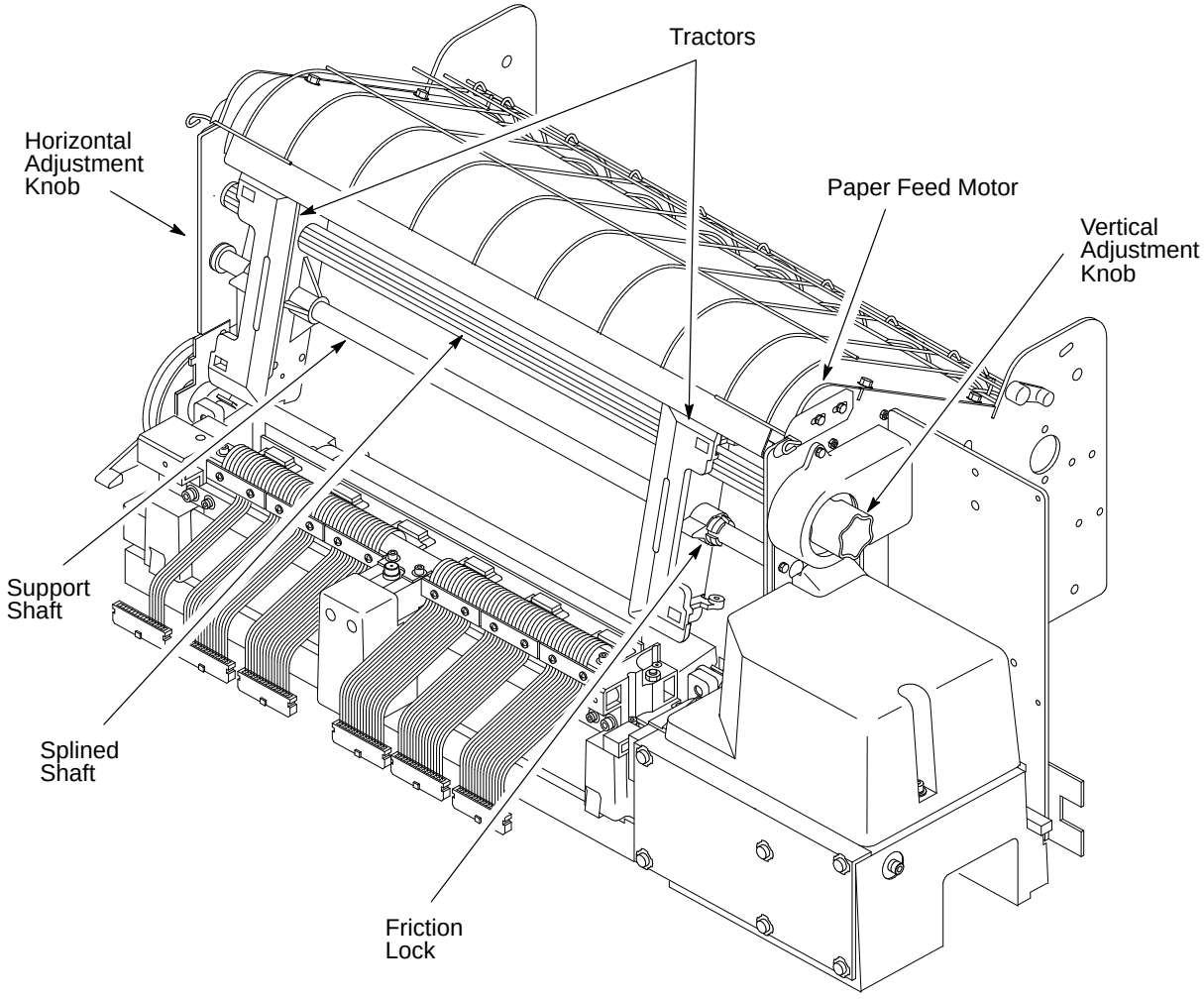


Figure 2–20. Paper Feed Components

3 Preventive Maintenance

Chapter Contents

Preventive Maintenance

The LG12 printer requires no preventive maintenance beyond normal replenishment of paper and ribbons and periodic cleaning. Since operating conditions vary widely, the user must determine how often to clean the printer.

Cleaning the Printer

CAUTION

Do not use abrasive cleaners, particularly on the window. Do not drip water into the printer; damage to equipment will result. When using spray solutions, do not spray directly onto the printer; spray the cloth.

1. Turn the printer off.
2. Disconnect the printer power cord.
3. Open the printer cover.
4. Remove paper from the printer.
5. Wipe the cabinet exterior with a clean, lint–free cloth dampened (not wet) with water and mild detergent or window cleaning solution.
6. Dry the cabinet with a clean, lint–free cloth.
7. Open the forms thickness lever all the way. (See Figure 3–1.)
8. Squeeze the lock tabs on the ribbon hubs and remove the ribbon spools.
9. Using a soft–bristled brush, remove paper dust and ribbon lint from the tractors, ribbon deck, ribbon path, and base casting. Vacuum up the residue.
10. Wipe the splined shaft and support shaft with a soft cloth.

CAUTION

To avoid corrosion damage, use only anhydrous alcohol to clean the print mechanism.

11. Using a cloth dampened with anhydrous alcohol, clean the ribbon guides.

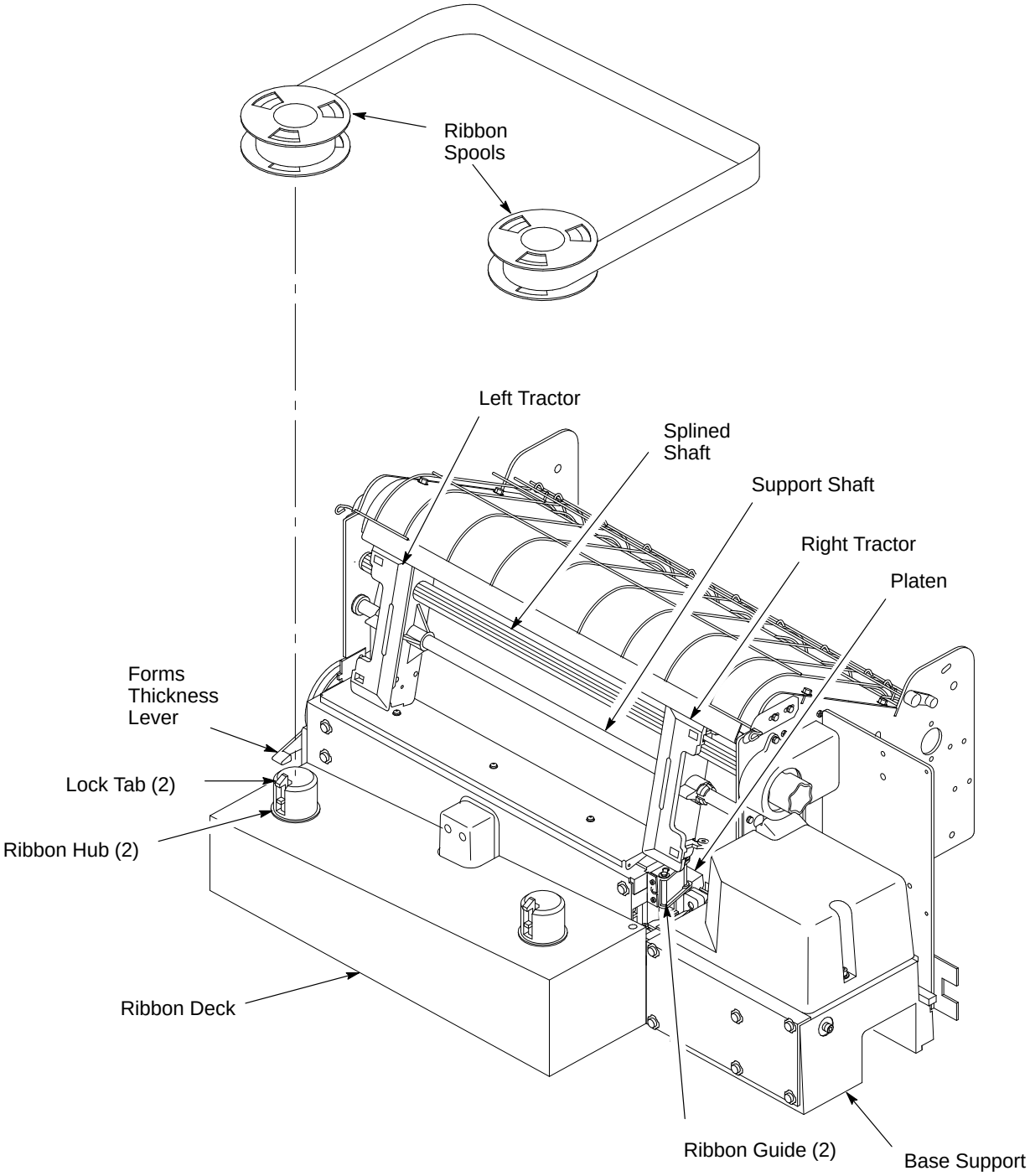


Figure 3–1. Cleaning Interior of Cabinet

12. Wipe the platen with a cloth dampened with anhydrous alcohol.

13. Unlock the right tractor and slide it all the way to the right. (See Figure 3–2.)

14. Remove the ribbon deck to gain access to the hammer bank.

15. Push the top edge of the ribbon mask on the hammer bank cover assembly toward the platen and hold it in that position as you do step16.

NOTE: Handle the ribbon mask carefully. A damaged ribbon mask can degrade print quality.

16. Use a stiff, nonmetallic brush to remove ribbon lint and paper dust from the hammer springs and ribbon mask along the ribbon path. Vacuum up loose particles. Remove stubborn accumulations using a cloth or Kimwipe moistened (not wet) with anhydrous alcohol.

17. Return the ribbon mask to the operating position.

18. Install the ribbon deck.

19. Vacuum up dust or residue that has accumulated inside the lower cabinet.

20. Wipe the lower cabinet interior with a clean, lint–free cloth dampened with water and mild detergent or window cleaning solution.

21. Dry the cabinet interior with a clean, lint–free cloth.

22. Install the ribbon.

23. Install the printer power cord.

24. Load paper.

25. Close the printer cover and return the printer to normal operation.

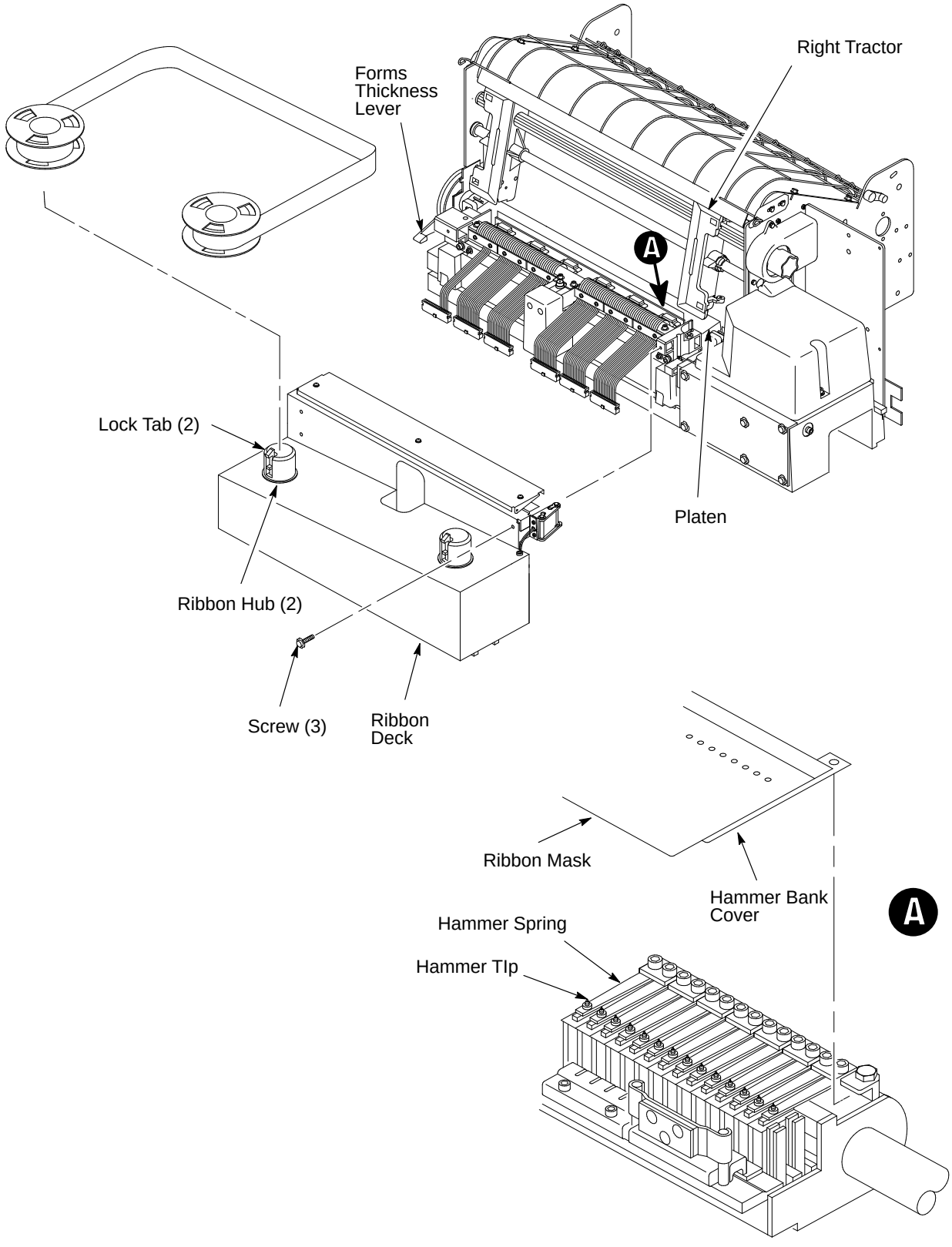


Figure 3–2. Cleaning Hammer Bank Assembly

4 Troubleshooting

Chapter Contents

Introduction

This chapter contains procedures for troubleshooting printer malfunctions. Diagnostic test procedures are covered in this chapter, but basic printer operation is not. Since you must operate the printer to check its performance, have the *Operator's Guide* or *User's Manual* at the printer site.

Fault Messages

This section contains troubleshooting tables for fault messages that can appear on the Liquid Crystal Display (LCD).

Two kinds of faults can appear on the LCD:

- Operator correctable faults
- Faults requiring the attention of a field service technician—indicated with an asterisk (*) after the fault message

IMPORTANT

Test printer operation after every corrective action, and stop troubleshooting when the symptom disappears. Always press the CLEAR switch after correcting a fault indicated by a fault message.

48 Volt Failed *

Instruction	Indication	Yes	No
1. Cycle power: Turn printer off. Wait 15 seconds. Turn printer on.	"48 Volt Failed * " message.	Go to step 2.	Return printer to normal operation.
2. Press the CLEAR switch.	"48 Volt Failed * " message.	Go to step 3.	Return printer to normal operation.
3. Turn printer off.	—	Go to step 4.	
4. Disconnect CCB/Mech Driver cable from connector J2 on the controller board and connector J6 on the mech driver board.	—	Go to step 5.	—

Instruction	Indication	Yes	No
5. Turn printer on and observe card cage fan: feel for air flow beneath the card cage.	Card cage fan comes on.	Replace the controller board.	Reattach CCB/Mech Driver cable to connector J2 on the controller and connector J6 on the mech driver board, and go to step 6.
6. Cycle power and observe the power supply fan.	Power supply fan runs, then stops.	Replace the mech. driver board.	Go to step 7.
7. Cycle power and observe the power supply fan.	Power supply fan runs, then stops, with new mech. driver board installed.	Replace the hammer driver board.	Go to step 8.
8. Cycle power and observe the power supply fan above the on/off switch.	Power supply fan does not run at all.	Replace the power supply.	Return printer to normal operation.
9. Cycle power and check for the fault message.	“48 Volt Failed * ” message.	Replace +5V cable assembly. (See Appendix A.) Go to step 10.	Return printer to normal operation.
10. Cycle power and check for the fault message.	“48 Volt Failed * ” message.	Replace Hi voltage cable assembly. (See Appendix A.) Go to step 11.	Return printer to normal operation.
11. Cycle power and check for the fault message.	“48 Volt Failed * ” message.	Replace Main Wire Harness. (See Appendix A.) Go to step 12.	Return printer to normal operation.
12. Cycle power and check for the fault message.	“48 Volt Failed * ” message.	Replace hammer bank cables. (See Appendix A.)	Return printer to normal operation.

Dynamic RAM Fault *

Instruction	Indication	Yes	No
1. Cycle power: Turn printer off. Wait 15 seconds. Turn printer on.	“Dynamic RAM Fault * ” message.	Go to step 2.	Return printer to normal operation.
2. Disconnect the input data line from the host computer. Set power switch to off. Wait 15 seconds. Set power switch to on.	“Dynamic RAM Fault * ” message.	Go to step 3.	Return printer to normal operation.
3. Make a Diagnostic Check of the CCB (page 4–21). If any problems are found on the CCB, replace the board.	—	—	—

Ham. Bank Hot

NOTE: The printer has protective circuits that sense conditions which can lead to overheating. When such conditions are sensed, print speed is reduced 50%. If the printer consistently prints at half speed, it may be printing long jobs of very dense graphics or operating in a severe environment. A severe environment is consistently above 90° Fahrenheit (32° Celsius) or is dirty enough to create blockage of the blower ducts. If the printer is located in such an environment, consider relocating it to a cooler, cleaner area or reducing the size and duration of the print jobs.

Instruction	Indication	Yes	No
1. Press the CLEAR switch.	The printer continues the print job.	No further attention required.	The printer continues original print job then fault message reappears.
2. Check ambient temperature where printer is operated.	Printer area at or above 100° F (37° C).	Allow hammer bank to cool for 10 minutes. Cool printer area or reduce size and duration of print jobs.	Go to step 3.
3. Run a diagnostic self–test (page 4–27).	Unobstructed air flow through blower duct.	Go to step 4.	Remove obstructions from blower assemblies.
4. Cool the hammer bank for 2 hours. (It must be at room temperature.) Run the hammer bank diagnostics program to calibrate the coils (page NO TAG). Run a diagnostic self–test (page 4–27).	“Ham. Bank Hot” message.	Replace the hammer bank. Run the hammer bank diagnostics program to calibrate the coils (page NO TAG).	Return the printer to normal operation.

Ham. Coil Open *

	Instruction	Indication	Yes	No
1.	Cycle power: Turn printer off. Wait 15 seconds. Turn printer on.	“Ham. Coil Open * ” message.	Go to step 2.	Return printer to normal operation.
2.	Press the CLEAR switch.	“Ham. Coil Open * ” message.	Go to step 3.	Return printer to normal operation.
3.	Run a diagnostic self–test (page 4–27).	“Ham. Coil Open * ” message.	Go to step 4.	Return printer to normal operation.
4.	Run a diagnostic self–test (page 4–27).	Observe where the non–printing hammer is located.	Go to step 5.	—
5.	Switch hammer bank cable connectors at the hammer driver board. (Top connectors are for the left side of the hammer bank.)	—	Go to step 6.	—
6.	Run a diagnostic self–test (page 4–27). Observe where the non–printing hammer is located.	Position of the non–printing hammer remains the same.	Replace the offending coil then go to step 7.	If the non–printing hammer is 1–40, replace the hammer driver board. If the non–printing hammer is 41–88, replace the mechanism driver board. Go to step 7.
7.	Return the hammer bank cables to their correct connectors on the hammer driver board. Run a diagnostic self–test (page 4–27).	“Ham. Coil Open * ” message.	Replace the hammer bank cables.	Return printer to normal operation.

Ham. Coil Short *

	Instruction	Indication	Yes	No
1.	Cycle power: Turn the printer off. Wait 15 seconds. Turn the printer on.	“Ham. Coil Short * ” message.	Go to step 2.	Return the printer to normal operation.
2.	Turn the printer off. Remove the ribbon deck. Measure the coil resistance at hammer bank connectors J1 – J6: each coil has a red and a white wire; put probes where wire enters the top of the connector.	Resistance is 4–8 Ohms for all coils.	Go to step 4.	For coils less than 4 Ohms, go to step 3.
3.	If a coil is less than 4 Ohms, disconnect its hammer bank connector and measure the coil resistance again, as in step 2.	Coil resistance still less than 4 Ohms.	Replace the coil.	Go to step 4.
4.	Disconnect the hammer bank cable connectors J1 – J6. Measure resistance of the coil leads of the hammer driver cable. (You are checking resistance through both the hammer driver cable and the hammer driver board. Do not disconnect the hammer driver cable at the hammer driver board. See Appendix A for pin assignments.)	Cable resistance is more than 1K Ohm.	For hammers 1 – 40, replace the hammer driver board. For hammers 41 – 88, replace the mechanism driver board.	Replace the hammer driver cable.

Ham. Drv. Short *

Instruction	Indication	Yes	No
1. Cycle power: Turn printer off. Wait 15 seconds. Turn printer on.	“Ham. Drv. Short * ” message.	Go to step 2.	Return printer to normal operation.
2. Press the CLEAR switch.	“Ham. Drv. Short * ” message.	Go to step 3.	Return printer to normal operation.
3. Disconnect connectors J4, J5, and J6 from hammer driver board. Cycle power.	“Ham. Drv. Short * ” message.	Replace the mechanism driver board.	Go to step 4.
4. Disconnect connectors J1, J2, J3, and J4 from the hammer driver board. Connect J5 and J6. Cycle power.	“Ham. Drv. Short * ” message.	Replace the hammer driver board.	Return printer to normal operation.
5. Connect all cables. Cycle power.	“Ham. Drv. Short * ” message.	Disconnect hammer driver cables one by one until offending cable is isolated. Go to step 6.	Return printer to normal operation.
6. Check resistance to ground of all contacts in the bad cable.	If any measure $\leq$ 100 KΩ to ground, replace the cable and the coil.		Return printer to normal operation.

Mech Driver Hot *

	Instruction	Indication	Yes	No
1.	Cycle power: Turn printer off. Wait 15 seconds. Turn printer on.	“Mech Driver Hot * ” message.	Go to step 2.	Return printer to normal operation.
2.	Observe operation of card fan: check for air flow at the bottom of card cage.	Card cage fan operates.	Go to step 3.	Replace the card cage fan.
3.	Observe operation of cabinet exhaust fan: check for air flow out of the grid at the rear of the printer.	Cabinet exhaust fan operates.	Go to step 4.	Replace the cabinet exhaust fan.
4.	Observe operation of power supply fan above the on/off switch at the rear of the printer.	Power supply fan operates.	Go to step 5.	Replace power supply.
5.	Press the CLEAR switch.	“Mech Driver Hot * ” message.	Go to step 6.	Return printer to normal operation.
6.	Run a diagnostic self–test (page 4–27).	“Mech Driver Hot * ” message.	Replace mechanism driver board.	Return printer to normal operation.

Mech Driver Link *

	Instruction	Indication	Yes	No
1.	Cycle power: Turn printer off. Wait 15 seconds. Turn printer on.	“Mech Driver Link * ” message.	Go to step 2.	Return printer to normal operation.
2.	Press the CLEAR switch.	“Mech Driver Link * ” message.	Go to step 3.	Return printer to normal operation.
3.	Run a diagnostic self–test (page 4–27).	“Mech Driver Link * ” message.	Go to step 4.	Return printer to normal operation.
4.	Remove the card cage cover.	—	Go to step 5.	—
5.	Check ribbon cable connectors between controller board and mechanism driver board.	Connectors are attached properly.	Go to step 6.	Connect and latch ribbon connectors. Go to step 6.
6.	Check installation of controller board and mechanism driver board.	Boards are installed correctly.	Go to step 7.	Reseat controller and mechanism driver boards in their edge connectors at back of card cage. Go to step 8.
7.	Check for correct installation and revision levels of EPROMs and microprocessors for the RTPU on the controller board and RSP on the mechanism driver board. (Appendix E.)	RTPU and RSP EPROMs and microprocessors are correct versions and installed correctly.	Go to step 8.	Install correct RTPU and RSP EPROMs and microprocessors. Go to step 8.
8.	Power up printer and check for fault message.	“Mech Driver Link * ” message.	Replace the controller board, then go to step 9.	Return printer to normal operation.
9.	Power up printer and check for fault message.	“Mech Driver Link * ” message.	Replace the mechanism driver board, then go to step 10.	Return printer to normal operation.
10.	Power up printer and check for fault message.	“Mech Driver Link * ” message.	Replace CCB/Mech. Dr. cable. (See Appendix A.)	Return printer to normal operation.

Paper Jam

Instruction	Indication	Yes	No
1. Inspect paper path for bunched, torn, folded paper or labels.	Paper path is clear.	Go to step 2.	Remove paper and go to step 2.
2. Inspect the narrow passageway between the face of the platen and the ribbon mask for bits of torn paper or ribbon lint. Check the holes in the ribbon mask surrounding each hammer tip.	Debris found.	Gently remove paper or lint particles with a wooden stick or pair of tweezers. CAUTION: Do not pry or apply force to the hammer tips. Go to step 3.	Go to step 3.
3. Check that the ribbon mask has not been deformed in such a way as to block the paper path.	Ribbon mask damaged or bent.	Replace the hammer bank cover assembly. Go to step 4.	Go to step 4.
4. Load paper and run a diagnostic self–test (page 4–27).	Paper moves correctly but “Paper Jam” message still appears.	Clean the paper motion detector with cotton swab. Go to step 5.	Go to step 5.
5. Run a diagnostic self–test (page 4–27).	“Paper Jam” message appears and paper does not move.	Replace following until paper moves correctly: 1) mech driver board 2) paper feed motor 3) main wire harness Go to step 6.	Return printer to normal operation.
6. Run a diagnostic self–test (page 4–27).	“Paper Jam” message.	Replace the following until the message clears: 1) paper detector switch assembly. 2) intermediate cable assembly. 3) controller board.	Return printer to normal operation.

Paper Out

Instruction	Indication	Yes	No
1. Load paper.	—	Go to step 2.	—
2. Run a diagnostic self–test (page 4–27).	“Paper Out” message.	Replace paper detector switch assembly. Adjust the new paper motion switch assembly (Chapter 4). Go to step 3.	Return printer to normal operation.
3. Run a diagnostic self–test (page 4–27).	“Paper Out” message.	Replace the sensor harness assembly. Go to step 4.	Return printer to normal operation.
4. Run a diagnostic self–test (page 4–27).	“Paper Out” message.	Replace the controller board.	Return printer to normal operation.

Platen Open

Instruction	Indication	Yes	No
1. Load paper and close the forms thickness lever.	—	Go to step 2.	—
2. Run a diagnostic self–test (page 4–27).	“Platen Open” message.	Replace platen interlock switch assembly. Go to step 3.	Return printer to normal operation.
3. Run a diagnostic self–test (page 4–27).	“Platen Open” message.	Replace sensor harness assembly. Go to step 4.	Return printer to normal operation.
4. Run a diagnostic self–test (page 4–27).	“Platen Open” message.	Replace the controller board.	Return printer to normal operation.

Ribbon Stall

Instruction	Indication	Yes	No
1. Check that forms thickness lever is not closed too tightly; this can jam the ribbon and shuttle.	Forms thickness lever is set correctly.	Go to step 2.	Readjust the setting of the forms thickness lever. Go to step 2.
2. Run a diagnostic self–test (page 4–27) and check for shuttle obstruction.	“Ribbon Stall” message.	Go to step 3.	Return printer to normal operation.
3. Check ribbon path for blockage or obstruction.	Ribbon path is clear.	Go to step 4.	Remove obstructions from ribbon path and go to step 4.
4. Wind ribbon by hand and inspect for folds, tears, holes, fraying.	Ribbon is OK. (Folds are permitted, if the ribbon is otherwise undamaged.)	Rewind and reinstall ribbon. Go to step 5.	Replace ribbon, if damaged. Unfold and rewind ribbon if it was folded. Go to step 5.
5. Do a fast shuttle self–test (page 4–27) and check the alignment of the ribbon guides and hubs if the ribbon was folded.	Ribbon tracks OK.	Go to step 6.	Align ribbon guides. Go to step 6.
6. Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. Check for a ribbon drive motor that will not wind ribbon.	Only one motor winds the ribbon.	Replace the following until symptom clears: 1) mechanism driver board. 2) defective ribbon drive motor.	Return printer to normal operation.

Shuttle Fan *

	Instruction	Indication	Yes	No
1.	Cycle power: Turn printer off. Wait 15 seconds. Turn printer on.	“Shuttle Fan” message.	Go to step 2.	Return printer to normal operation.
2.	Run a shuttle/ribbon diagnostic test (page 4–27) and observe the blower fan.	Blower starts and runs, but “Shuttle Fan” message displays.	Go to step 3.	Go to step 4.
3.	Turn off the printer. Check all cable connections between hammer drivers, power supply wire harness, and the sensor harness assembly.	Cables are connected and undamaged.	Replace the controller and hammer driver boards.	Replace the defective cable assembly.
4.		“Shuttle Fan” message displays and blower does not run.	Replace the blower. Go to step 5.	Return printer to normal operation.
5.	Turn the printer on and run a diagnostic self–test (page 4–27).	“Shuttle Fan” message displays and blower does not run.	Replace the hammer driver board. Go to step 6.	Return printer to normal operation.
6.	Run a diagnostic self–test (page 4–27).	“Shuttle Fan” message displays and blower does not run.	Replace the mechanism driver board. Go to step 7.	Return printer to normal operation.
7.	Run a diagnostic self–test (page 4–27).	“Shuttle Fan” message displays and blower does not run.	Replace the power supply high voltage cable assembly.	Return printer to normal operation.

Shuttle Jam

Instruction	Indication	Yes	No
1. Check the forms thickness lever: if it is set too tightly, it can slow the shuttle enough to trigger the fault message.	Forms thickness lever set correctly.	Go to step 2.	Set forms thickness lever for thicker paper. Go to step 2.
2. Run a diagnostic self–test (page 4–27) and check for shuttle obstruction.	“Shuttle Jam” message.	Go to step 3.	Return printer to normal operation.
3. Remove ribbon deck. Inspect shuttle area and mechanism for obstruction.	Shuttle movement blocked.	Remove obstruction. Go to step 4.	Install ribbon deck. Go to step 4.
4. Run a diagnostic self–test (page 4–27).	Nothing obstructing shuttle, but “Shuttle Jam” message appears.	Go to step 5.	Return printer to normal operation.
5. Run shuttle/ribbon diagnostic test and check MPU voltage.	MPU voltage is 2.5–6 VAC.	Replace mechanism driver board. Go to step 6.	Replace the MPU. Adjust the gap to 0.008 inches and adjust the phasing. Go to step 6.
6. Run a diagnostic self–test (page 4–27).	“Shuttle Jam” message.	Replace hammer bank.	Return printer to normal operation.

Software Error *

Instruction	Indication	Yes	No
1. Cycle power: Turn printer off. Wait 15 seconds. Turn printer on.	“Software Error * ” message.	Go to step 2.	Return printer to normal operation.
2. Disconnect the input data line from the host computer. Cycle power.	“Software Error * ” message.	Go to step 3.	Problem is not in the printer. Return printer to normal operation.
3. Make a Diagnostic Check of the CCB (page 4–21). If any problems are found on the CCB, replace the board.	—	—	—

Troubleshooting Symptoms Not Indicated by Fault Messages

Use standard fault–isolation techniques to troubleshoot malfunctions not indicated by fault messages:

1. Ask the user to describe the problem.
2. Verify the fault by running diagnostic self–tests or replicating conditions reported by the user.
3. Locate the malfunction using the half–split method:
    a. Isolate faults to half the remaining system at a time, until the final half is a field–replaceable part or assembly.
    b. Start at a general level and work down to details.
4. Replace the defective part or assembly.

IMPORTANT

Do not attempt field repairs on electronic components or assemblies — replace the entire assembly. Most electronic problems are corrected by replacing the printed circuit board, sensor, or cable that causes the fault indication.

5. Test the printer after every corrective action. Stop troubleshooting and return the printer to normal operation when the reported symptom disappears.

Troubleshooting Aids

- **Printer Confidence Check** (page 4–20). This procedure checks basic printer functions. Use it to establish basic printer status or to troubleshoot imprecise or intermittent symptoms.
- **CCB Diagnostic Check** (page 4–21). This procedure checks processor operations on the CCB and mechanism driver boards. (For CCB printers only.)
- **Diagnostic Self–Tests** (Page 4–27.)
- **Hex Code Printout** (Page 4–30.)
- **Appendix A: Wire Data**

Printer Confidence Check

Instruction	Indication	Yes	No
1. Check that printer is plugged into correct power source. (Refer to *User's Manual*.)	Power cable installed correctly to proper source.	Go to step 2.	Connect printer to correct power source.
2. Disconnect the interface (data) cable from the host computer to isolate the printer, then run a diagnostic self–test (page 4–27.)	Printer operates correctly.	Fault is not in the printer. Check host computer, applications software, cabling, etc.	Go to step 3
3. Connect the interface (data) cable to host and printer.	—	Go to step 4.	—
4. Make a configuration printout. (Refer to *User's Manual*.)	Make sure that: a) Configuration is correct for the user's application. b) Host computer and printer are using the same protocol (emulation). c) Configuration has not been inadvertently changed by the user.	Go to step 5.	Reconfigure the printer. (Refer to *Setup Guide*.)
5. Check alignments and adjustments. (Chapter 5.)	Assemblies and components adjusted in accordance with Chapter 5.	Go to step 6.	Adjust all assemblies that are out of spec.
6. Check all electrical connectors.	Connections are clean and tight, wires are not stripped, frayed, or out of connectors.	Go to step 7.	Replace stripped, frayed, or broken wires.
7. Check that all circuit boards are seated correctly in the card cage.	Boards are seated in card cage.	Go to step 8.	Reseat all boards.
8. Inspect for debris that could cause short circuits (loose fasteners, foil, etc.).	Metallic debris.	Remove debris. Clean printer (page 3–2).	Go to step 9.
9. Set power switch to on.	Printer powers up and initializes correctly.	Return printer to normal operation.	Troubleshoot the fault message (page 4–3).

CCB Diagnostic Checks

This procedure checks the operation of the microprocessors and IC chips on the Common Controller (CCB) and Mechanism Driver boards. Do the steps in the order presented.

1. Turn the printer off.

2. Open the card cage and reseat the CCB and Mech Driver boards.

3. Turn the printer on. Wait at least 15 seconds; while you are waiting watch the DPU LED at location A2 on the CCB and watch the display on the control panel. (NOTE: IC locations are shown in Appendix C. The DPU LED is also identified as “68010,” though some boards may be silk–screened as “68000.”)

    a. When the CCB is operating correctly, the control panel displays “Diagnostic Tests in Progress,” and the DPU LED turns on for 1 to15 seconds, then turns off. The DPU LED turns off after the 68010 successfully tests itself, RAM, 68010 ROM, and communication with the 64180 CPU. The more RAM or ROM installed in the printer, the longer the LED is on, but it *always* turns on then off when the CCB is functioning correctly. If the printer turns on normally, the CCB is okay. Turn power off and return the printer to normal operation.

    If the DPU LED turns on and off as described above, but the printer does work properly, or fails later, go to step 4.

    (“Dynamic RAM Fault” on the display can mean the 64180 has waited 15–20 seconds without getting its handshake from the 68010. The following substeps use the DPU LED to fault isolate this message.)

    b. **If the DPU LED never turns on**, it means the 68010 did not execute the first software instruction in its ROM. Go to step 5.

    c. **If the DPU LED stays on for 30 seconds but never blinks**, it means RAM and ROM for the 68010 are okay, but the 64180 is not executing instructions. Go to step 6.

d. **If the DPU LED blinks steadily at 1 blink per second**, it means that the 68010 ROMs are bad. Turn off the printer, remove the CCB, and check that all ROM chips are inserted in the correct position and with all pins inserted correctly.

   This check will catch out–of–order ROMs and all single and multiple bit failures of floating–gate EPROMs (the type with the window, that erase with ultraviolet light).

   If a ROM chip was inserted backwards, discard it. Even if it operates properly, a high current flowed through the backwards–biased transistors, and its service life is probably shortened due to thermal damage.

   If ROMs appear correctly inserted, they may still be defective. Sometimes bits “fade” to one when internal floating gates discharge. This can occur from over–voltage programming, radiation damage, too many EPROM erasures, etc. Install new program PROMs.

e. **If the DPU LED blinks steadily 5 times per second**, it means CCB RAM has failed. The most common cause of this failure during maintenance is turning off the printer too briefly for the 64180 to reset. The 64180 shares memory with the 68010, and writes to RAM if it is not completely reset. Turn the printer off, wait at least 15 seconds, then recycle power before accepting this indication of CCB RAM failure.

   The RAM chips are at board coordinates N9 and P9. The sockets at N8 and P8 are normally empty; this will not cause a RAM failure. Inspect the RAM chips, sockets and traces for shorts or missing chips. Damaged traces or sockets call for replacement of the CCB.

   A remote possibility is failure of the 64180 in the start–up handshake or in the code that programs the memory controller. Try changing the 64180 RTPU PROM.

4. The DPU LED turns on, then off, but the printer doesn’t work. Look at the control panel display:

a. **If the display is blank, or has a single line of black squares across the top**, the connector to the control panel probably needs to be plugged in or reseated. Turn off the printer, plug in the panel cable to connector J3 on the CCB, and start over at step 1. If the display is still blank, or has a black line, and the DPU LED lights and turns off, the control panel or its cable are defective.

b. **If the display reads "Mech Driver Link,"** the 8032 at location J12 on the CCB may have failed. Check the 8032 and its PROM at location J10 for bent pins, misalignment, or backwards insertion. Also, make sure the clock–test jumper E2 at location J14 is installed. If everything appears okay, try reseating the PROM at location J10, the 8032 at J12, the clock jumper at J14, and the connector at J2—sometimes this message is caused by a failure to communicate with the 8032 on the Mech Driver board.

   If the problem persists, check the Mech Driver 8032, its clock jumper, and the PROM. Look for backwards insertion, misalignment, etc., and try reseating the parts. (NOTE: On some Mech Driver boards, the 8032 PROM correct orientation may be *upside down* in relation to the rest of the board. On these boards, the silk–screen will show the correct orientation.) Always replace PROMs and parts that were inserted backwards.

   If the problem persists, replace the 8032 PROMs on the CCB and Mech Driver boards. If the problem persists, replace the CCB/Mech. Driver interconnect cable. (See Appendix A.)

c. **If the printer appears normal, but does not print from the host**, check the data cable to the host and reseat the cable that attaches to J1 of the CCB and A12. Then make sure the correct interface is selected and configured from the control panel. (Refer to the *Setup Guide* or *User's Manual*.) Save the configuration and reset the printer.

   If the printer is running RS–232, interchange the wires to pins 2 and 3. This is the most common cause of a completely inoperative RS–232 cable. Make sure the printer and host have the same baud rate and parity. In RS–232, configure the host for XON/XOFF if possible; this requires the least complex cable.

d. **If the printer prints from the host, but occasionally loses blocks of data**, the most likely cause is the host not responding to “send no more data” signals from the printer. With a Centronics interface, this means the host is ignoring BUSY; in RS–232, the host is ignoring the XOFF character or “Data Terminal Ready” (pin 20). Sometimes the cable is not conveying the necessary signals. Test this by using a serial line analyzer and software or test equipment that displays the data and handshake lines of the printer. A break–out box works, but will not debug XON/XOFF or other RS–232 data protocols. If the printer is sending XOFF, the host may not be receiving it if it requires 1.5 or 2 stop bits.

e. **If the printer prints from the host, but occasionally prints double characters**, there is probably a noise problem at the interface or the host computer is sending an inverted strobe. This problem can occur on Centronics or Dataproducts interfaces, never on RS–232. What happens is the strobe signal registers logic 1 more than once for a certain character. To fix this, change the strobe to trailing edge or invert the Dataproducts strobe polarity.

   Also check that the terminating resistors are present at locations C12 and D12 on the CCB. You can correct noise problems by using a shielded data cable or by changing the terminating resistors. (Refer to Appendix E.) The standard terminating resistors are optimized for high speed data transfer for cables between 1 and 5 meters long; you can change them to be slower and slightly more immune to noise.

   Noise is caused by static, floating logic ground, unshielded cable, changes in ground voltage from nearby equipment, or capacitively– or magnetically–induced noise. On very long cables, capacitively–induced noise from the other signals of the cable (especially Centronics “ACK” or Dataproducts data request “DRQ”) can cause false strobes. Unshielded and flat ribbon cables are much more prone to problems due to increased length. The best solution is to shorten cable, shield it, and reduce local electromagnetic noise.

f. **If the printer prints garbled data or slews uncontrollably**, put the printer into hex dump mode and analyze the binary data. One cause of garble is the host interface or cable is not transmitting all the data. When this occurs, the Centronics or Dataproducts interface receives a 1 on every unconnected data line. Uncontrolled slewing is often caused by enabling PI (Paper Instruction) when the host lacks a PI signal. (PI shows as “p” on the hex dump.) Some DEC RS–232 and Dataproducts interfaces only send 7 data bits. In this case, the eighth bit will be received as one.

   In RS–232, a common cause of garble is the interface configured at the wrong baud rate or parity. Sometimes the host sends 1.5 or 2 stop bits; in this case, the printer’s “1–stop–bit” setting will accept both 1.5 and 2 stop bit data. Sometimes the data may “fade” or “persist” from one character to the next. This reveals a problem with Centronics or Dataproducts terminating resistors on the CCB at C12 and D12, especially if they are absent. Garble can also result from failed terminating resistors or parallel logic, but this is rare.

5. The DPU LED never lights. The 68010 has not run its first instruction.

   a. The first two programs PROMs may be malfunctioning or inserted wrong. Do the corrective actions listed in step 3.d.

   b. Check the power supply voltages: look at the control panel display. If it is not blank, the logic power supply is okay. If the display is blank, turn off the printer. Reseat the power supply cable on the Mech Driver board and the CCB/Mech. Driver cable assembly W1. Turn the printer on. If that does not correct the problem, check for logic supply voltage on the CCB board between the positive end of C4 (location A5) and TP1 (location A1).

   c. On the CCB, inspect the PROM sockets, the 68010 socket (if installed), and the oscillator module at location P6. Remove any obvious dirt or conductive dust.

   d. Test for voltage supplied to the DPU LED. The LED may have failed.

   e. If the failure persists, replace the common controller board (CCB).

6. The DPU LED lights, but never turns off. Look at the control panel display:

    a. **If the top line of the display is blank**, the control panel is probably unplugged or defective. Do the corrective actions listed in step 4.a.

    b. **If the display has a single line of black squares on the top line,** the 64180 has failed. Turn off the printer, remove the CCB, and check the 64180 RTPU PROM at location H8 for bent pins, pins not inserted, or backwards insertion. Discard any PROMs that were inserted backwards. Their transistors were reverse biased, and even if they work their service life has been shortened by thermal damage. Replace the 64180 RTPU PROM. Check that the 64180 is correctly inserted and completely seated in its socket.

    c. **If the display reads "Diagnostic Test in Progress" and DPU LED has been on for 20 seconds or more but is not blinking**, it means the 64180 cannot communicate with the 8032 on the Mech Driver board. Turn off the printer, reseat the cable in J2 of the CCB and on the Mech Driver board. Check the 8032 on the Mech Driver, its PROM, and its clock jumper (E1–E2) for correct insertion, bent pins, etc. Reseat the jumper and socketed parts. If the problem persists, replace the Mech Driver's PROM and the CCB/Mech. Driver cable assembly W1.

Diagnostic Self–Tests

Run diagnostic self–tests to check the print quality and operation of the printer. The self–tests are listed below; the procedure for running the tests is explained on page 4–29.

NOTE: Under the description of each diagnostic test is a list of items that may require adjustment or replacement if the test produces a bad print pattern. Items are listed in the order they should be checked: simplest items first, moving to more complex components.

ASCII Swirl A sliding alphanumeric pattern useful for identifying missing or malformed characters, improper vertical alignment, or vertical compression.

Ribbon
Splined shaft skew adjustment
MPU sensor
Hammer spring
Hammer coil

All E's A pattern of all uppercase letter Es useful for identifying missing characters, misplaced dots, smeared characters, improper phasing, or light/dark character variations.

Ribbon
Splined shaft skew adjustment
MPU sensor
Hammer spring
Hammer coil

E's plus TOF A pattern of all Es followed by a form feed to the next page top of form, useful for identifying paper motion or feeding problems.

Power supply board
Mechanism Driver board
Paper motion sensor
Paper feed belt or motor
Splined shaft bearings
Tractors or tractor belts

All H's A pattern of all uppercase letter Hs useful for detecting missing characters or dots, smeared characters, or improper phasing.

Ribbon
MPU sensor
Hammer spring
Hammer coil

All Underlines An underline pattern useful for identifying hammer bank misalignment.

Mechanism Driver board
Hammer tips
Paper feed belt or motor
Splined shaft bearings
Tractor bearings or belts

All Black All odd dot positions are printed, creating a solid black band. Exercises shuttle and hammer bank at maximum capacity.

Mechanism Driver board
Power Supply board
Hammer spring
Hammer coil

Shuttle Slow Verifies proper operation by exercising shuttle motion at low speed.

Shuttle Fast Verifies proper operation by exercising shuttle motion at high speed.

Phasing A hammer timing parameter that permits you to adjust the vertical alignment of dots in character printing.

Test Width Permits you to run tests at all available print widths.

Running the Diagnostic Self–Tests

To run a diagnostic self–test:

1. On the control panel, press the ON LINE switch to place the printer off–line. “Off–line Emulation” displays.
2. Raise the printer cover.
3. On the control panel, press the ▲ and ▼ switches at the same time. “ENTER Switch Not Locked” briefly displays. (If “Locked” displays, press ▲ and ▼ again.)
4. Press the ▼ switch. The current emulation displays.
5. Press the ▶ or ◀ switch until “Emulation Self Test” displays.
6. Press ENTER. “Emulation Self Test * ” displays.
7. Press ▼. “Self Test ASCII Swirl” displays.
8. Press ▶ or ◀ until the test you want to run displays. (The tests are summarized on page 4–27.)
9. Press R/S (or ENTER) to start the self–test.
   Press R/S (or ENTER) to stop the test.
10. Examine the print quality. Characters should be horizontally and vertically aligned and solidly formed.
11. Press CLEAR. “Off–Line Emulation” displays.
12. Press ▼ once, then press ▶ until the emulation you want displays.
13. Press ENTER, then press the ▲ and ▼ switches simultaneously.
14. Close the printer cover.
15. Press the ON LINE switch to place the printer on–line.

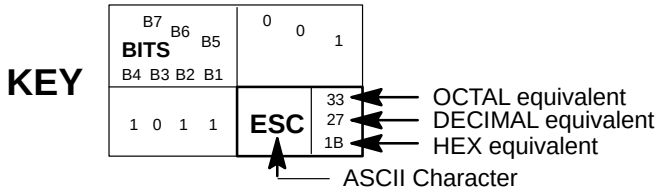
Hex Code Printout

Hex dumps list all ASCII character data received from the host computer with their corresponding two–digit hexadecimal codes. (The ASCII character set is on page 4–31.) You can use hex dumps to troubleshoot printer data reception problems. Printable characters print as the assigned symbol; nonprintable characters are indicated by the period symbol (.). The letter p before a hex code indicates an active Paper Instruction (PI) line. A blank space before a hex code indicates an inactive PI line.

To make a hex printout:

1. On the control panel, press the ON LINE switch to place the printer off–line. “Off–line Emulation” displays.
2. Raise the printer cover.
3. On the control panel, press the ▲ and ▼ switches simultaneously. “ENTER Switch Not Locked” briefly displays. (If “Locked” displays, press ▲ and ▼ again.)
4. Press the ▼ switch. The current emulation displays.
5. Press the ▶ or ◀ switch until “Emulation Hex Dump” displays.
6. Press ENTER. “Emulation Hex Dump * ” displays, indicating hex dump mode is now active.
7. Press ON LINE. The display indicates the printer is ready to print in hex dump mode: “On–Line Hex Dump”
8. Send data from the host — the data print in hex dump format. (Any data remaining in the buffer will print before the hex code printout starts.)
9. To stop the hex dump, press ON LINE. The display reads “Off–line Hex Dump”.
10. Press CLEAR. “Off–Line Emulation” displays.
11. Press ▼ once, then press ▶ until the emulation you want to use displays.
12. Press ENTER, then press the ▲ and ▼ switches simultaneously.
13. Close the printer cover and press ON LINE to place the printer on–line.

ASCII Character Set



B7 B6 B5 / BITS / B4 B3 B2 B1	ROW	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
		COLUMN 0	1	2	3	4	5	6	7
0 0 0 0	0	NUL 0 0 0	DLE 20 16 10	SP 40 32 20	0 60 48 30	@ 100 64 40	P 120 80 50	` 140 96 60	p 160 112 70
0 0 0 1	1	SOH 1 1 1	DC1 (XON) 21 17 11	! 41 33 21	1 61 49 31	A 101 65 41	Q 121 81 51	a 141 97 61	q 161 113 71
0 0 1 0	2	STX 2 2 2	DC2 22 18 12	” 42 34 22	2 62 50 32	B 102 66 42	R 122 82 52	b 142 98 62	r 162 114 72
0 0 1 1	3	ETX 3 3 3	DC3 (XOFF) 23 19 13	# 43 35 23	3 63 51 33	C 103 67 43	S 123 83 53	c 143 99 63	s 163 115 73
0 1 0 0	4	EOT 4 4 4	DC4 24 20 14	$ 44 36 24	4 64 52 34	D 104 68 44	T 124 84 54	d 144 100 64	t 164 116 74
0 1 0 1	5	ENQ 5 5 5	NAK 25 21 15	% 45 37 25	5 65 53 35	E 105 69 45	U 125 85 55	e 145 101 65	u 165 117 75
0 1 1 0	6	ACK 6 6 6	SYN 26 22 16	& 46 38 26	6 66 54 36	F 106 70 46	V 126 86 56	f 146 102 66	v 166 118 76
0 1 1 1	7	BEL 7 7 7	ETB 27 23 17	’ 47 39 27	7 67 55 37	G 107 71 47	W 127 87 57	g 147 103 67	w 167 119 77
1 0 0 0	8	BS 10 8 8	CAN 30 24 18	(50 40 28	8 70 56 38	H 110 72 48	X 130 88 58	h 150 104 68	x 170 120 78
1 0 0 1	9	HT 11 9 9	EM 31 25 19	) 51 41 29	9 71 57 39	I 111 73 49	Y 131 89 59	i 151 105 69	y 171 121 79
1 0 1 0	10	LF 12 10 0 A	SUB 32 26 1A	* 52 42 2A	: 72 58 3A	J 112 74 4A	Z 132 90 5A	j 152 106 6A	z 172 122 7A
1 0 1 1	11	VT 13 11 0 B	ESC 33 27 1B	+ 53 43 2B	; 73 59 3B	K 113 75 4B	[133 91 5B	k 153 107 6B	{ 173 123 7B
1 1 0 0	12	FF 14 12 0 C	FS 34 28 1C	, 54 44 2C	< 74 60 3C	L 114 76 4C	\ 134 92 5C	l 154 108 6C	| 174 124 7C
1 1 0 1	13	CR 15 13 0 D	GS 35 29 1D	− 55 45 2D	= 75 61 3D	M 115 77 4D	] 135 93 5D	m 155 109 6D	} 175 125 7D
1 1 1 0	14	SO 16 14 0 E	RS 36 30 1E	. 56 46 2E	> 76 62 3E	N 116 78 4E	^ 136 94 5E	n 156 110 6E	~ 176 126 7E
1 1 1 1	15	SI 17 15 0 F	US 37 31 1F	/ 57 47 2F	? 77 63 3F	O 117 79 4F	_ 137 95 5F	o 157 111 6F	DEL 177 127 7F

Clearing Nonvolatile Memory (NVRAM)

Clearing nonvolatile memory (NVRAM) erases all configuration values stored in NVRAM. These values include the saved configuration under all emulations, the print statistics, and the phasing index.

IMPORTANT

The printer must be rephased if NVRAM is cleared.

To clear NVRAM, hold down the CLEAR switch while the printer is turned on and powers up.

5 Adjustments

Chapter Contents

Special Procedures

Adjustments

Hammer Bank Service Position

Putting the Hammer Bank in the Service Position

1. Remove the printer's power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.
2. Remove the paper supply from the print station and tractors.
3. Disconnect four connectors (1) from the bottom of the ribbon deck assembly (2). (See Figure 5–1.)
4. Squeeze the lock tabs (3) and remove the ribbon spools (4) from the ribbon hubs (5).
5. Remove three hex head screws (6).
6. Raise the ribbon deck assembly slightly and lift it off the retaining clips (7). Set the ribbon deck aside.

(Procedure continued on page 5–4.)

1. Connector (4)
2. Ribbon Deck Assembly
3. Lock Tab (2)
4. Ribbon Spool (2)
5. Ribbon Hub (2)
6. Screw (3)
7. Retaining Clip (2)

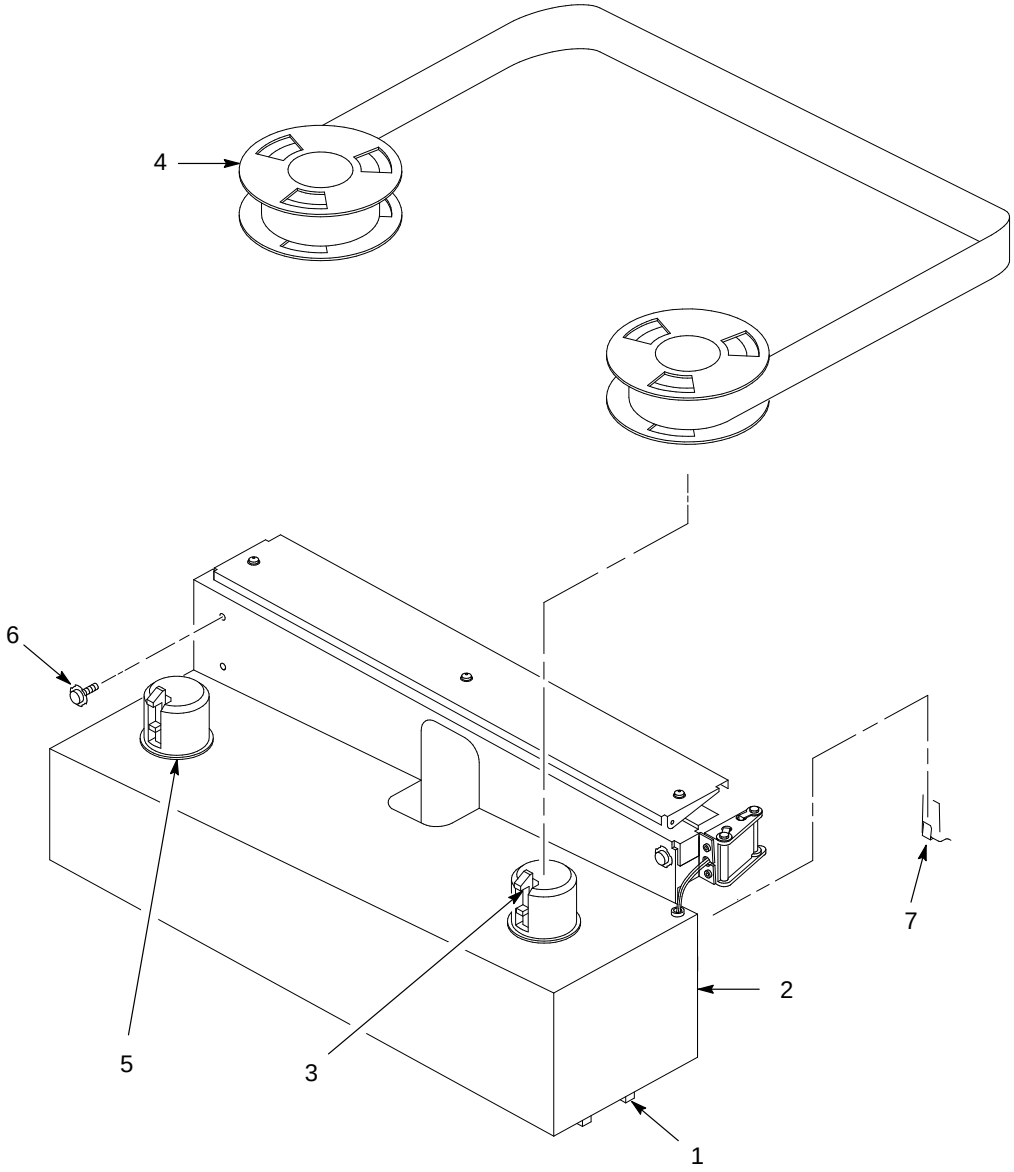


Figure 5–1. Ribbon Deck Removal

7. Place the hammer bank assembly in the service position, as follows:

    a. Raise the forms thickness lever (1) all the way. (See Figure 5–2)

    b. Remove the velcro pad (2) holding the coil wires.

    c. Disconnect the coil connectors (3).

    d. Remove four screws (4), eight washers (23, 24), and two coil lead brackets (5).

    e. Remove two screws (6), lockwashers (7), and washers (8).

    f. Remove two screws (9) and washers (10) from the shroud (11).

    g. Separate the shroud from the shuttle assembly (12).

CAUTION

Be careful to prevent shims and the antirotation block from falling into the printer.

    h. Remove two screws (13). Separate the antirotation block (14) and shims (15) from the shuttle assembly by compressing the spring on the side and lifting the block up.

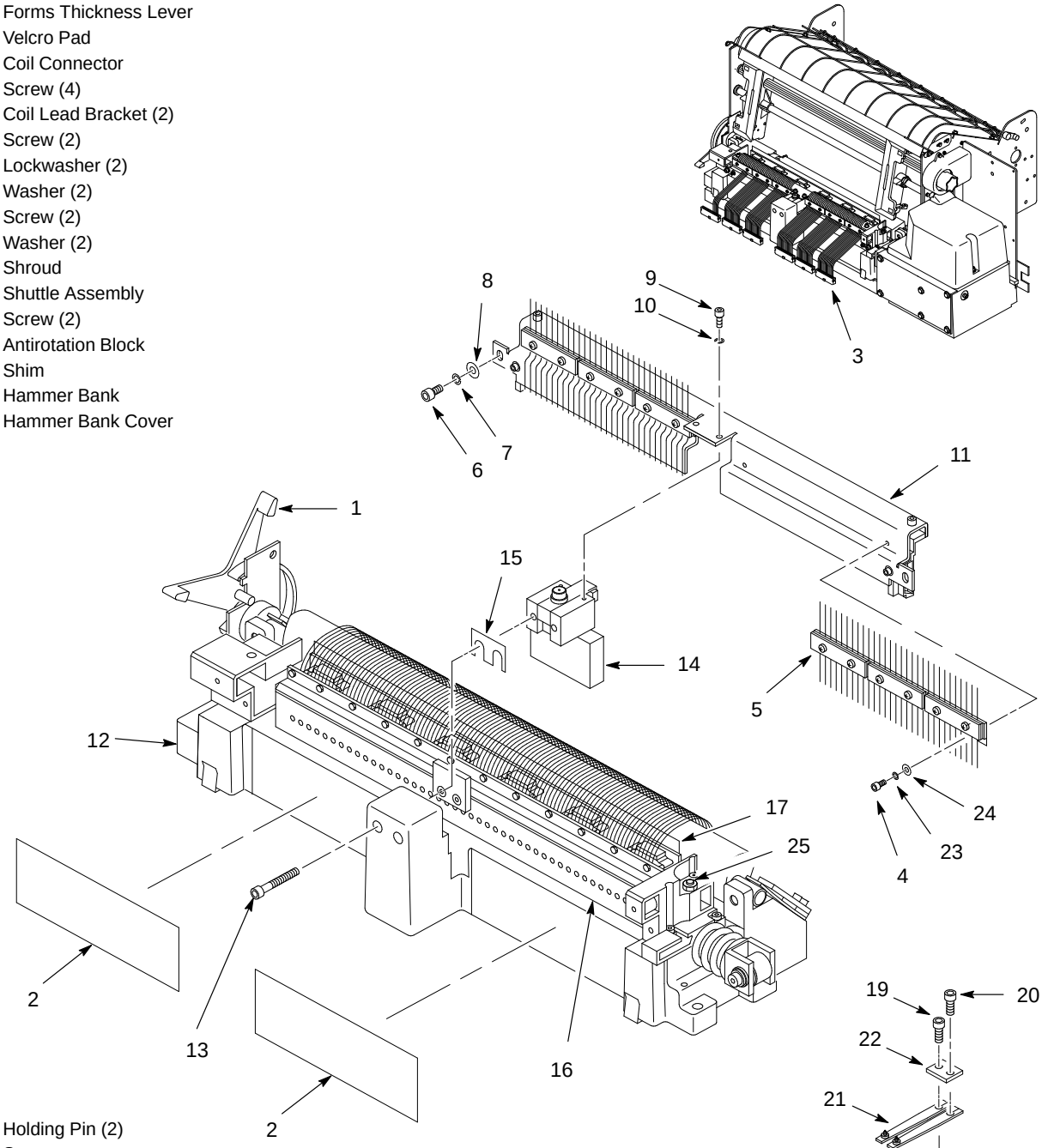
    i. Rotate the hammer bank (16) as far as it will go toward the front of the printer.

CAUTION

Do not loosen the bearing block set screws (25).

    j. Pull the hammer bank cover (17) away from the magnets on the hammer bank. Disengage the cover from the holding pins (18) and remove it from the printer.

1. Forms Thickness Lever
2. Velcro Pad
3. Coil Connector
4. Screw (4)
5. Coil Lead Bracket (2)
6. Screw (2)
7. Lockwasher (2)
8. Washer (2)
9. Screw (2)
10. Washer (2)
11. Shroud
12. Shuttle Assembly
13. Screw (2)
14. Antirotation Block
15. Shim
16. Hammer Bank
17. Hammer Bank Cover



18. Holding Pin (2)
19. Screw
20. Screw
21. Hammer Spring
22. Clamp Plate
23. Washer (4)
24. Washer (4)
25. Set Screw (2)
26. Coil Clamp
27. Clamp Screw (2)

Figure 5–2. Hammer Bank Service Position

Returning the Hammer Bank to the Operating Position

1. Install the hammer bank cover. Check for engagement with the holding pins.

2. Rotate the hammer bank as far as it will go toward the rear of the printer.

CAUTION

Do not lubricate the bearing block assemblies or hammer bank shaft.

3. Apply a 1/4 inch dab of bearing lubricant (see page 1–8) to both sides of the plate of the hammer bank where the plate contacts the bearing surfaces of the antirotation block.

4. Place the antirotation block and shim(s) on the shuttle assembly by forcing the slide toward the rear of printer. Install two screws (13).

5. Place the shroud (11) on the shuttle assembly. Install two screws (9) and washers (10) at the top loosely.

6. Loosely install two screws (6), lockwashers (7), and washers (8). Pull the shroud toward the front of the printer and tighten the top screws (9). Release the shroud, then tighten the front screws (6).

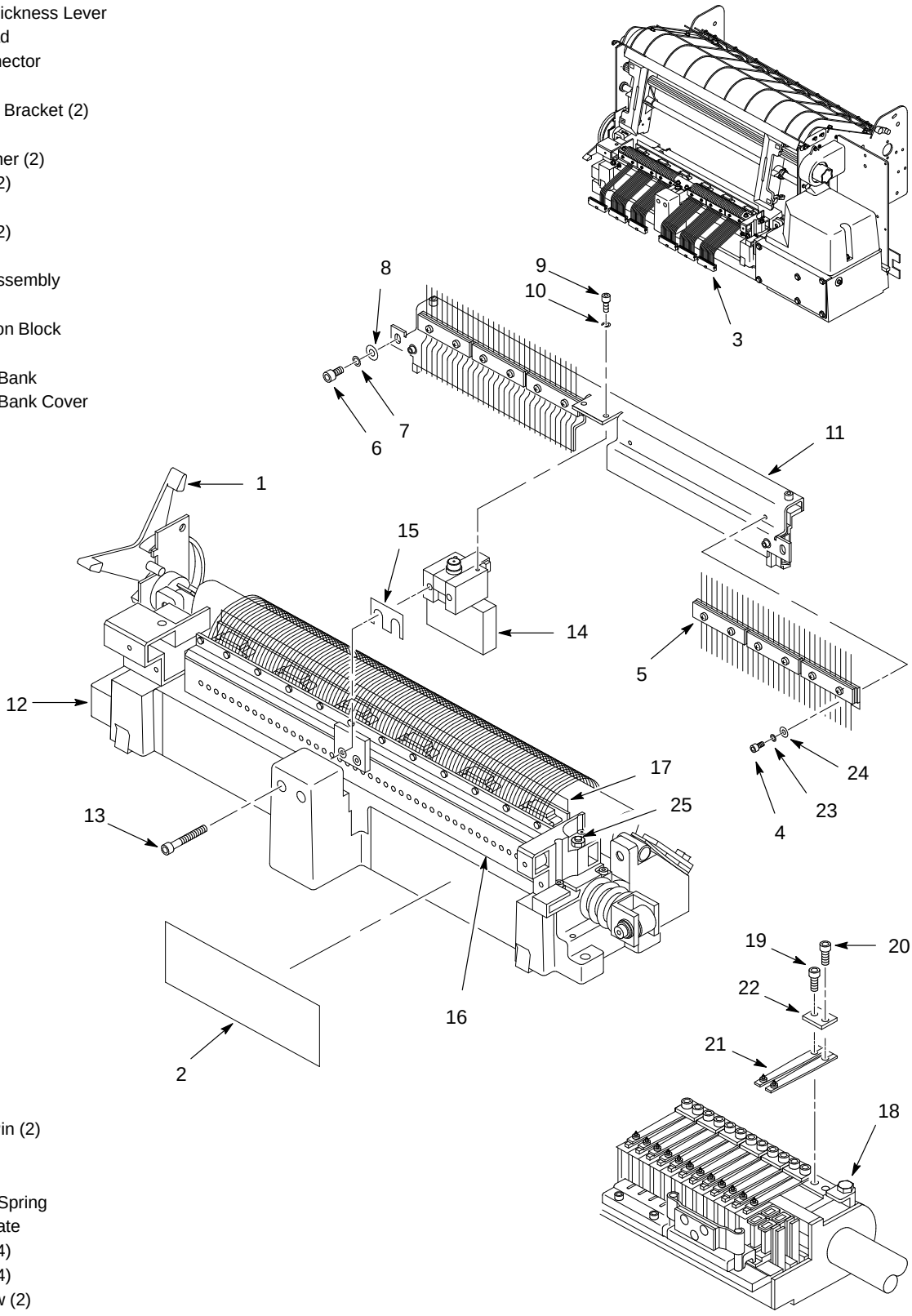
CAUTION

To prevent wear on the front of the shroud, do the next step carefully. Incorrect placement can also cause poor print quality. Inspect the front area of the shroud to ensure that there is adequate clearance between the shroud and the screws on the hammer bank assembly.

7. Install two coil lead brackets to the shroud with four screws (4) and eight washers (23, 24). Be sure to position the brackets down against the ledge on the shroud. Working from left to right, connect the coil connectors and reinstall the velcro pad.

8. Install the ribbon deck assembly by reversing the steps on page 5–2.

1. Forms Thickness Lever
2. Velcro Pad
3. Coil Connector
4. Screw (4)
5. Coil Lead Bracket (2)
6. Screw (2)
7. Lockwasher (2)
8. Washer (2)
9. Screw (2)
10. Washer (2)
11. Shroud
12. Shuttle Assembly
13. Screw (2)
14. Antirotation Block
15. Shim
16. Hammer Bank
17. Hammer Bank Cover



18. Holding Pin (2)
19. Screw
20. Screw
21. Hammer Spring
22. Clamp Plate
23. Washer (4)
24. Washer (4)
25. Set Screw (2)

Figure 5–2. Hammer Bank Service Position

Hammer Spring Retensioning (Figure 5–3)

NOTE: Tensioning hammer springs is a trial–and–error process. Adjust and test until print quality is satisfactory.

If Print is Too Light:

1. Put the hammer bank in the service position. (See page 5–2.)

CAUTION

The hammer tip is fragile. Take care not to damage the hammer tip with the screwdriver when flexing the spring.

2. Using the tip of a screwdriver, *carefully* flex the tip of the hammer spring away from the pole pin under the spring.
3. Restore the hammer bank to the operating position. (See page 5–6.)

If Print is Too Dark:

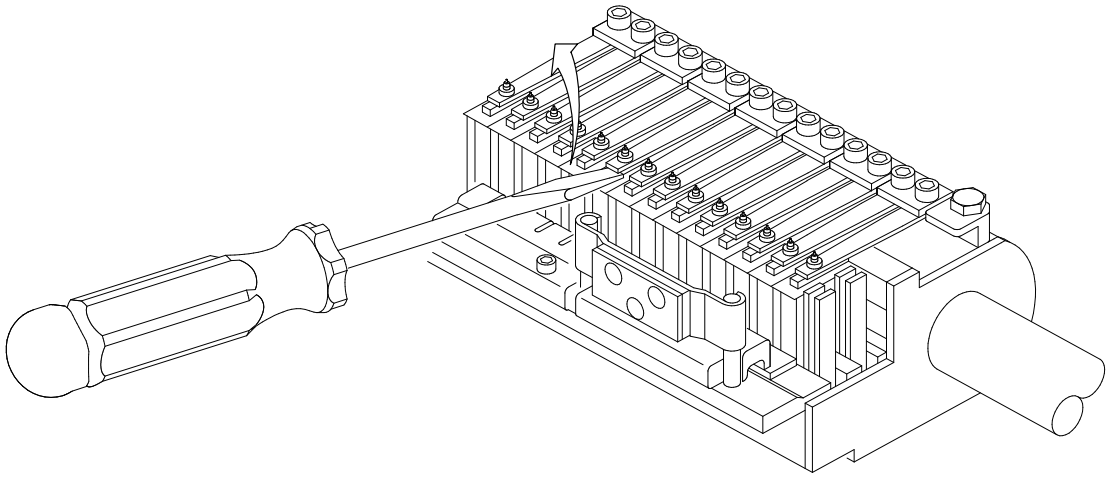
1. Put the hammer bank in the service position and remove the hammer that is printing too dark. (See page 5–2.)

CAUTION

The hammer tip is fragile. Be careful not to damage the hammer tip with the screwdriver when flexing the spring.

2. Grip the spring with long nose pliers so the screw hole is just covered. Using the tip of the screwdriver, *carefully* flex the spring in a direction away from the hammer tip.
3. Install the hammer spring.
4. Align the hammer tip. (See page 5–10.)
5. Restore the hammer bank to the operating position. (See page 5–6.)

PRINT TOO LIGHT



PRINT TOO DARK

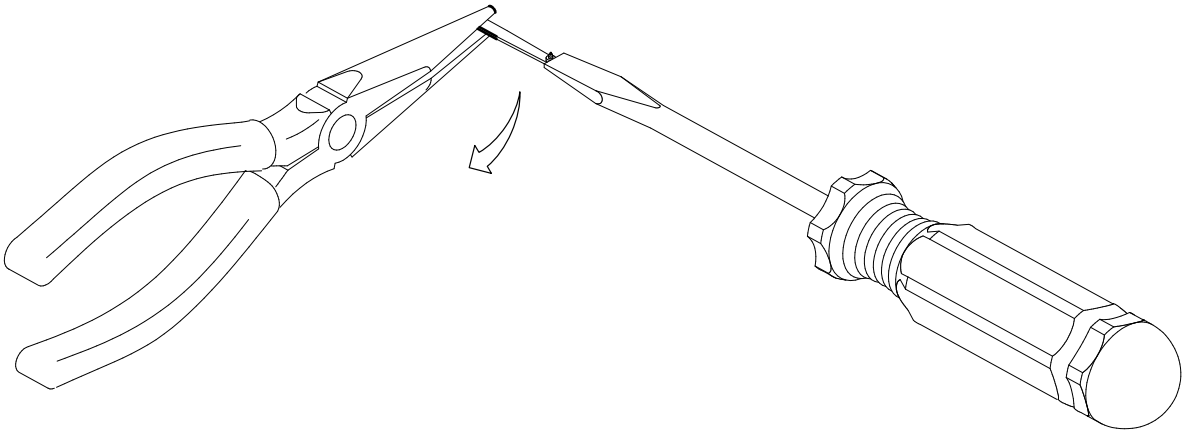


Figure 5–3. Hammer Spring Retensioning

Hammer Tip Alignment (Figure 5–4)

IMPORTANT

You must use the alignment tool to correctly align the hammer tips. This procedure cannot be done accurately by hand.

1. Put the hammer bank in the service position. (See page 5–2.)
2. Loosen the screw (1) of the hammer spring (2) to be aligned.
3. Place the hammer alignment tool (3) (P/N FD–28262–01) over the hammer tips. Move the hammer spring until the tip is in an appropriate hole in the alignment tool.
4. Torque the screw (1) to 6 to 9 in–lbs.
5. Remove the alignment tool.
6. Return the hammer bank to the operating position. (See page 5–6.)

1. Screw
2. Hammer Spring
3. Hammer Alignment Tool (P/N FD–28262–01)

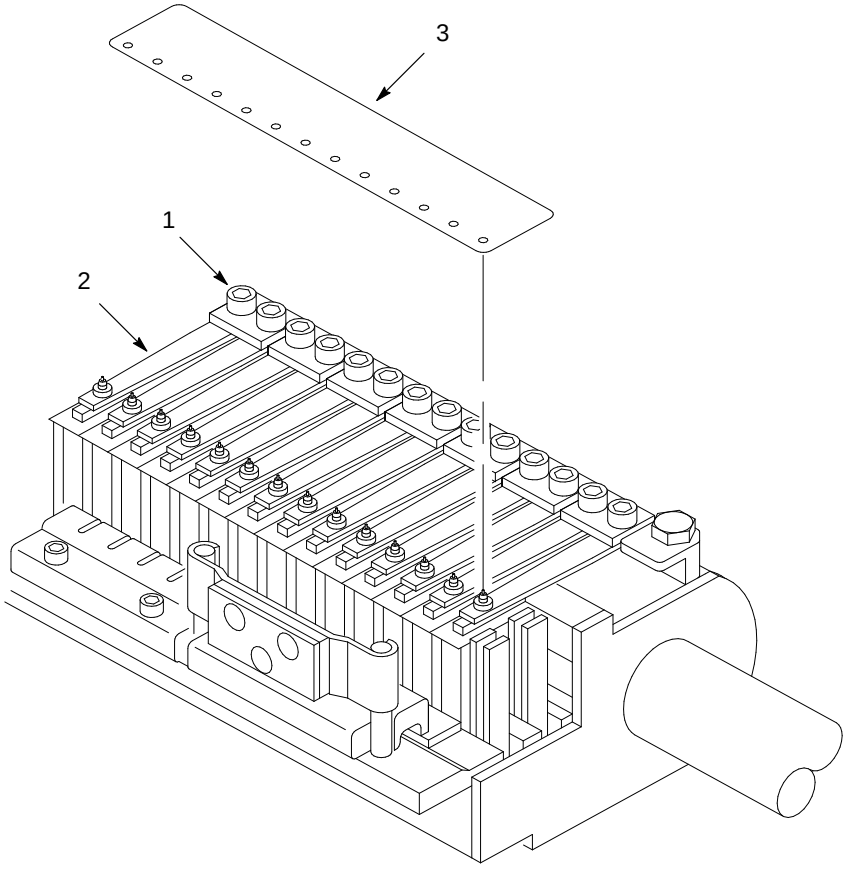


Figure 5–4. Hammer Tip Alignment

Magnetic Pickup Gap (Figure 5–5)

NOTE: Unless otherwise directed, do the MPU phasing adjustment (page 5–14) immediately after this procedure.

1. Loosen the two captive screws and remove the cam cover (1).
2. Loosen the clamping screw (2) enough to allow the MPU (3) to be rotated.
3. Set the gap between the MPU and the flywheel (4) using a flat feeler gauge (5):
   a. If a blue mark is on the flywheel, use a 0.002 inch feeler gauge and set the gap in line with the blue mark.
   b. If the flywheel does not have a blue mark, use a 0.008 inch feeler gauge.
4. Tighten the clamping screw (2). Verify that the MPU does not rotate.
5. Adjust the MPU phasing (page 5–14).

1. Cam Cover
2. Screw
3. MPU
4. Flywheel (Sync Windows)
5. Flat Feeler Gauge

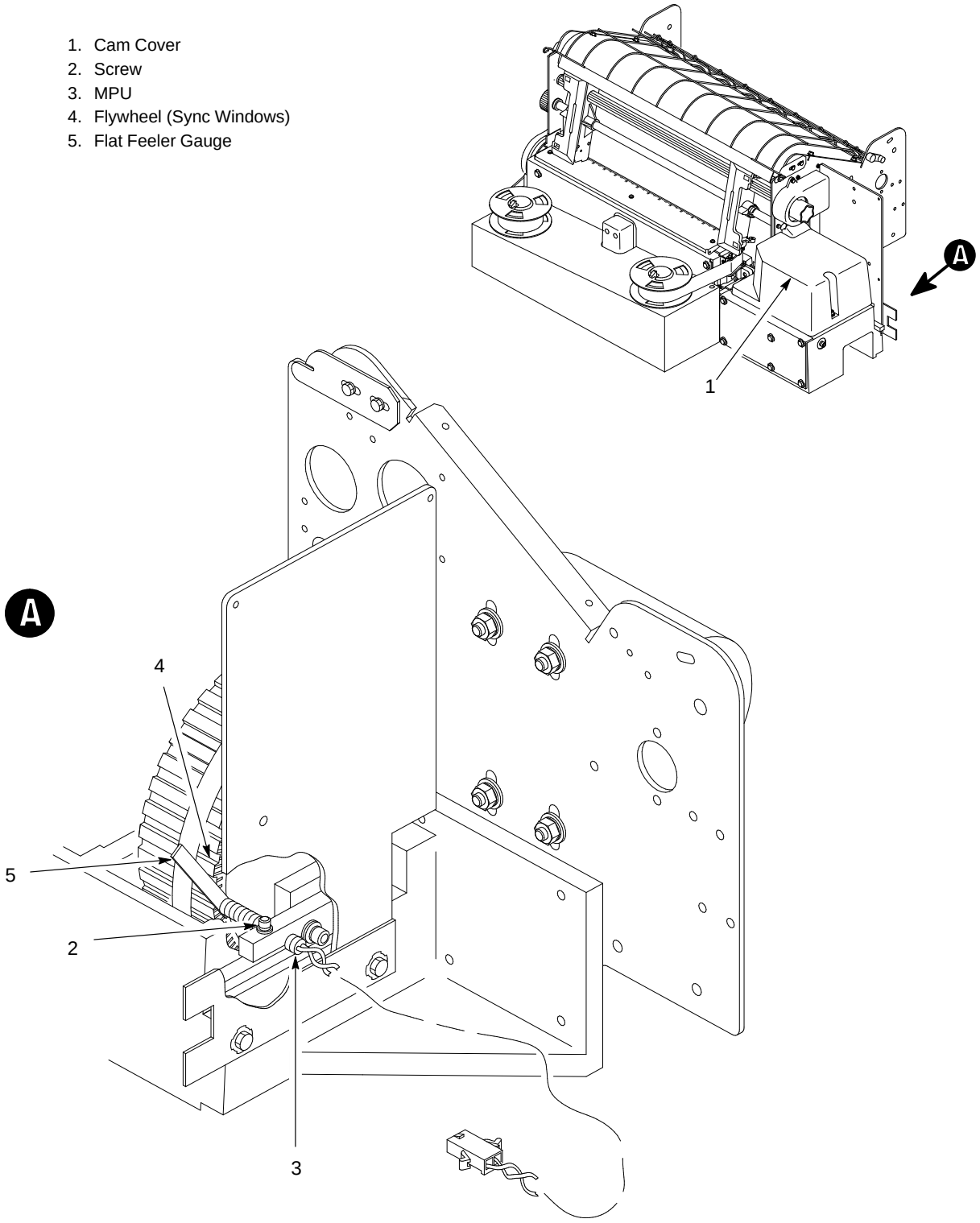
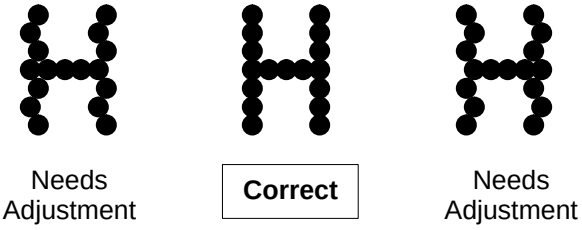


Figure 5–5. Magnetic Pickup Gap Adjustment

Magnetic Pickup Phasing Adjustment (Figure 5–6)

NOTE: Unless otherwise directed, adjust the MPU gap (page 5–12) before doing this procedure.

1. Open the printer cover.
2. Loosen the screw (1) until the MPU arm (2) can be pivoted, but only with some effort. Push the MPU arm (2) all the way down.
3. Load full width (132 column) paper and ribbon.
4. Turn the printer on.
5. Press ON LINE to take the printer off–line.
6. Press ▲ and ▼ at the same time to unlock the ENTER switch.
7. Press ▼. The current emulation appears on the LCD.
8. Press ▶ or ◀ until “Emulation Self Test” appears on the LCD.
9. Press ENTER to select this “emulation,” then press ▼.
10. Press ▶ until “Self Test Phase Value” appears on the LCD.
11. Press R/S. “Phase Value” and the current phasing index number display. The printer begins printing all H’s, each line preceded by the phasing index number.
12. Press the ▶ or ◀ switches to increase or decrease the phasing index until the pattern of H’s appears as shown below:



13. When the pattern of H’s is acceptable, press R/S. Printing stops, and the current phase index value is entered into nonvolatile memory.
14. Press the CLEAR switch. “Off–Line Emulation” appears on the LCD.
15. Press ▼ once. Press ▶ until the emulation that you want to print with appears on the LCD. Press ENTER to select this emulation.
16. Press ▲ and ▼ at the same time to lock the ENTER switch.
17. Close the printer cover and place the printer on–line.

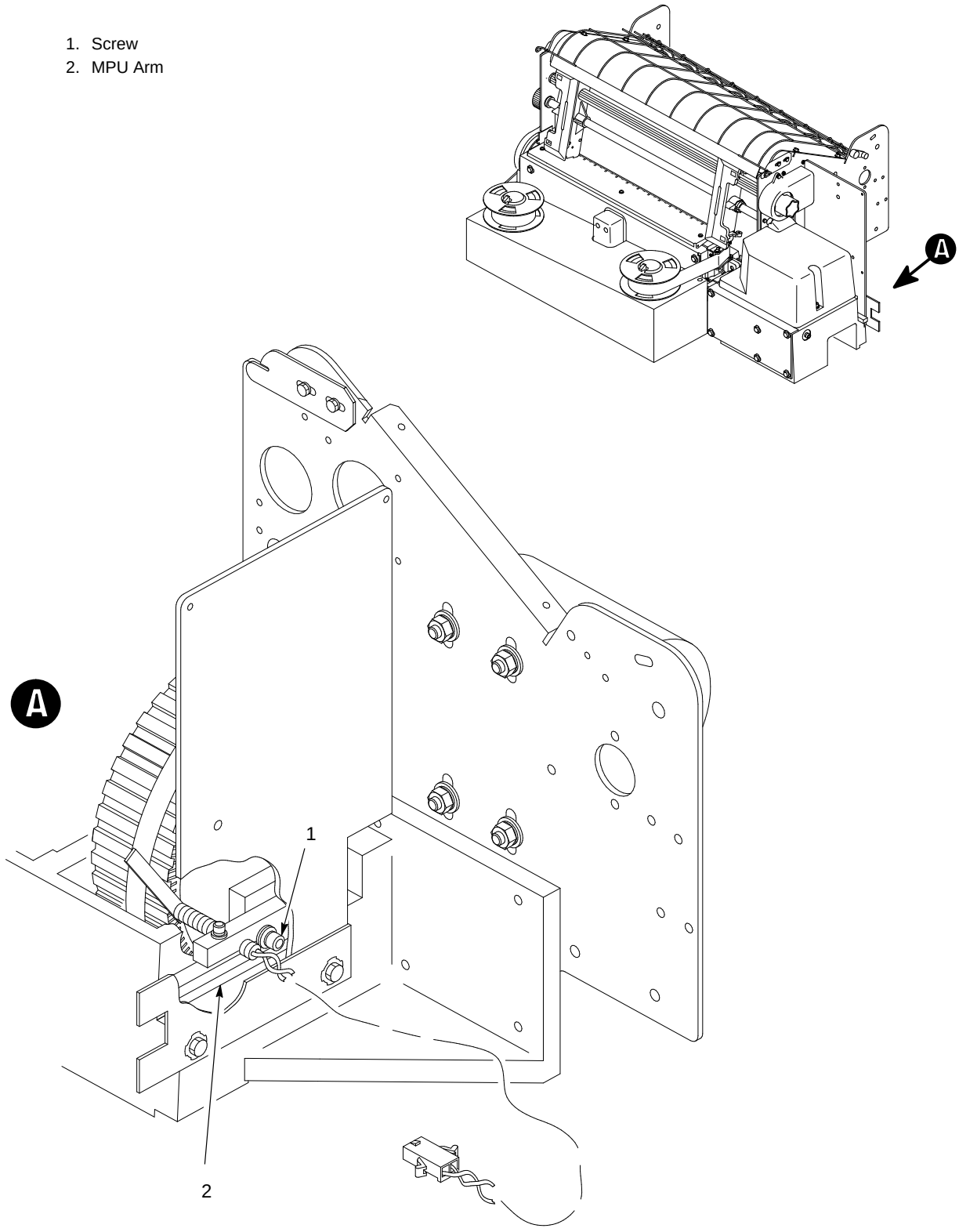


Figure 5–6. Magnetic Pickup Phasing Adjustment

Paper Feed Belt Tension (Figure 5–7)

Tension Check

1. Open the printer cover.
2. Remove two screws (1) and the belt guard (2).
3. Press the middle of the paper feed belt (3) down with the force gauge, using 2 to 5 pounds of force.
4. If the belt deflects more or less than .06 inch (1.6 mm), adjust the tension as described below.
5. Install the belt guard and two screws.
6. Close the printer cover.

Adjustment

1. Remove the lower paper guide. (See page 6–40.)
2. Loosen the four nuts (4) securing the paper feed motor (5).
3. Place a reusable tie–wrap around the motor, leaving enough slack to insert the force gauge, in the manner illustrated on page 5–25.
4. Hook the right–angle end of the force gauge through the tie–wrap and apply 7 pounds of tension to motor by pulling the gauge in the direction opposite the splined shaft.
5. Hold 7 pounds tension on the force gauge and torque the motor mount nuts (4) to 14 inch–pounds.
6. Remove the reusable tie–wrap from the paper feed motor.
7. Install the lower paper guide. (See page 6–40.)

1. Screw (2)
2. Belt Guard
3. Paper Feed Belt
4. Nut (4)
5. Paper Feed Motor

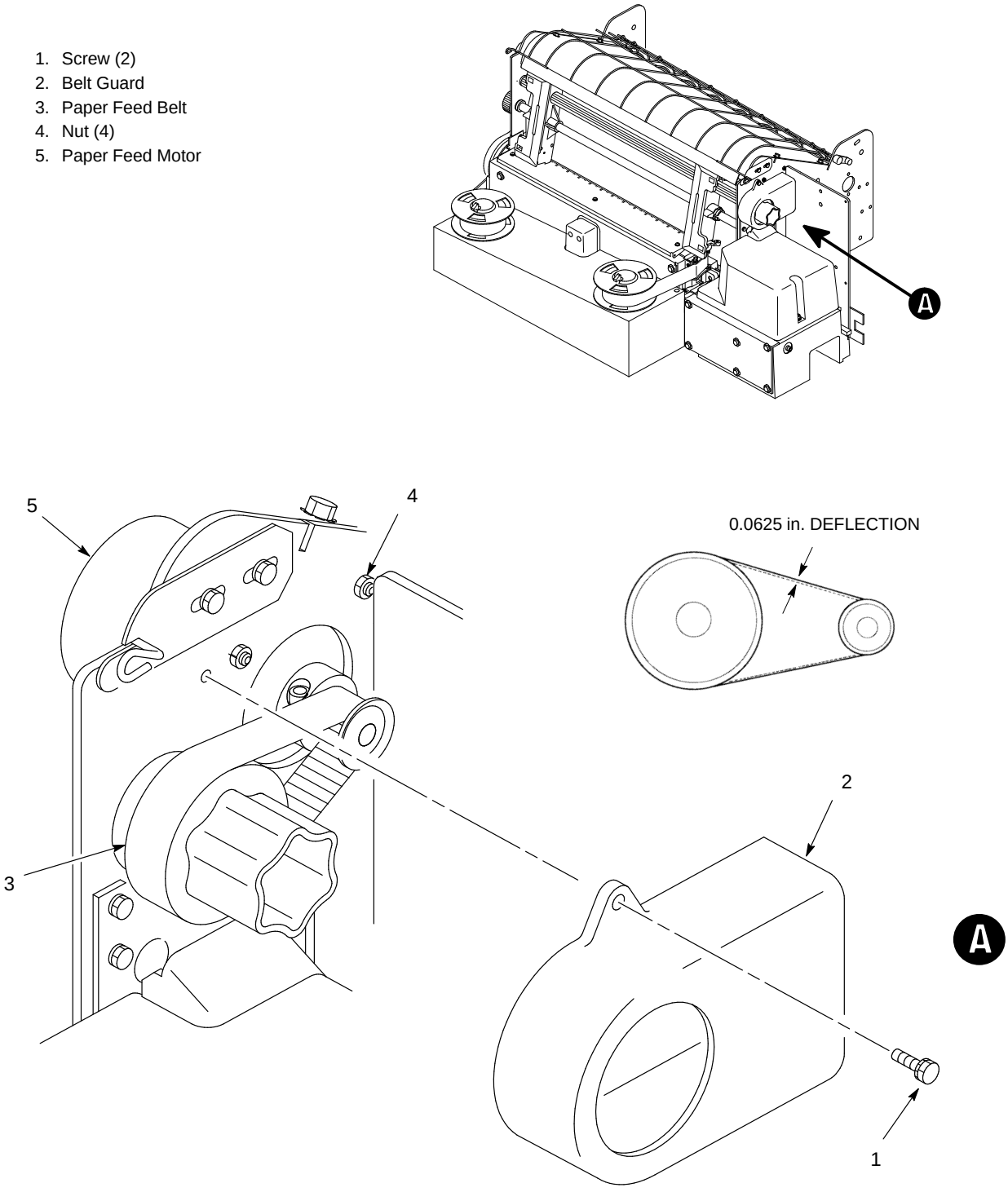


Figure 5–7. Paper Feed Belt Tension Check and Adjustment

Paper Out Switch Adjustment

This procedure is required only if a new paper out switch has been installed or if the paper out distance is set incorrectly. Although not mandatory, it is advisable to test the Paper Out distance with 6–part paper, in order to verify printing with multi–part forms.

1. Turn the printer on and load full width (132 column) paper.
2. Make sure the printer is not in a fault condition and the forms thickness lever is closed.
3. Press ON LINE to take the printer off–line. Open the printer cover.
4. Press ▲ and ▼ at the same time to unlock the ENTER switch.
5. Press ▼. The current emulation appears on the display.
6. Press ▶. “Off–Line Print Engine” appears on the LCD.
7. Press ▼. “Print Engine Unidirectional” displays.
8. Press ◀. “Print Engine Paperout Adjust” displays.
9. Press ▼. “Paperout Adjust *xxx* dots * ” appears.
10. Set the paper out distance to the default value:
    a. Increase or decrease the paper out distance as necessary to show 159 dot rows on the control panel display. Use the ▶ switch to increase, or the ◀ switch to decrease the number of dot rows. (The possible range of dot rows is 117 to 177.)
    b. When the display reads “Paperout Adjust 159 Dot Rows,” press ENTER. An asterisk (*) appears, indicating that the value is now the active value in nonvolatile memory.
11. Press the CLEAR switch.
12. Adjust the Paper Out distance:
    a. On a sheet of paper two or three sheets below the paper channel in the printer, cut or tear a 4–inch–by–4–inch square in the paper on the left side and immediately below the perforation. (See Figure 5–8.) This hole will create a Paper Out condition but allows printing to the right of the hole.

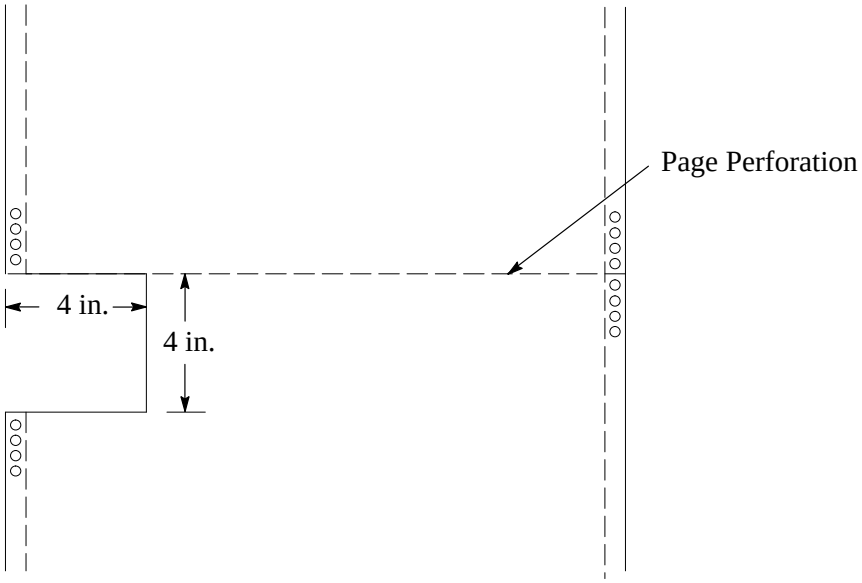


Figure 5–8. Paper Preparation for Paper Out Adjustment Test

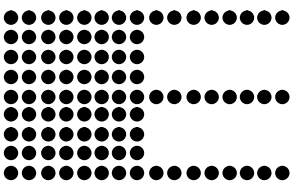
NOTE: You will use paper prepared this way a number of times during this procedure. Cut or tear 8 to 10 pages, every third sheet.

b. Press ▼. the current emulation appears on the LCD.

c. Press ▶ until the display reads “Emulation Self Test.” Press ENTER to select this “emulation.”

d. Press ▼, then press ▶ repeatedly until the display reads “Self Test Paperout Adjust.”

This self–test causes the printing of a vertical “comb” pattern at column 70, each long bar (or comb) separated by 4 dot rows. The pattern, though much smaller, looks like this:



e. On the page just below the paper channel, cut or tear the paper in the same manner as in Step 12.a.

f. Press R/S or ENTER to start the test. When the Paper Out condition occurs, remove the paper from the tractors, and determine the distance to the edge of the paper by counting the number of dot rows from the end of the comb to the perforation (if short), or the dot rows beyond the perforation (if long).

NOTE: Use the long bars for counting the dot rows quickly. The distance between long bars is 4 dot rows. You can tear off a small piece of the comb pattern from the beginning of the pattern to help you determine the dot rows required to reach the perforation (or back up to it).

- If the comb pattern is short or long, go to substep g.
- If the comb pattern succeeds in just meeting the edge of the paper, insert new paper, close the forms thickness lever, and go to Step 13.

g. Press CLEAR.

h. Press ▼. The current emulation appears on the display.

i. Press ▶. “Off–Line Print Engine” appears on the LCD.

j. Press ▼. “Print Engine Unidirectional” displays.

k. Press ◀. “Print Engine Paperout Adjust” displays.

l. Press ▼. “Paperout Adjust *xxx* dots * ” appears.

m. Increase (for short test) or decrease (for long test) the Paper Out Adjust value by the number of dot–rows you counted in Step 12.f. For example:

- If the distance is short by the distance between 2 long combs, add 4 to the Paper Out Adjust value (using the ▶ switch).
- If the distance is long by half the distance between 2 long combs, subtract 2 from the Paper Out Adjust value (using the ◀ switch).

Press ENTER to select the new value as the active value. An asterisk (*) will appear next to it on the display.

n. Load the paper and close the forms thickness lever.

o. Repeat Step 12. to print the comb pattern. If the pattern does not stop just at the perforation, repeat the steps to increase or decrease the Paper Out Adjust value as necessary. Otherwise, go to Step 13.

13. Press CLEAR to exit the configuration menus.

14. Press ▼, then press ▶ until the emulation you want to print with is displayed.

15. Press ENTER to select this emulation. An asterisk (*) appears next to it on the display.

16. Press ▲ and ▼ at the same time to lock the ENTER switch.

17. Close the printer cover and return the printer to normal operation.

Platen Gap (Figure 5–9)

1. Disconnect the power cord from the rear of the printer. Open the printer cover. Remove paper from the printer.
2. Remove the ribbon deck assembly. (See page 5–2.)
3. Remove the RPF belt cover. Loosen the platen open motor screws to loosen the platen open belt. (See page 6–44.)
4. Raise the forms thickness lever (1) all the way.
5. Measure the platen gap, as follows:

CAUTION

Take care not to damage the hammer bank cover or the hammer tips with the feeler gauge.

   a. Insert a flat feeler gauge (2) between the platen (3) and the hammer tips (4) in the ribbon path of the hammer bank cover (5) within six hammer positions of the left end of the hammer bank. If the forms thickness lever is in the "A" position, use a 0.009 inch feeler gauge. When the forms thickness lever is fully closed, use a 0.007 inch gauge.

   b. Carefully lower the forms thickness lever until the platen just contacts the feeler gauge with the lever at the "A" setting. The feeler gauge should move with only slight friction. Make sure the gauge is vertical and in the same plane as the hammer tips.

6. Repeat Steps 4 and 5 at the right end of the hammer bank.
7. If the platen gap is incorrect:

   a. Adjust the two set screws (6) as required:
   1/4 turn equals approximately 0.008 inch.

   b. Repeat Steps 4 through 6 until the platen gap is correct.

8. Adjust the platen open belt (page 5–24).
9. Install the ribbon deck assembly by reversing the steps on page 5–2. Load paper. Close the printer cover and connect the power cord.

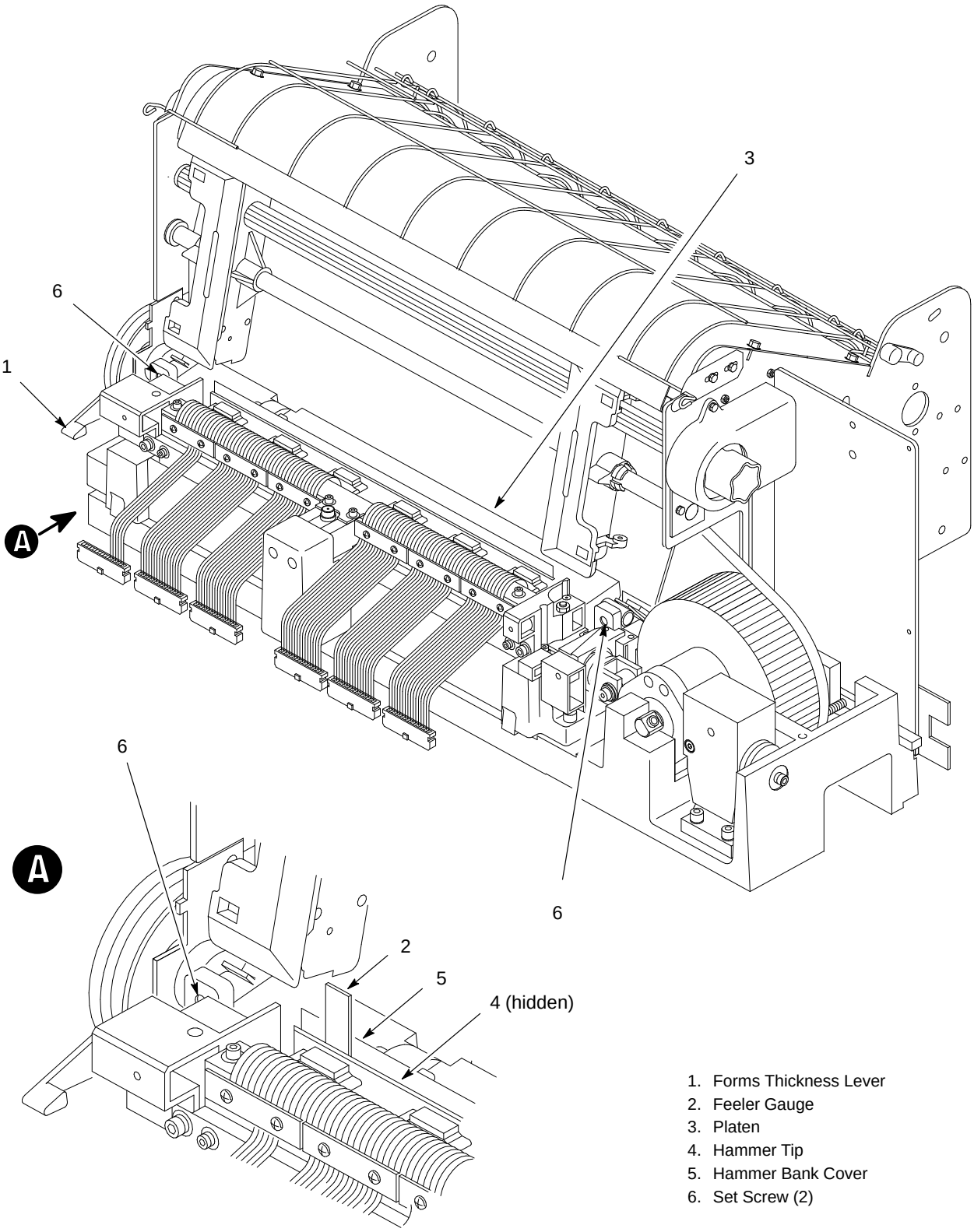


Figure 5–9. Platen Gap Adjustment

Platen Open Belt Adjustment (Figure 5–10)

1. Open the printer cover and the rear door.
2. Remove the RPF belt cover (1) by squeezing the top and bottom to release the plastic tabs from the slots in the side plate.
3. Loosen the platen open motor mount screws (2).
4. Place a reusable tie–wrap (3) around the platen open motor (4), leaving enough slack to insert the force gauge.
5. Close the forms thickness lever all the way.

CAUTION

Too much tension on the platen open belt can cause the platen gap to change, which can lead to premature wear of the platen, damaged hammer tips, and poor print quality.

6. Hook the right–angle end of the force gauge (5) through the tie–wrap and apply 5–6 pounds of tension to the platen open motor by pulling the gauge in the direction opposite the forms thickness lever.
7. Hold 5–6 pounds tension on the force gauge and torque the motor mount screws (2) to 20 inch–pounds.
8. Remove the reusable tie–wrap from the platen open motor.
9. Snap the RPF belt cover into the slots in the side plate.
10. Close the printer cover and the rear door.

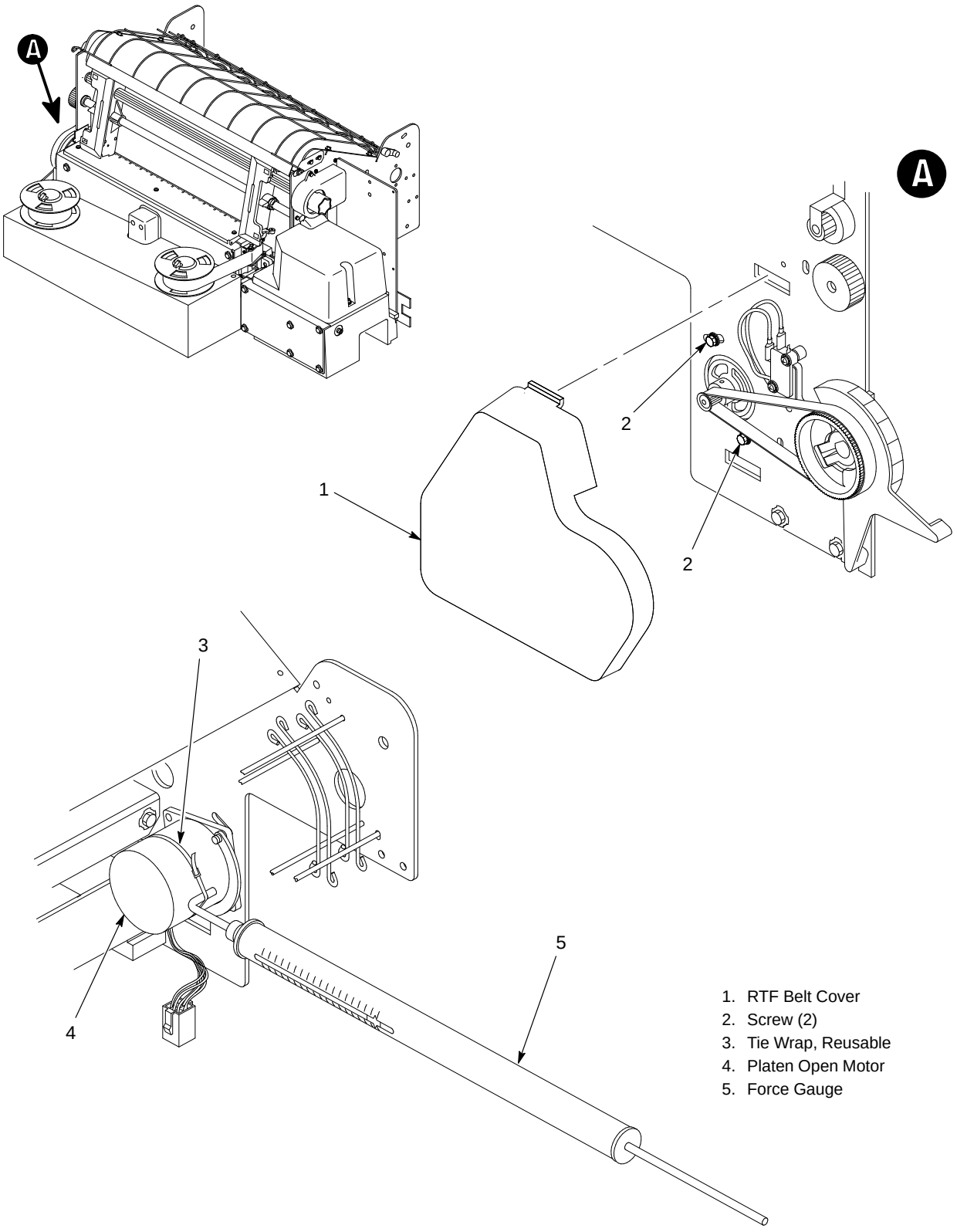


Figure 5–10. Platen Open Belt Adjustment

Ribbon Tracking Check and Adjustment (Figure 5–11)

1. Make sure ribbon and paper are loaded and that the ribbon is fully wound on one of the spools.
2. Turn the printer on and open the printer cover.
3. Set the forms thickness lever (1) to any position between “A” and “B.” Make sure no error indications appear.
4. Run a shuttle fast self–test (page 4–27). Shuttle action and ribbon motion should begin.
5. On either the left or right ribbon guide (2), momentarily short across the skids (3) with a screwdriver. The ribbon should reverse direction.
6. Let the ribbon run completely out of one spool. Verify that the ribbon is centered in the guide. If it is not, follow these Steps:
    a. Loosen two screws (4) until the ribbon guide can be rotated about the guide post (6).
    b. Pivot the guide until the ribbon tracks in the center.
    c. Tighten two screws.
    d. Verify that the ribbon is centered and winds up without interference on the ribbon spool.
7. The spool should automatically reverse. If it does not, follow these Steps:
    a. Replace the ribbon. Run the shuttle test again.
    b. If there is still an error, check the cabling.
    c. If ribbon tracking is still unsuccessful, check that the ribbon deck is installed properly and replace it if necessary. (See page 5–2.)

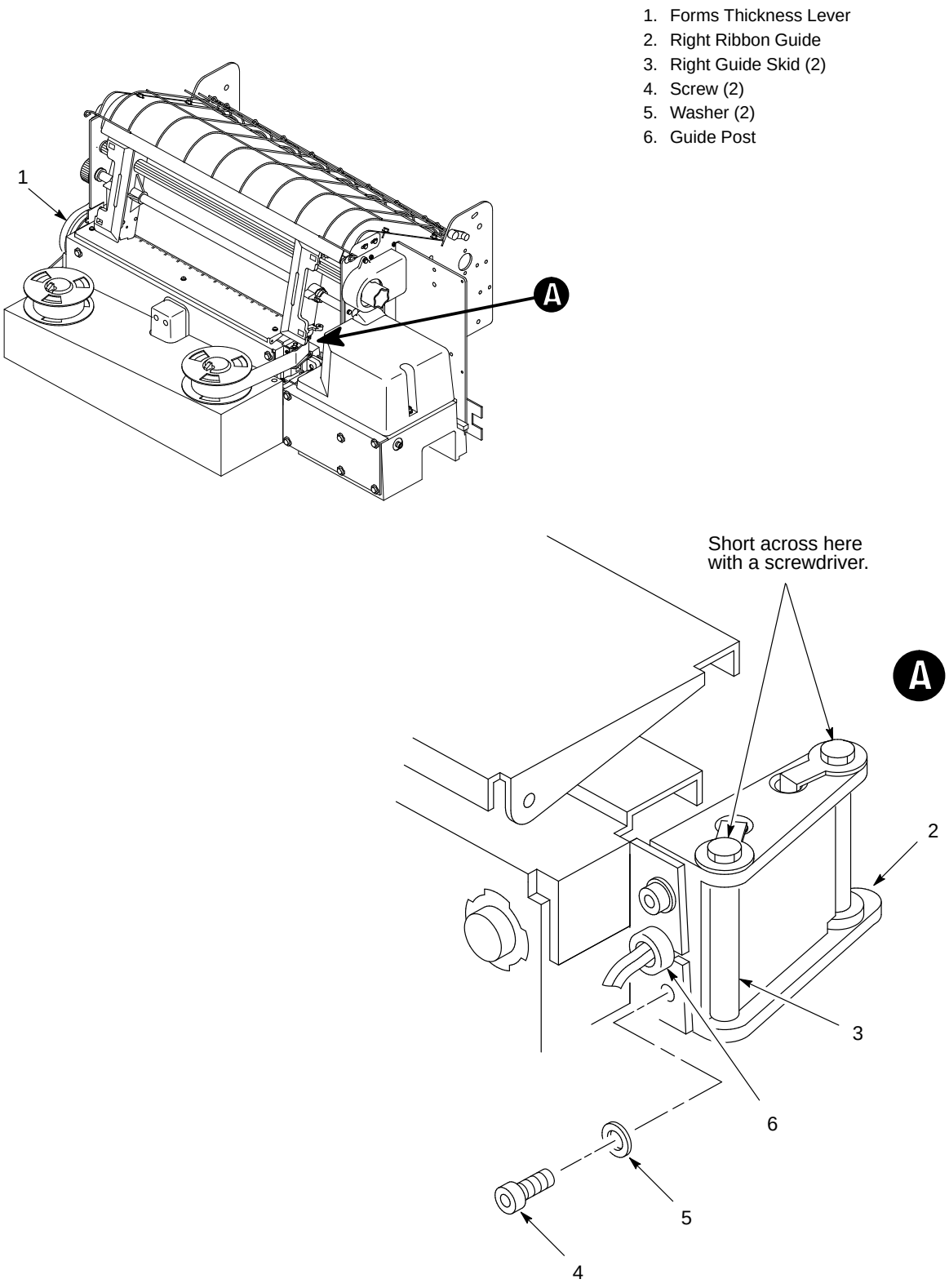


Figure 5–11. Ribbon Tracking Check and Adjustment

Shuttle and Counterweight Preload (Figure 5–12)

NOTE: Set shuttle and counterweight preload when improper shuttling action or excessive rattle is detected, or whenever shuttle drive components have been replaced.

1. Disconnect the AC power cord from the rear of the printer. Open the printer cover.
2. Remove the ribbon deck assembly. (See page 5–2.)
3. Loosen two captive screws (1) and remove the cam cover (2). (Figure 5–12, detail A.)
4. Remove six screws (3) and the cam front cover plate (4).
5. Remove the dust barrier (5).
6. Insert force gauge (6) in the hole in the counterweight (7). (Figure 5–12, detail B.)
7. Insert a 0.003 inch flat feeler gauge (8) between the cam (9) and the right cam follower (10).
8. Pull the force gauge horizontally to the right. Note the gauge indication when the feeler gauge comes loose.
    a. If the indication is between 12 and 17 pounds, go to Step 9.
    b. If the indication is less than 12 pounds, install a shuttle spring shim as described on page 5–32 and repeat Steps 6. through 8.
    c. If the indication is greater than 17 pounds, remove a counterweight spring shim and repeat Steps 6. through 8.
9. Insert a 0.003 inch flat feeler gauge (8) between the cam (9) and the left cam follower (11).
10. Press the rod end of the force gauge against the cam follower yoke (12), positioning the gauge as close to parallel with the shuttle shaft as possible. (Figure 5–12, detail C.)

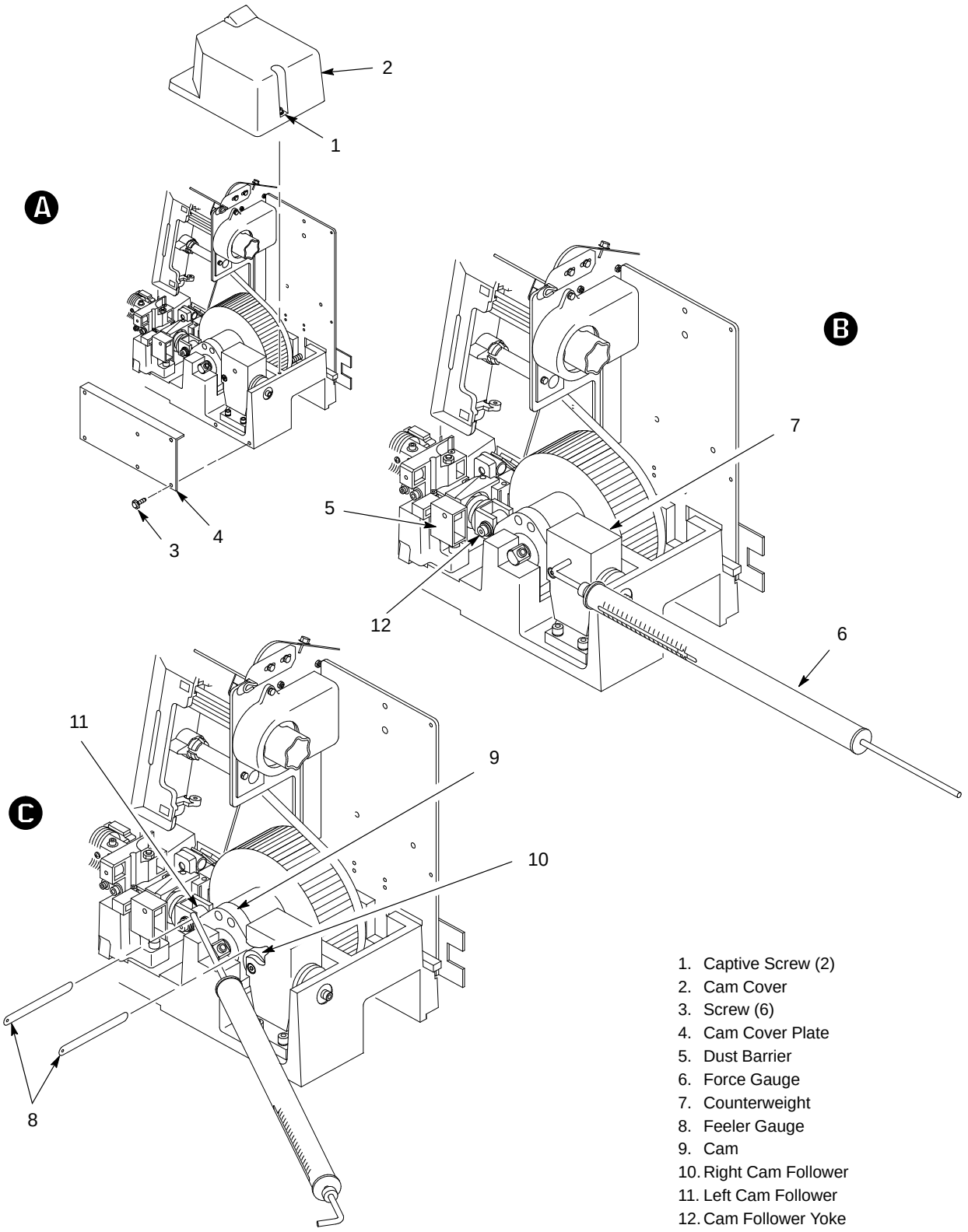


Figure 5–12. Setting Shuttle and Counterweight Preload

11. Push the force gauge horizontally to the left. Note the gauge indication when the feeler gauge comes loose.

NOTE: If springs have been replaced, set the preload at the high end of range, otherwise set it at the low end.

    a. If the indication is between 12 and 17 pounds, go to Step 12.

    b. If the indication is less than 12 pounds, install a shuttle spring shim as described on page 5–32 and repeat Steps 9. through 11.

    c. If the indication is greater than 17 pounds, remove a shuttle spring shim and repeat Steps 9. through 11.

12. Operate the printer.

    a. Run a shuttle/ribbon fast test for 10 minutes. Check for rattle and increase the preload if necessary.

    b. Run a shuttle/ribbon slow test. Check for stalls or no–start conditions and decrease the preload if necessary.

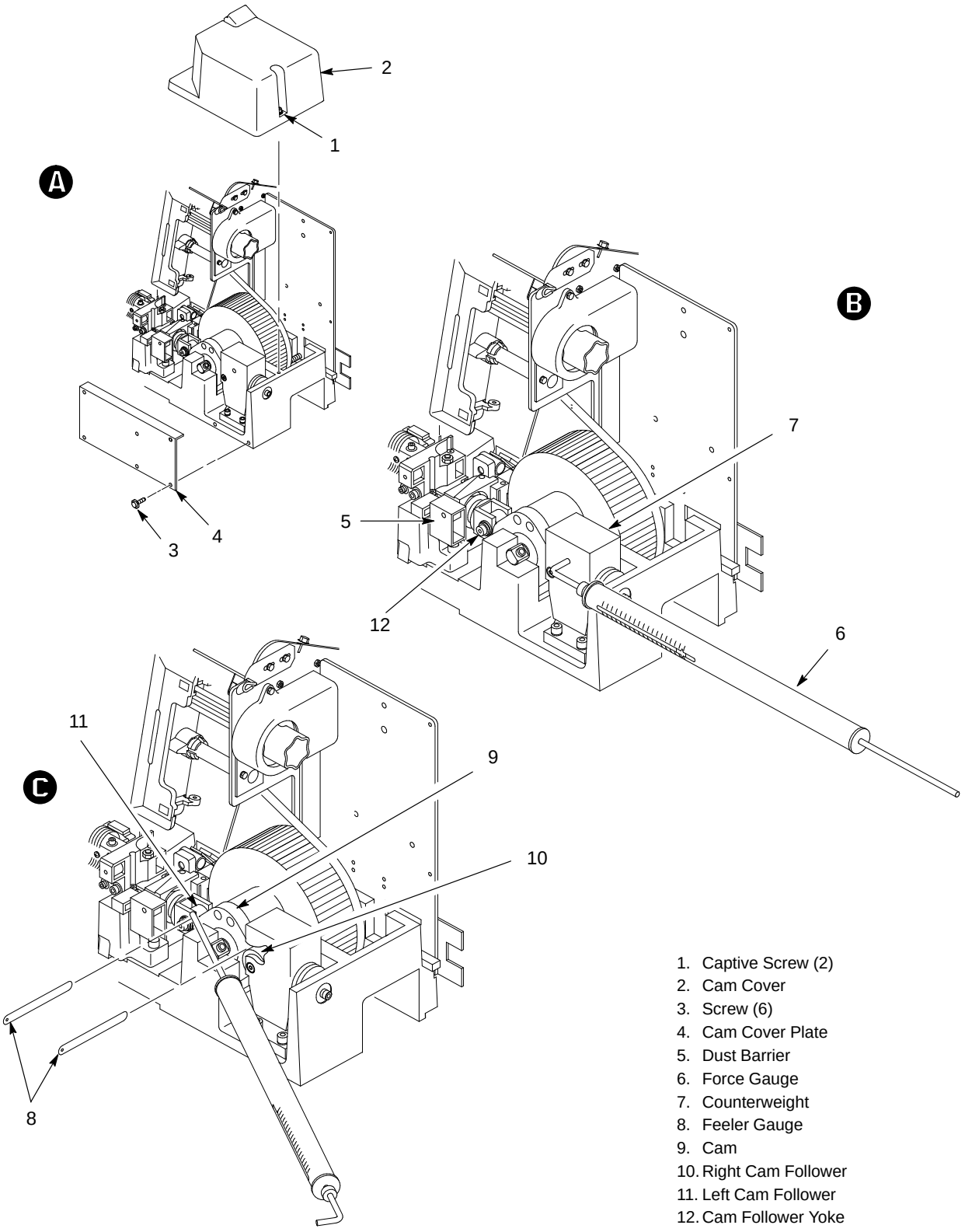
13. Install the dust barrier.

14. Install the gasket, cam front cover plate, and six screws.

15. Install the cam cover and tighten the two captive cover screws.

16. Install the ribbon deck assembly by reversing the steps on page 5–2.

17. Install paper and close the printer cover.



1. Captive Screw (2)
2. Cam Cover
3. Screw (6)
4. Cam Cover Plate
5. Dust Barrier
6. Force Gauge
7. Counterweight
8. Feeler Gauge
9. Cam
10. Right Cam Follower
11. Left Cam Follower
12. Cam Follower Yoke

Figure 5–12. Setting Shuttle and Counterweight Preload

Shuttle and Counterweight Spring Adjustment (Figure 5–13)

NOTE: You can make force adjustments with or without a force gauge. The procedure on page 5–28 describes the use of a force gauge and is the preferred method. Although the procedure below is *not* recommended, you can do it if excessive rattle is detected under the cam cover and you are unable to do the procedure on page 5–28. (Rattle under the cam cover indicates incorrect spring force, which can effect print quality.)

1. Open the printer cover.
2. Loosen two captive screws (1) and remove the cam cover (2).
3. Inspect the area around the shuttle spring (3) and the counterweight spring (4) for broken or loose shims. Replace loose shims per Steps 6 and 7.
4. Turn the printer on. Run the printer using a shuttle/ribbon test to keep the shuttle moving.
5. Loosen screw (8) about three turns. With the screwdriver, press in on the loosened screw to apply heavy pressure to the right side of the counterweight (5). Check for rattle.
    a. If the rattle does not change, go to Step 6.
    b. If the rattle decreases, go to Step 7.
6. Install a 0.01 inch shuttle spring shim as follows:

NOTE: More than one shim may be required to obtain the desired effect.

    a. Turn the printer off.
    b. Use a screwdriver to pry the spring away from the yoke (6).
    c. Insert a shim (7) and press down until it is flush with the yoke.

1. Captive Screw (2)
2. Cam Cover
3. Shuttle Spring
4. Counterweight Spring
5. Counterweight
6. Yoke
7. Shim, Shuttle Spring
8. Screw
9. Shim, Counterweight Spring
10. Base Support

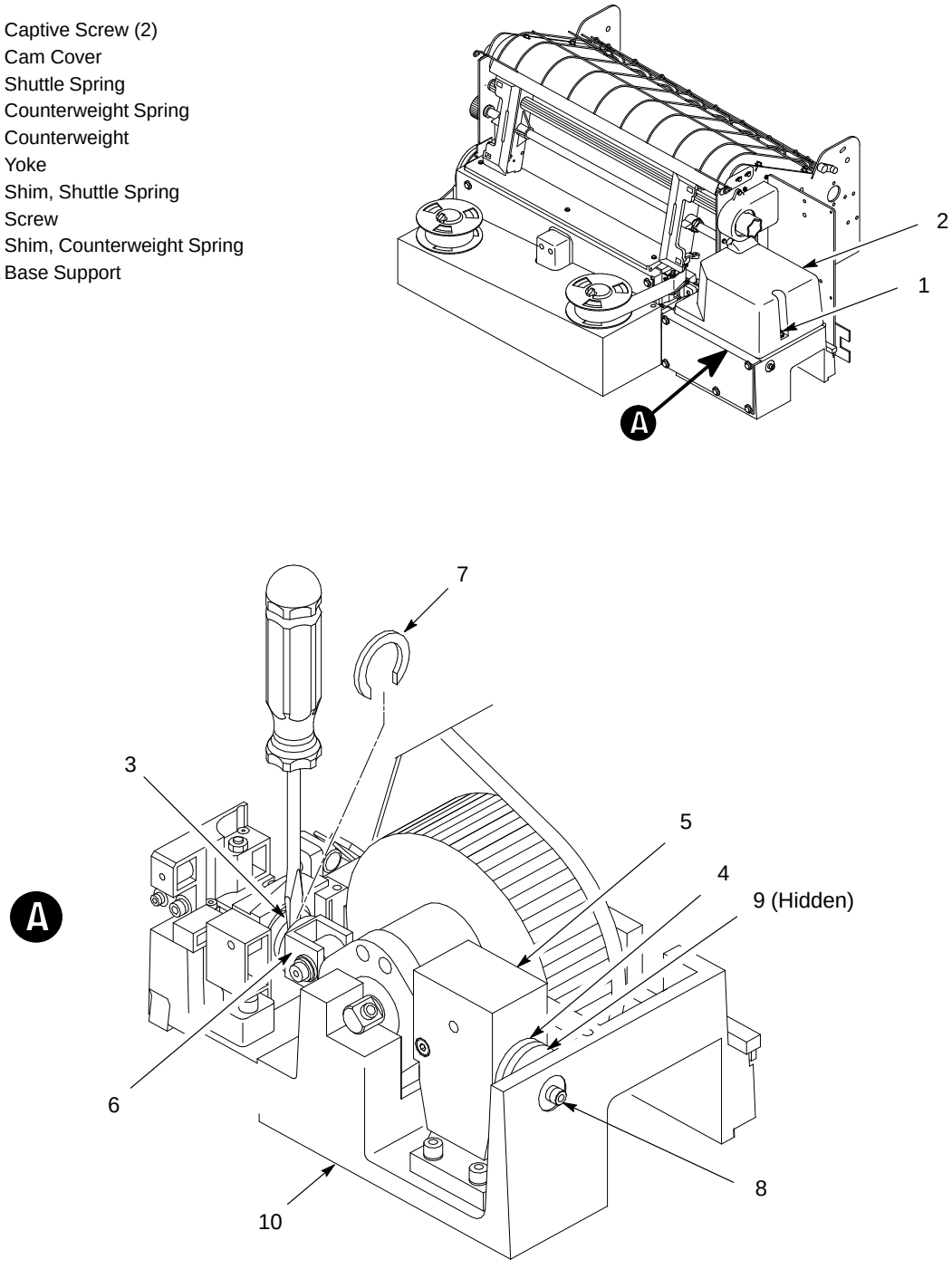


Figure 5–13. Shuttle Spring Force Adjustment

7. Install a counterweight spring shim as follows:

NOTE: More than one shim may be required to obtain the desired effect.

   a. Loosen screw (8) about three turns.

   b. With the screwdriver, press in on the loosened screw to create space for a shim (9).

   c. Install a shim between the spring spacer and the base support (10).

   d. Tighten the screw.

8. Operate the printer.

   a. Run a shuttle/ribbon fast test for 10 minutes. Check for rattle and increase the preload if necessary.

   b. Run a shuttle/ribbon slow test. Check for stalls or no–start conditions and decrease the preload if necessary.

9. Install the cam cover and attached gasket.

10. Tighten the two captive screws and close the printer cover.

1. Captive Screw (2)
2. Cam Cover
3. Shuttle Spring
4. Counterweight Spring
5. Counterweight
6. Yoke
7. Shim, Shuttle Spring
8. Screw
9. Shim, Counterweight Spring
10. Base Support

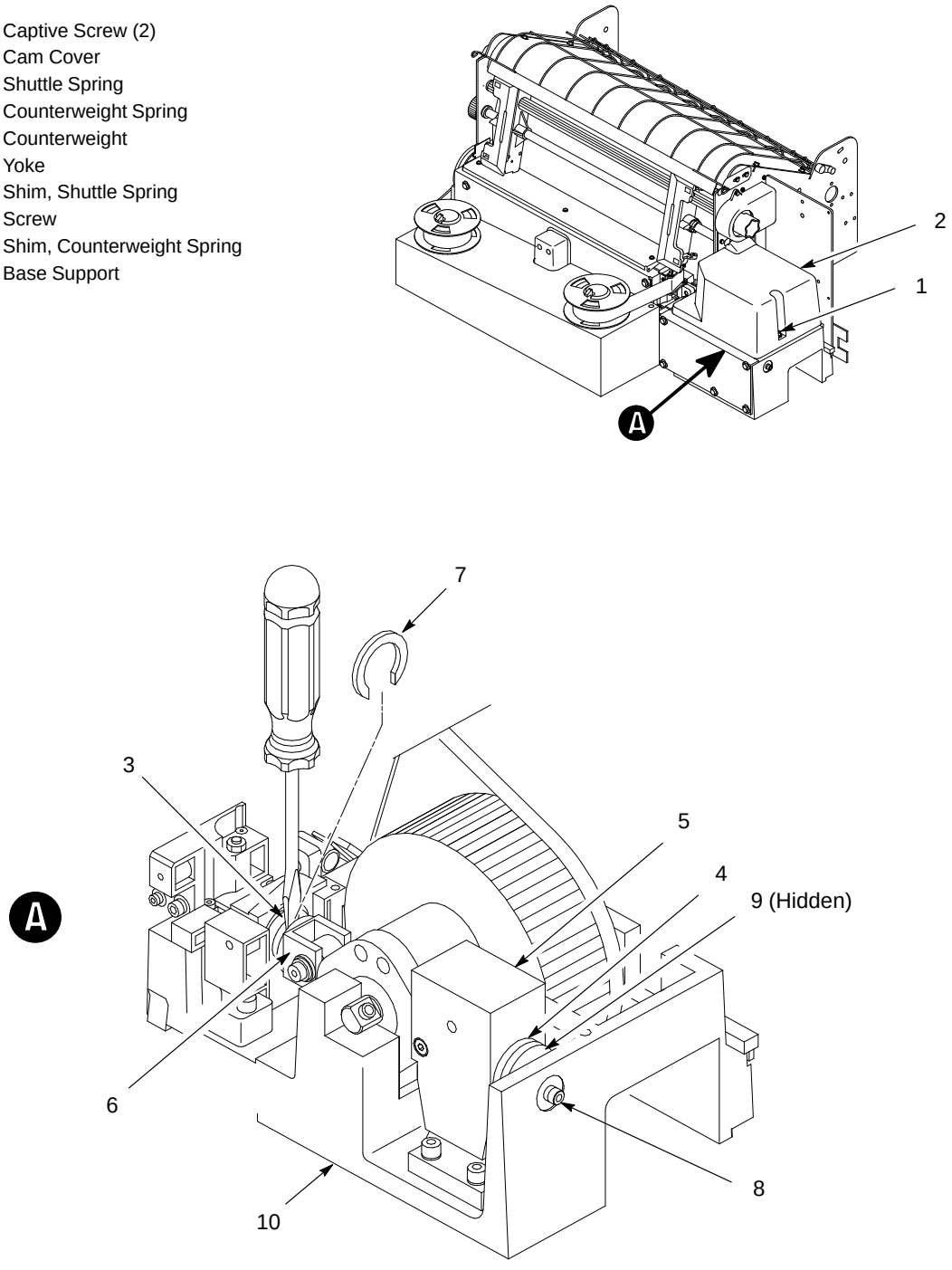


Figure 5–13. Shuttle Spring Force Adjustment

Shuttle Belt Tension (Figure 5–14)

Tension Check

1. Open the printer cover.
2. Loosen the two captive screws and remove the cam cover (1).
3. Press down with your finger in the middle of the shuttle belt (2) using about 2 ounces of force.
4. If the belt deflection is more or less than 0.21 inches (5.3 mm), do the adjustment procedure below.

Adjustment

1. Loosen the four motor mount nuts (3).
2. Position the motor (4) to obtain the proper belt tension. Do not allow the motor to tilt.
3. Torque the four motor mount nuts (3) to 105 in–lbs.
4. Return the printer to normal operation.

1. Cam Cover
2. Shuttle Belt
3. Nut (4)
4. Motor

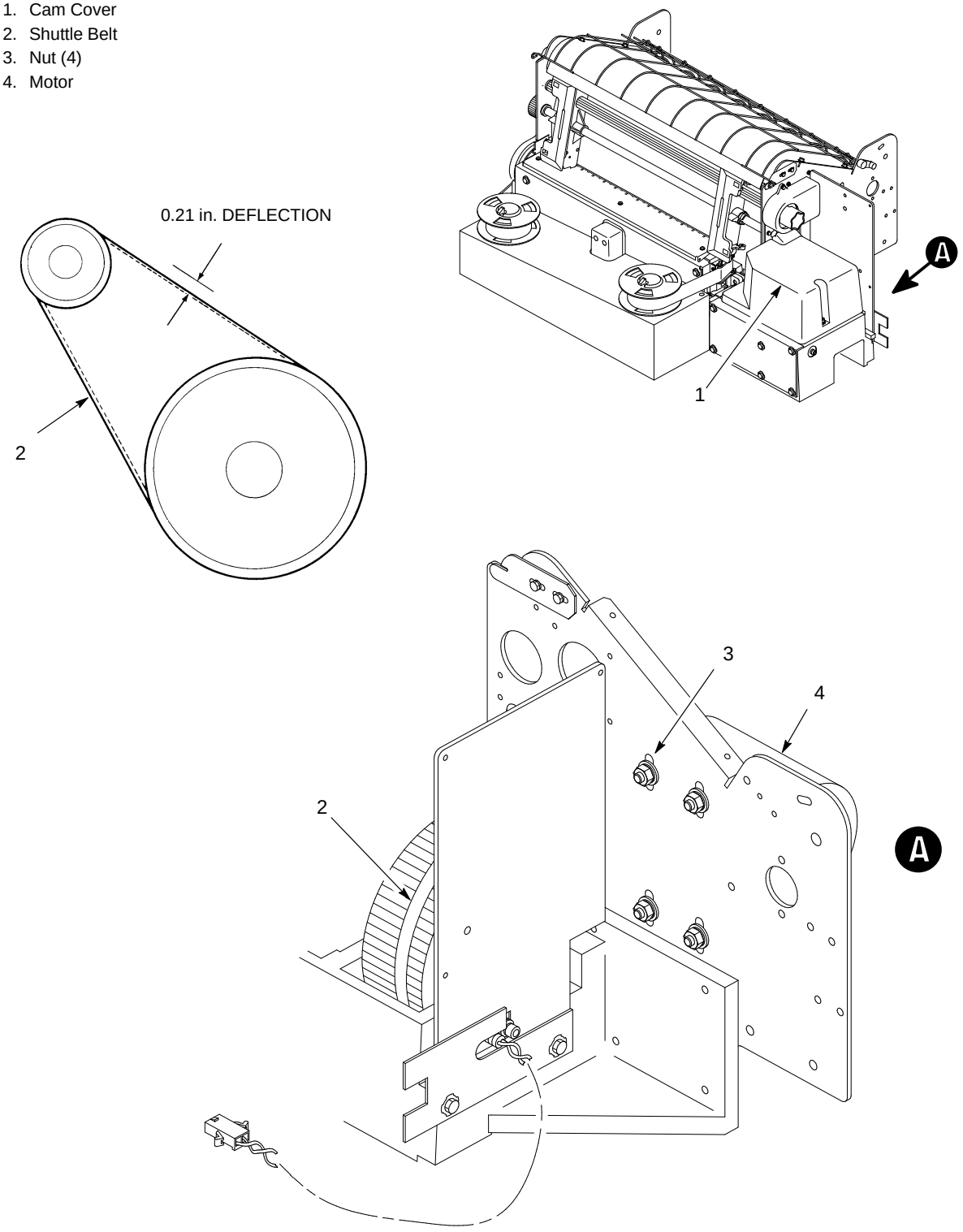


Figure 5–14. Shuttle Belt Tension Check and Adjustment

6 Replacement Procedures and Parts

Chapter Contents

Replacement Procedures

Illustrated Parts Lists

Blower Assembly (29–30891–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the paper supply from the print station and tractors. Remove the paper chains, paper tent, and wire paper guide.

3. As shown in Figure 6–17 (page 6–60, item #2), remove the inner access panel by removing seven (7) 5/16” screws.

4. Figure 6–17 shows the general position of the blower assembly, located in the right rear of the cabinet directly above the power supply.

5. Loosen the hose clamp (Figure 6–16, page 6–58, item #10) nearest the blower, slide it to the center of the blower hose, and remove the hose from the blower outlet.

6. Remove the blower power mate–n–lock connector J18.

7. From the top rear of the cabinet loosen the three (3) blower mounting screws; slide the blower forward and down for removal.

NOTE: It is necessary to remove the Cabinet Cooling Fan (29–29294–01), located in the right rear of the cabinet in order to loosen the third blower mounting screw. Review the procedure to remove this fan if instructions are needed. (See page 6–5.)

8. Once the blower is free from the cabinet, remove the braided ground strap from the cabinet end. (5/16” nut driver, or slotted screwdriver)

9. Reverse the removal steps to install the new blower motor.

NOTE: Use the mounting hardware and ground strap from the old blower when installing the new assembly.

Cabinet Cooling Fan (29–29294–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Open the printer cover to gain access to the upper cooling fan, located at the right rear of the printer. (See Figure 6–6, page 6–38).

3. Disconnect the power mate–n–lock connector from the fan., and remove the two (2) 1/4” retaining screws. (See Figure 6–16, page 6–58.)

NOTE: Two of the four screws are used to attach the grill to the fan, these must be removed and used with the new fan.

4. The fan will now be free of its housing. Reverse these steps for new fan replacement.

Card Cage Fan (29–29294–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the front panel (Figure 6–6, page 6–38, item #1), from the cabinet to gain access to the card cage and fan. This is accomplished by loosening the retaining screw located inside the top of the cabinet, directly below the control panel. Lift and pull the panel away from the printer to remove.

3. Remove the two (2) 1/4” retaining screws with the appropriate wrench. Two of the four screws are used to attach the grill to the fan, these must be removed and used with the new fan.

4. Remove the fan from the front of the cabinet, and disconnect the mate–n–lock power connector P1.

5. Reverse the removal steps to install the new fan.

NOTE: It may be necessary to remove the inner access panel to gain better access to the two screws which hold the fan in place. This can be accomplished by removing seven (7) 5/16” screws. (See Figure 6–17, page 6–60, item #2)

Control Panel (29–29286–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Using a 5/16” wrench or nut driver, loosen the 4 screws which hold the control panel in place. (See Figure 6–15, page 6–56.)

3. Remove the front panel (Figure 6–6, page 6–38), from the cabinet to gain access to the card cage. This is accomplished by loosening the retaining screw located inside the top of the cabinet, directly below the control panel. Lift and pull the panel away from the printer to remove.

4. Remove the card cage access panel by removing the five (5) screws which hold it in place. Follow the control panel ribbon cable to the berg connector on the front edge of the CCB PCBA.

5. Remove the connector from the module, and cut the necessary tie–wraps to free the cable. Remove the cable and control panel from the printer.

6. Reverse the removal steps to install the new control panel.

NOTE: Before tightening the screws that secure the control panel to its bracket, close the printer cover and center the control panel in the cutout.

Counterweight Assembly (29–30892–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap(29–26246–01) be worn, especially while servicing logic components.

2. Remove the cam cover (Figure 6–7, page 6–40, item #4), and the cam cover plate (item #12), to gain access to the counterweight assembly.

3. Remove the front two (2) allen screws (Figure 6–13, page 6–52, item #21), from the counterweight base plate, and just ”loosen” the rear screw.

4. Remove one (1) allen screw (Figure 6–13, page 6–52, item #3), from the counter–weight assembly. (Right side of printer deck)

5. To remove the counterweight, slide the assembly forward, toward the front of the printer. Exercise care while removing the counterweight assembly, so as not to lose the counterweight spring guide shims, and spring seat.

6. To install the new counterweight assembly first remove the rear base plate allen screw which was loosened during the removal procedure. Position this screw into the base plate rear slot, and with the allen wrench inserted into the screw, slide the counter weight assembly into place, starting the screw into the printer deck threads. Do not tighten this screw at this time.

7. Next replace the the counterweight allen screw which secures the right spring seat. (Right side of printer deck) Do not tighten this screw at this time.

8. To complete the installation, replace the two front base plate allen screws, and tighten all 4 screws. To insure proper shuttle performance, this procedure should be followed by the shuttle and and counterweight preload and spring adjustments found in chapter 5.

(Shuttle) Cam and Flywheel (FD–38890–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap(29–26246–01) be worn, especially while servicing logic components.

2. Remove the paper supply from the print station and tractors.

3. Remove the lower paper guide (Figure 6–7, page 6–40, item #16), four (4) 1/4” screws, this will allow access to the shuttle motor, when tightening of the shuttle belt becomes necessary during the re–assembly steps.

4. Loosen the four (4) shuttle motor mounting nuts, to aid in the removal of the flywheel assembly.

5. Remove the counterweight assembly:

    a. Remove the cam cover (Figure 6–7, page 6–40, item #4), and the cam cover plate (item #12), to gain access to the counterweight assembly.

    b. Remove the front two (2) allen screws (Figure 6–13, page 6–52,, item #21), from the counterweight base plate, and just loosen the rear screw.

    c. Remove one (1) allen screw (Figure 6–13, page 6–52, item #3), from the counter–weight assembly. (Right side of printer deck)

    d. To remove the counterweight, slide the assembly forward, toward the front of the printer. Exercise care while removing the counterweight assembly, so as not to lose the counterweight spring guide shims.

6. Remove the two (2) allen screws (Figure 6–14, page 6–54, item #11), which secure the flywheel assembly to the printer deck. The flywheel can now be lifted up and away from the deck casting.

7. When re–installing the flywheel, the shuttle motor belt should first be fed onto the shuttle motor sprocket, then onto the flywheel. Exercise care when handling the flywheel, so as not to damage the MPU (magnetic pickup unit). Replace the two (2) allen screws, which hold the flywheel in place, and tighten to the recommended torque specifications. (Appendix D)

8. Re–install the counterweight assembly:

    e. To install the counterweight assembly first remove the rear base plate allen screw which was loosened during the removal procedure. Position this screw into the base plate rear slot, and with the allen wrench inserted into the screw, slide the counter weight assembly into place, starting the screw into the printer deck threads. Do not tighten this screw at this time.

    f. Next replace the the counterweight allen screw which secures the right spring seat. (Right side of printer deck) Do not tighten this screw at this time.

    g. To complete the installation, replace the final front base plate allen screws, and then tightened all 4 screws.

9. Insure that the shuttle belt tension adjustment is completed as described in Chapter 5., and then replace the lower paper guide.

10. To insure proper shuttle performance, the shuttle and counterweight preload and spring adjustments, and the MPU gap and phase adjustments found in chapter 5. should be performed.

Gas Shock (107961–005)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the paper supply from the print station and tractors. Remove the paper chains, paper tent, and wire paper guide.

3. As shown in Figure 6–17 (page 6–60, item #2), remove the inner access panel by removing seven (7) 5/16” screws.

WARNING

The printer cover is very heavy and personal injury, or equipment damage can result if care is not exercised while replacing the gas shock.

4. Raise the cover to its full height, if the cover will not easily remain in this position, another person should be asked to assist.

5. With the cover in this position extract the locking clip located on the top swivel socket of the gas shock. Once this clip is extracted, the socket can be pulled from the ball. The top cover can now be rotated backward. The cover hinges will support its weight, but it is recommended that another means of support is used.

6. From inside the bottom cabinet immediately above the power supply, extract the locking clip located on the bottom swivel socket of the gas shock. The gas shock can now be removed from the printer.

7. Reverse the removal steps to replace the new gas shock.

Hammer Bank

Removal

1. Turn the printer off and unplug the ac power cord.
2. Remove the ribbon and unload paper.
3. Disconnect the two ribbon motor cables (1) on each side of the ribbon deck. (See Figure 6–1.)
4. Remove the ribbon deck assembly (2) by removing one screw on the right side of the ribbon deck, and two screws on the left side.
5. Remove the cam cover (3).
6. Remove the cam cover plate (4).
7. Remove the dust barrier block (5).
8. Disconnect the six hammer bank cables (6).
9. Remove the two velcro covers (7).
10. Remove the two screws (8) that attach the shuttle shroud to the bearing caps.
11. Remove the two anti–rotation block screws (9) using an allen wrench. Remove the anti–rotation shims (10). Do not discard the shims; you will use them later.
12. Loosen the jam nut (11) in the center of each bearing cap. Loosen the bearing set screw (12) in the center of each bearing cap. Loosen and remove the bearing cap screws (13 and 14), and remove the right and left bearing caps (15 and 16).

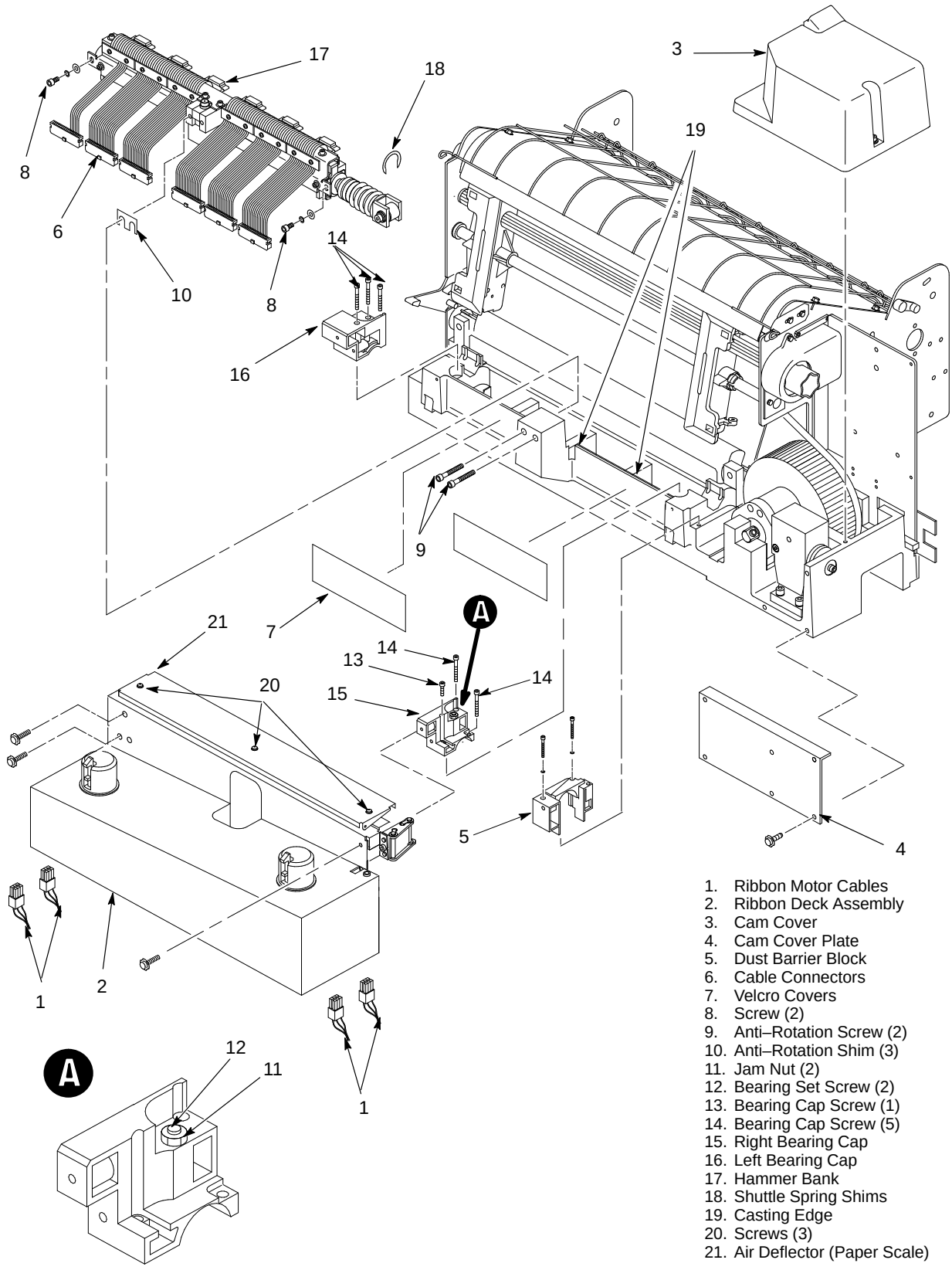


Figure 6–1. Hammer Bank Removal/Installation

13. Remove the hammer bank (17): (See Figure 6–2.)

    a. Note the U–shaped shims (18) installed at the end of the shuttle spring (22). Do not lose these shims while removing the hammer bank.

    b. Firmly gripping the right and left shuttle shroud screws (24) with your right and left thumbs, slowly lift the hammer bank while keeping the shuttle shroud, hammer bank cables, and antirotation pad in place.

    c. Be careful that the left linear bearing sleeve (23) does not slip off the shaft or that the hammer bank cables catch on any exposed edges of the printer.

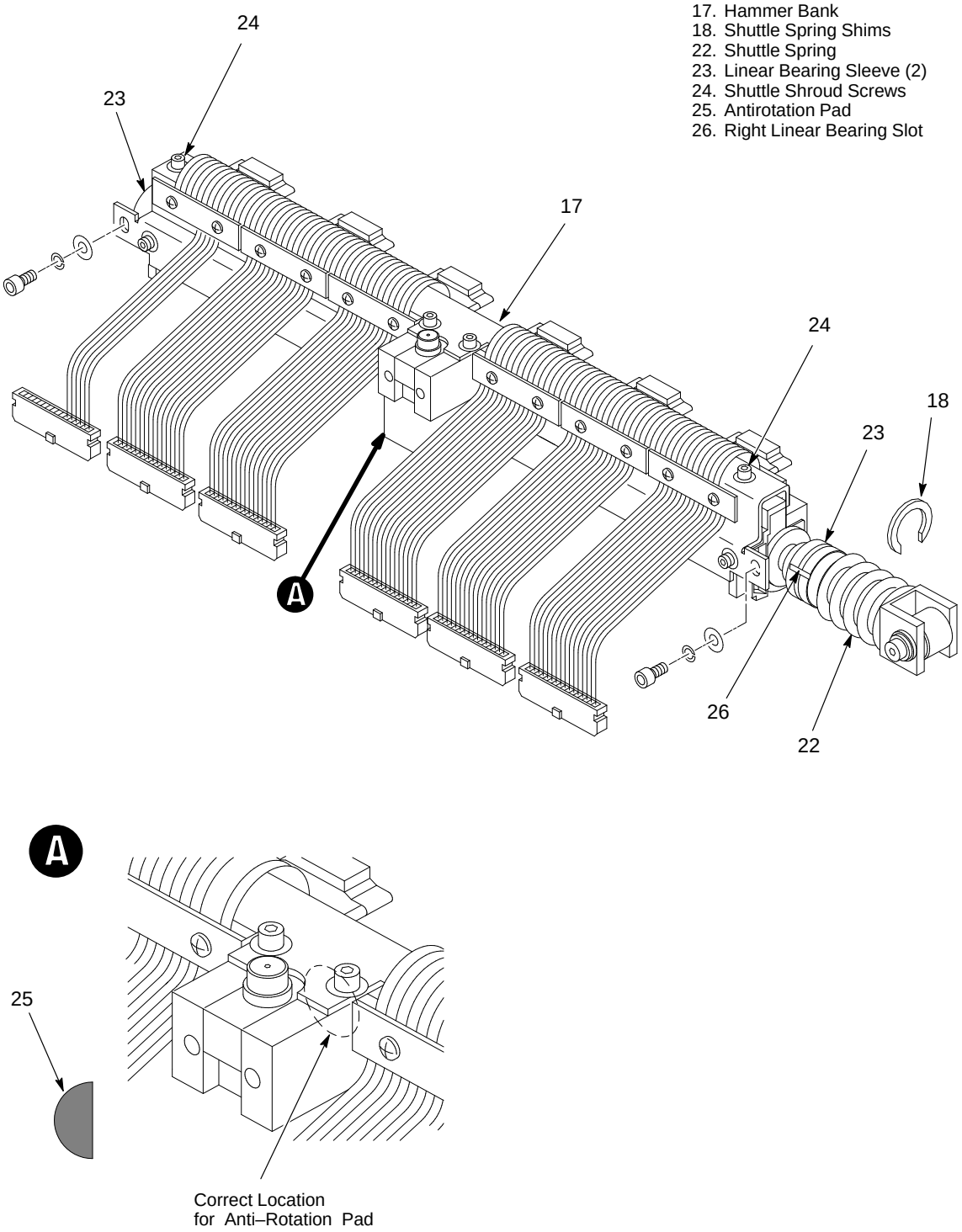


Figure 6–2. Hammer Bank Removal

Installation

CAUTION

To prevent excessive noise, bearing failure, and poor print quality, carefully perform every step in this procedure. Do not skip or omit any steps.

1. Clean oil, dirt, and paper dust from the base casting in the hammer bank area, the bearing seats, and the anti–rotation block.

IMPORTANT

The antirotation pad (Figure 6–3, item 25) must be kept in place inside the shuttle shroud (Figure 6–3A) to ensure good print quality. Hold the hammer bank unit carefully to avoid dislodging the antirotation pad, as follows:

2. Remove the replacement hammer bank unit (17) from its box: (See Figure 6–3.)

    a. When picking up the hammer bank unit, keep the shuttle shroud, hammer bank cables, and antirotation pad (25) in place by firmly gripping the right and left shuttle shroud screws (24) with your thumbs. Do not let the hammer bank cables catch on any exposed edges of the printer.

    b. Note the U–shaped shims (18) installed at the end of the shuttle spring (22). These were installed at the factory to set the correct spring pre–load. Make sure that these shims stay in place while transferring the hammer bank into the casting.

    c. Be careful not to let the left linear bearing (23) slip off the shaft.

3. Gripping the shuttle shroud screws (24) with your thumbs, install the hammer bank in the base casting with the shuttle spring shoulder washer against the machined surface of the casting, the linear bearing sleeves near the center of their mounting blocks (Figure 6–4A and B), and the cam follower bearing in contact with the cam (Figure 6–4C).

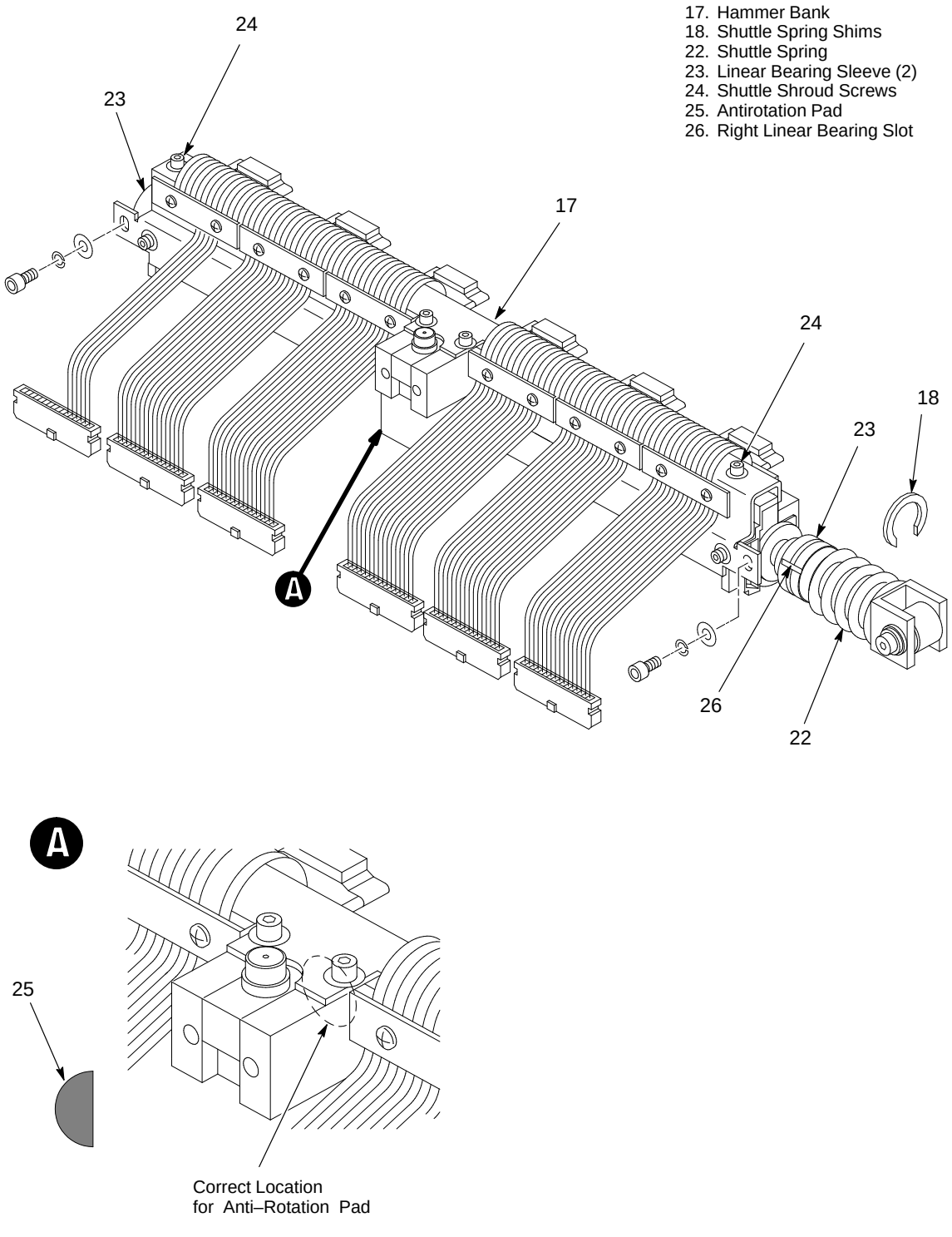


Figure 6–3. Replacement Hammer Bank

4. Rotate the bearing sleeves (23) so that the slots (Figure 6–3, item 26) are facing the front of the printer. Make sure that the front edge of the shuttle shroud (Figure 6–4, item 26) fits behind the machined edge of the casting, and that the foam air seal (27) makes a tight seal against the casting.

5. Line up the left edge of the *right* bearing sleeve (Figure 6–4A) so that it is directly adjacent to the recessed bearing cap screw hole and base casting indent, with the bearing sleeve slot facing forward (Figure 6–3, item 24). Verify that the slot faces forward by placing a 1/16–inch allen wrench (28) into the hole in the right bearing mounting block, pushing the allen wrench in so that the end fits into the bearing sleeve slot, and attempting to rotate the bearing sleeve by hand.

6. Install the *right* bearing cap (15) by tightening the short mounting screw (13) and two longer mounting screws (14) finger tight. Then tighten them snugly using an allen wrench, in the following order: first 13; second 14(2); third 14(3).

7. Line up the right edge of the *left* bearing sleeve (Figure 6–4B) so that is directly adjacent to the recessed bearing cap screw hole, with the bearing sleeve slot facing forward (Figure 6–3, item 24). Verify that the slot faces forward by placing a 1/16–inch allen wrench (28) into the right hole in the left bearing mounting block, pushing the allen wrench in so that the end fits into the bearing sleeve slot, and attempting to rotate the bearing sleeve by hand.

8. Install the *left* bearing cap (16) and tighten the three mounting screws (14) finger tight. Then tighten them snugly using an allen wrench, in the following order: first 14(1); second 14(2); third 14(3).

9. Install the two screws (8) that attach the shuttle shroud to the bearing caps.

10. Install the anti–rotation shims (10) that were removed with the old hammer bank (Removal, Step 11.). Install the anti–rotation block screws (9) using an allen wrench.

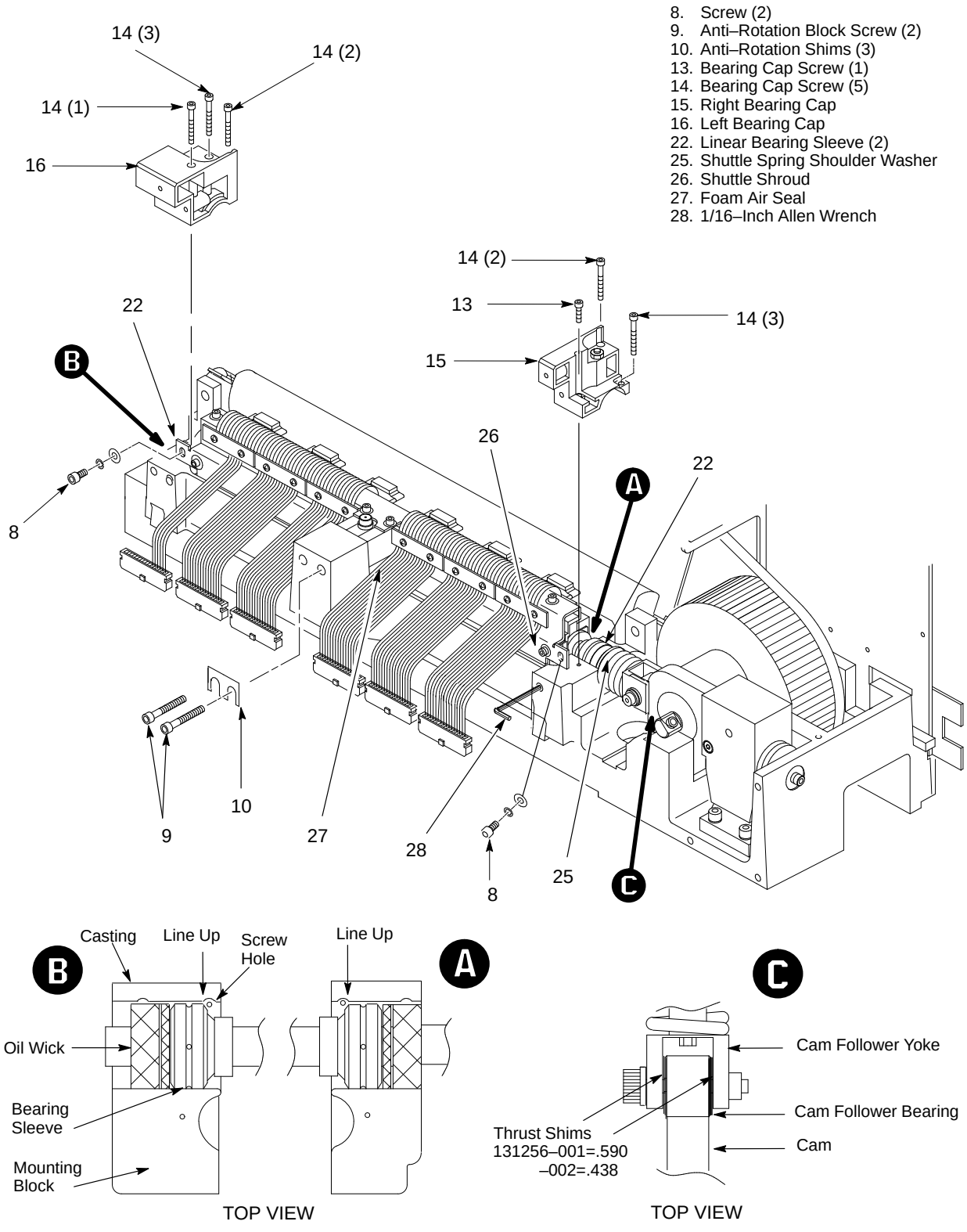


Figure 6–4. Installing Hammer Bank

11. Torque the right and left bearing set screws (Figure 6–5A, item 12) to 10 in–lb.
12. Wedge the shank of a large screwdriver between the yoke and the flywheel shank (29) such that the cam follower bearing and cam are not in contact. Remove the cam follower bearing screw (Figure 6–5B, item 30), holding a finger under the bearing to keep it in place. Remove the two washers from the screw. Reinstall the screw with the antirotation tool (Figure 6–5B, item 32). Do not use a wrench to tighten the screw; hand tighten only. The bracket is intended to be at an angle, as shown in Figure 6–5B.
13. Try to fit a .004–inch feeler gauge (Figure 6–5C, item 33) between the side of the cam and the alignment tool at the top and bottom of the tool. If the gauge fits in the top space (Figure 6–5C, left), add anti–rotation block shims (Figure 6–4, item 10). If there is clearance at the bottom (Figure 6–5C, right), remove shims. (Adding or removing one .005–inch shim will normally correct the alignment.)
14. Remove the antirotation tool, install the cam follower bearing screw with the original washers, and torque it to 20 in–lb. Remove the screwdriver from between the yoke and fly wheel shank.
15. Connect the six hammer bank cables and install the velcro covers. Install the dust barrier block (Figure 6–1, item 5). Install the ribbon deck (Figure 6–1, item 2). Remove the three screws (Figure 6–1, item 20) that secure the air deflector, then remove the deflector (Figure 6–1, item 21).
16. Connect the ribbon motor cables (Figure 6–1, item 1).
17. Install a standard (60 yard) ribbon. (This procedure is not possible with 100–yard ribbons.)
18. Load paper in the printer, then turn the printer on.

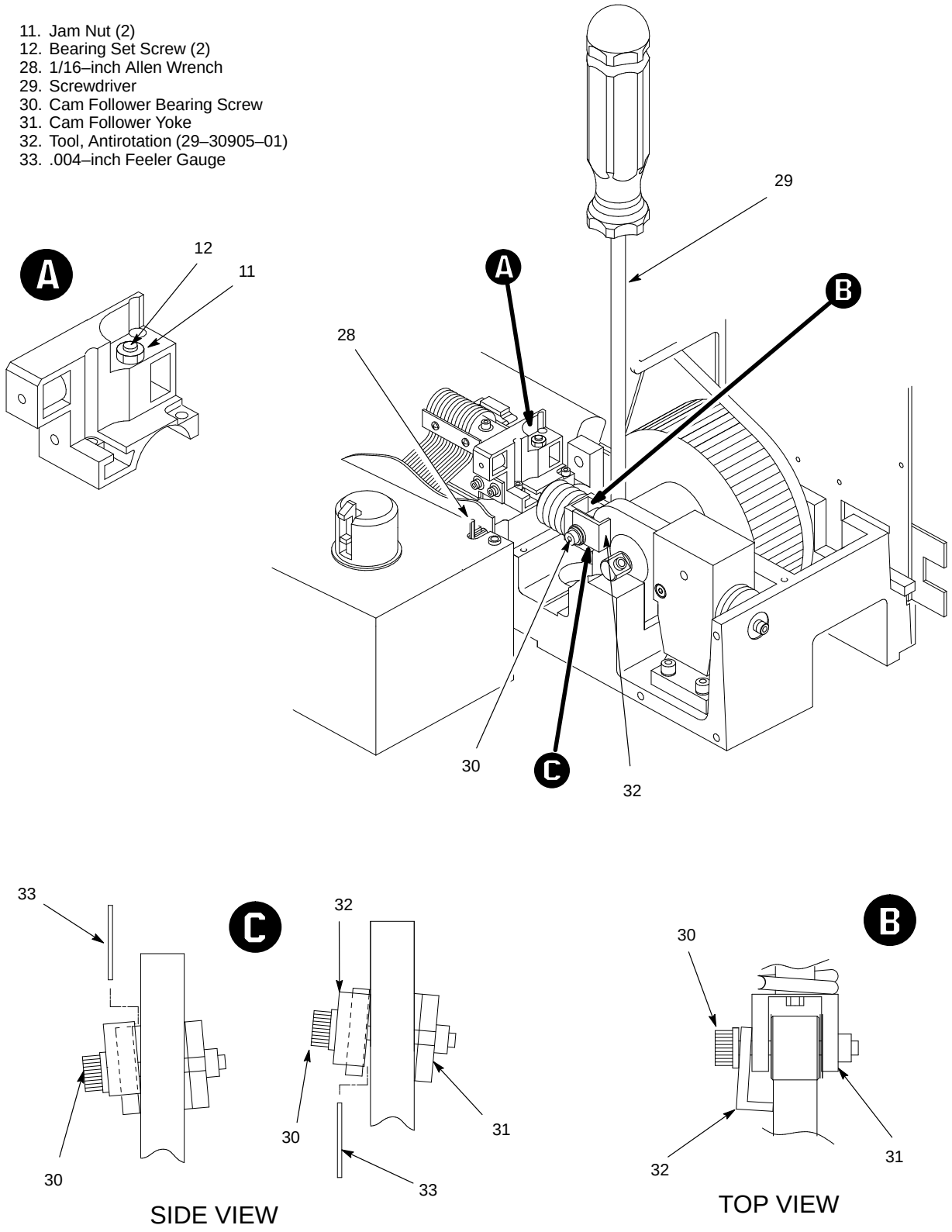


Figure 6–5. Yoke and Antirotation Shim Adjustment

19. Adjust the *right* bearing set screw using the shuttle/ribbon fast diagnostic test. Place a 1/16–inch allen wrench through the cutout in the ribbon deck and into the slot of the right bearing sleeve to keep the slot forward, then run the shuttle/ribbon fast diagnostic test. As the printer is shuttling, loosen the right bearing set screw two turns and retighten it with a torque driver, torquing it to 10 in–lb. If a binding noise comes from the bearing, repeat this process, loosening and tightening the right bearing set screw while holding the allen wrench in the slot in the bearing sleeve.

20. Tighten the *right* jam nut to hold the right bearing set screw in place, and remove the allen wrench from the right mounting block hole.

21. Adjust the *left* bearing set screw using the shuttle/ribbon fast diagnostic test. Place a 1/16–inch allen wrench through the cutout in the ribbon deck and into the slot of the right bearing sleeve to keep the slot forward, then run the shuttle/ribbon fast diagnostic test. As the printer is shuttling, loosen the left bearing set screw two turns and retighten it with a torque driver, torquing it to 10 in–lb. If a binding noise comes from the bearing, repeat this process, loosening and tightening the left bearing set screw while holding the allen wrench in the slot in the bearing sleeve.

22. Tighten the *left* jam nut to hold the left bearing set screw in place, and remove the allen wrench from the left mounting block hole.

23. Check the shuttle and counterweight preload. (See page 5–28.)

24. Check and adjust the platen gap. (See page 5–22.)

25. Install the air deflector (Figure 6–1, item 22), dust barrier block (Figure 6–1, item 5), cam cover plate (Figure 6–1, item 4), and cam cover (Figure 6–1, item 3).

26. Install the ribbon and load 132–column paper.

27. Check and adjust the magnetic pickup phasing. (See page 5–14.)

28. Run a diagnostic self test to print some 132–column lines.

29. Check alignment of the scale to the print at column positions 1 and 132.

30. If adjustment is necessary, loosen the three screws (Figure 6–1, item 20), position the air deflector so that column positions 1 and 132 line up with the first and last characters on the 132 character printout, and tighten the screws.

31. Close the printer cover and return the printer to normal operation.

Hammer Cover Assembly (FD–38422–01)

1. Put the hammer bank in the service position (page 5–2). From the service position, the hammer cover, which is magnetic, can be lifted clear of the hammer bank face and the two lower tabs which hold it in place.

2. Install the new hammer cover assembly by reversing the removal procedure. Return the hammer bank to the operating position (page 5–6).

Hammer Spring (FD–15794–01) and Hammer Coil (FD–15793–01)

Spring Removal:

1. Put the hammer bank in the service position (page 5–2).
2. To remove a defective hammer spring, remove the two (2) allen screws which secure the hammer retaining clamp. Each clamp supports 2 hammer springs. (See Figure 6–12, page 6–50.)
3. After reassembling the hammer bank, adjust the hammer tips (page 5–10).

Coil Removal:

1. Remove the corresponding hammer spring to expose the defective coil. (See Figure 6–12, page 6–50, item #6.)
2. Remove the two (2) allen screws which secure the coil clamp (Figure 5–2, page 5–5, items #26 and #27), and the two (2) phillips screws which secure the coil lead bracket(s) of the coil being replaced.
3. Carefully remove the hammer coil by prying upward with a plastic tool.
4. At the berg header of the defective hammer coil, using a sharp pointed tool, release the red and white wires/leads by depressing inward on the silver locking tab of the female contact.
5. After reassembling the hammer bank, adjust the hammer tips (page 5–10).

I/O Panel and Cable Assembly (29–30893–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the paper supply from the print station and tractors. Remove the paper chains, paper tent, and wire paper guide.

3. As shown in Figure 6–17 (page 6–60, item #2), remove the inner access panel by removing seven (7) 5/16” screws.

4. Remove the four (4) 5/16” retaining screws from the I/O panel assembly, and rest the panel on the inside of the cabinet floor.

5. Remove the front panel (Figure 6–6, page 6–38) from the cabinet to gain access to the card cage. This is accomplished by loosening the retaining screw located inside the top of the cabinet, directly below the control panel. Lift and pull the panel away from the printer to remove.

6. Remove the card cage access panel by removing the five (5) screws which hold it in place.

7. Follow I/O panel ribbon cable to the berg connector on the front edge of the CCB PCBA module, and remove. Pull this end of the cable through the side of the card cage to free the I/O panel assembly from the printer.

8. Reverse the removal steps to install the new I/O panel.

Magnetic Pickup Assembly (MPU) (FD–15800–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap(29–26246–01) be worn, especially while servicing logic components.
2. Loosen the MPU locking screw (Figure 5–5, page 5–13, item #2).
3. Remove the MPU guide bracket (Figure 6–14, page 6–54, item #3).
4. Disconnect the MPU cable connector P35.
5. Using your fingers, unscrew the MPU completely until it is removed from the pickup arm.
6. Reverse the removal steps to install a new MPU. Then perform the MPU gap adjustment (page 5–12). It is also recommended that the MPU phasing adjustment be performed as a final step (page 5–14).

Oil Wick (29–30900–01)

1. Perform the flywheel assembly removal procedure (page 6–9).
2. Once the flywheel has been separated from the printer, remove the two (2) 5/16” screws which secure the oil wick (Figure 6–14, page 6–54, item #7).
3. Re–install the new oil wick, and then reverse the flywheel removal steps as outlined. Complete this procedure by performing the shuttle and and counterweight preload and spring adjustments, and the MPU gap and phase adjustments found in chapter 5.

Paper Feed Motor and Belt (FD–30894–01) (FD–13861–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the paper supply from the print station and tractors.

3. Remove the lower paper guide (Figure 6–7, page 6–40, item #16), four (4) 1/4” screws. This will allow access to the paper motor when tightening the belt.

4. Remove the Paper Feed Belt Cover.

5. Loosen the four (4) 5/16” nuts which secure the paper feed motor. (See Figure 6–10, page 6–46.)

6. Slide the new belt onto the paper tractor shaft sprocket, and the paper feed motor sprocket, and adjust the belt tension (page 5–16).

7. If the paper feed motor is to be replaced, remove the four (4) 5/16” nuts which secure the paper feed motor, disconnect the power and signal cable connector, and remove the motor.

8. Install a new paper feed motor using the 5/16” hardware, and adjust the belt tension (page 5–16).

9. Reverse the removal steps to replace the paper feed belt cover and lower paper guide.

Paper Motion/Out Detector (29–30805–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the paper supply from the print station and tractors. Remove the paper chains, paper tent, and wire paper guide.

3. Working from the rear of the paper cabinet, remove the three (3) 5/16” screws that hold the machined and front paper guide assembly in place. (See Figure 6–10, page 6–46, items #1 and #2.)

4. Disconnect the mate–n–lock connectors, and cut the necessary tie–wraps to allow the removal of the entire assembly.

5. To remove the paper motion/out switch assembly, remove the two (2)1/4” screws securing it to the machined and front paper guide assembly.

6. Reverse the removal procedure to re–install the paper motion/out switch assembly. When assembly is complete, adjust the Paper Out Switch (page 5–18).

Platen Open Motor and Belt (29–29282–01) (29–30899–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the platen belt cover by depressing down to release the top tab, then tip the cover out while pulling upward.

3. Remove the lower paper guide (Figure 6–7, page 6–40, item #16), four (4) 1/4” screws. This will allow access to the platen open motor.

4. If replacing the platen belt, adjust the Platen Open Belt (page 5–24), and return the printer to an operational state.

5. If replacing the platen open motor, remove both the top and bottom mounting screws, and the power connector (PLM). Replace the motor, adjust the Platen Open Belt (page 5–24), and return the printer to an operational state.

Platen Open Switch (FD–15791–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the platen belt cover by depressing down to release the top tab, then tip the cover out while pulling upward.

3. Remove the lower paper guide (Figure 6–7, page 6–40, item #16), four (4) 1/4” screws. This will allow access to the platen open switch nutplate.

4. Remove the two connectors from the switch, noting their position for correct re–installation.

5. Remove the two (2) allen screws while holding the mating nutplate. Take care so as not to drop the two spacers behind the switch.

6. For re–installation of the new platen open switch, reverse the removal steps.

Power Supply (29–30895–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the paper supply from the print station and tractors. Remove the paper chains, paper tent, and wire paper guide.

3. As shown in Figure 6–17 (page 6–60, item #2), remove the inner access panel by removing seven (7) 5/16” screws.

4. Remove the six (6) 5/16” screws which secure the power supply, from the rear of the cabinet.

5. From inside the printer remove the two (2) 5/16” screws which secure the power supply to the floor of the cabinet.

6. Remove the 5/16” nut from the power supply ground strap stud, and remove the strap.

7. Release the two cables from the rear of the power supply, and from the back of the printer

8. Pull the assembly out of the cabinet.

9. Reverse the removal steps to install the new power supply.

Printed Circuit Board Assemblies (PCBAs):
(CCB DX 29–30901–01)
(Mech Driver 29–30903–01)
(Hammer Driver 29–30902–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the front panel (Figure 6–6, page 6–38), from the cabinet to gain access to the card cage. This is accomplished by loosening the retaining screw located inside the top of the cabinet, directly below the control panel. Lift and pull the panel away from the printer to remove.

3. Remove the card cage access panel by removing the five (5) screws which hold it in place.

4. Identify the correct PCBA to be replaced, and, with your wrist strap in place, remove and replace the defective PCBA.

NOTE: The Mech Driver PCBA (center module) seats very firmly into the upper and lower card guides. It may be necessary to gently lift up on the card cage directly above the upper card guide in order to slide the Mech Driver board into the card cage.

5. Before re–installing the front covers, apply power to the printer and insure that the problem has been corrected.

6. Re–install the front covers, and return the printer to the on–line state.

Ribbon Hub (29–29296–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Squeeze the lock tabs and remove the ribbon spools from the ribbon hubs. (See Figure 5–1, page 5–3.)

3. As shown in Figure 6–8 (page 6–42, item #2), loosen the ribbon hub set screw and remove the hub.

4. Reverse the removal steps to install the new ribbon hub.

Ribbon Motor (29–30897–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Squeeze the lock tabs and remove the ribbon spools from the ribbon hubs. (See Figure 5–1, page 5–3.)

3. Disconnect four connectors from the bottom of the ribbon deck assembly.

4. Remove three (3) hex head screws from the ribbon deck.

5. Raise the ribbon deck assembly slightly and lift it off the retaining clips. Set the ribbon on a flat working surface.

6. On the ribbon motor to be replaced, loosen the ribbon hub set screw (Figure 6–8 (page 6–42, item #2), and remove the hub from the motor shaft.

7. To remove the ribbon motor, remove the four (4) screw and nut pairs which secure the ribbon motor to the ribbon deck.

8. Reverse the removal steps to install the new ribbon motor and return the printer to an operational state. Complete this procedure by performing the ribbon tracking check and adjustment (page 5–26).

Shuttle Motor (FD–32538–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.

2. Remove the paper supply from the print station and tractors.

3. Remove the lower paper guide (Figure 6–7, page 6–40, item #16), this will allow access to the shuttle motor.

4. Remove the cam cover (Figure 6–7, page 6–40, item #4), and the paper feed belt guard (Figure 6–9, page 6–44, item #4).

5. Remove the shuttle motor belt guard by removing one (1) bottom 5/16” screw, and one (1) 5/16” nut/bolt pair from the top, being careful not to drop the nut into the printer. This cover fits tightly, and will need to be flexed for removal.

6. Remove the shuttle motor power and signal cables from their mate–n–lock connectors, and the four (4) shuttle motor mounting nuts, (7/16) to free the motor from its mounting plate.

7. Install the new shuttle motor, while looping the belt around the shuttle motor sprocket prior to installing the four shuttle motor mounting bolts. Reconnect the power and signal cables, and adjust the shuttle belt tension (page 5–36).

8. Reverse the remaining removal steps to complete the shuttle motor replacement.

Shuttle Motor Belt (FD–34554–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.
2. Remove the paper supply from the print station and tractors.
3. Remove the lower paper guide (Figure 6–7, page 6–40, item #16), this will allow access to the shuttle motor.
4. Remove the flywheel assembly (page 6–9).
5. Discard the old belt and loop the new belt around the flywheel, and re–install.
6. Loop the free end of the belt around the shuttle motor sprocket, and adjust the belt tension (page 5–36).
7. Complete this procedure by replacing the counterweight assembly, and performing the shuttle and and counterweight preload and spring adjustments, and the MPU gap and phase adjustments found in chapter 5.
8. Replace all remaining belt guards and covers, and invoke the necessary self–test routines to insure the printer performs as expected.

Tractor Assemblies (Left – 29–30906–01) (Right – 29–30907–01)

1. Unplug the printer power cord from the AC receptacle to insure that there are no hazardous voltages present while servicing this equipment. It is also recommended that an anti–static wrist strap (29–26246–01) be worn, especially while servicing logic components.
2. Remove the paper supply from the print station and tractors.
3. Loosen the 3/32nd set screw in the left bushing (Figure 6–9, page 6–44, item #19), and remove the bushing from the splined shaft.
4. Loosen the two (2) 5/64th set screws in the adjustment knob (Figure 6–9, page 6–44, item #17), and remove the knob from the tractor support shaft.
5. While holding the tractor support shaft from turning, remove the 5/16" screw from the left end of the shaft.
6. Remove the paper feed belt cover and belt, as described in the paper feed belt replacement procedure.
7. Slide both the splined shaft and the tractor support shaft to the right, and remove the paper adjustment bushing and washer (Figure 6–9, page 6–44, items #20 and #21) from the tractor support shaft.
8. Unlock the left tractor lock, and remove the tractor assembly from the two shafts.
9. To remove the right tractor assembly, first remove the snap ring from the tractor support shaft. Then with the left tractor lock released, remove the assembly from the two shafts.
10. Reverse the removal steps to install the new tractor assemblies.

NOTE: Insure that the paper pins on both the right and left tractors are aligned vertically when installing tractors.

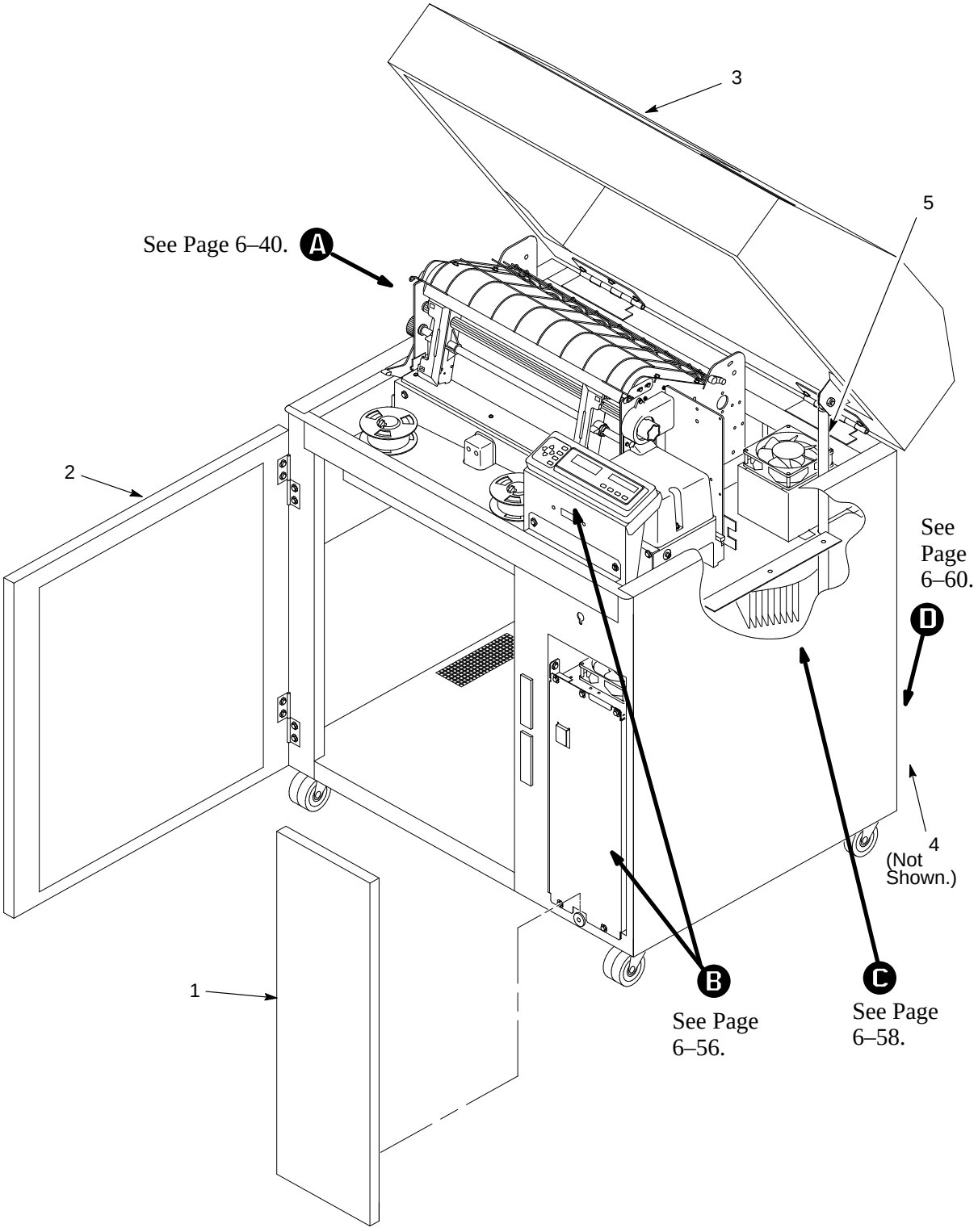


Figure 6–6. Printer Assembly

Item No.	Part Number	Description	Notes
1	134294–004	Front Panel	
2	134294–002	Front Door	
3	134294–001	Top Cover	
4	134294–003	Rear Door	
5	107961–005	Gas Spring	

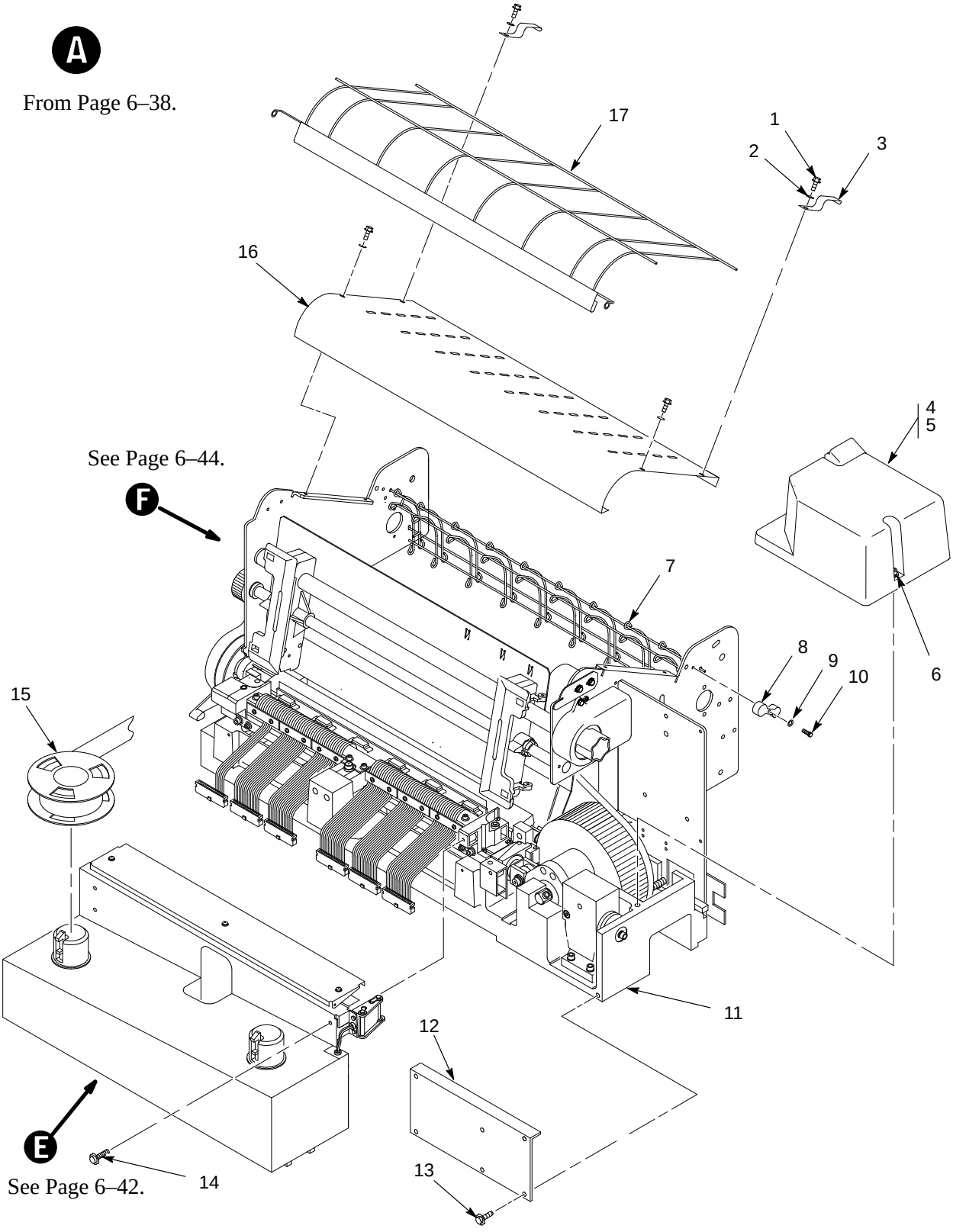


Figure 6–7. Print Mechanism

Item No.	Part Number	Description	Notes
1	102786–605	Screw, Hex w/LW, 6x.31 (4)	Torque: 11 in–lb
2	101526–002	Washer, Flat #6 (4)	
3	133519–001	Ground Clip (2)	
4	140269–001	Cam Cover	
5	106963–001	Gasket	
6	103258–001	Captive Screw (2)	
7	131152–001	Rear Paper Guide	
8	108740–001	Paper Guide Retainer (2)	
9	101526–001	Washer, Flat #6 (2)	
10	102786–605	Screw, Hex w/LW, 6x.31 (2)	Torque: 11 in–lb
11	133673–001	Base Support	
12	131580–001	Cam Cover Plate	
13	140113–003	Screw, Hex, w/LW (6)	Torque: 20 in–lb
14	140113–003	Screw, Hex, w/LW (3)	Torque: 20 in–lb
15	Ref	Ribbon Spool	
16	108763–001	Lower Paper Guide	
17	108649–001	Upper Paper Guide	

From Page 6–40.

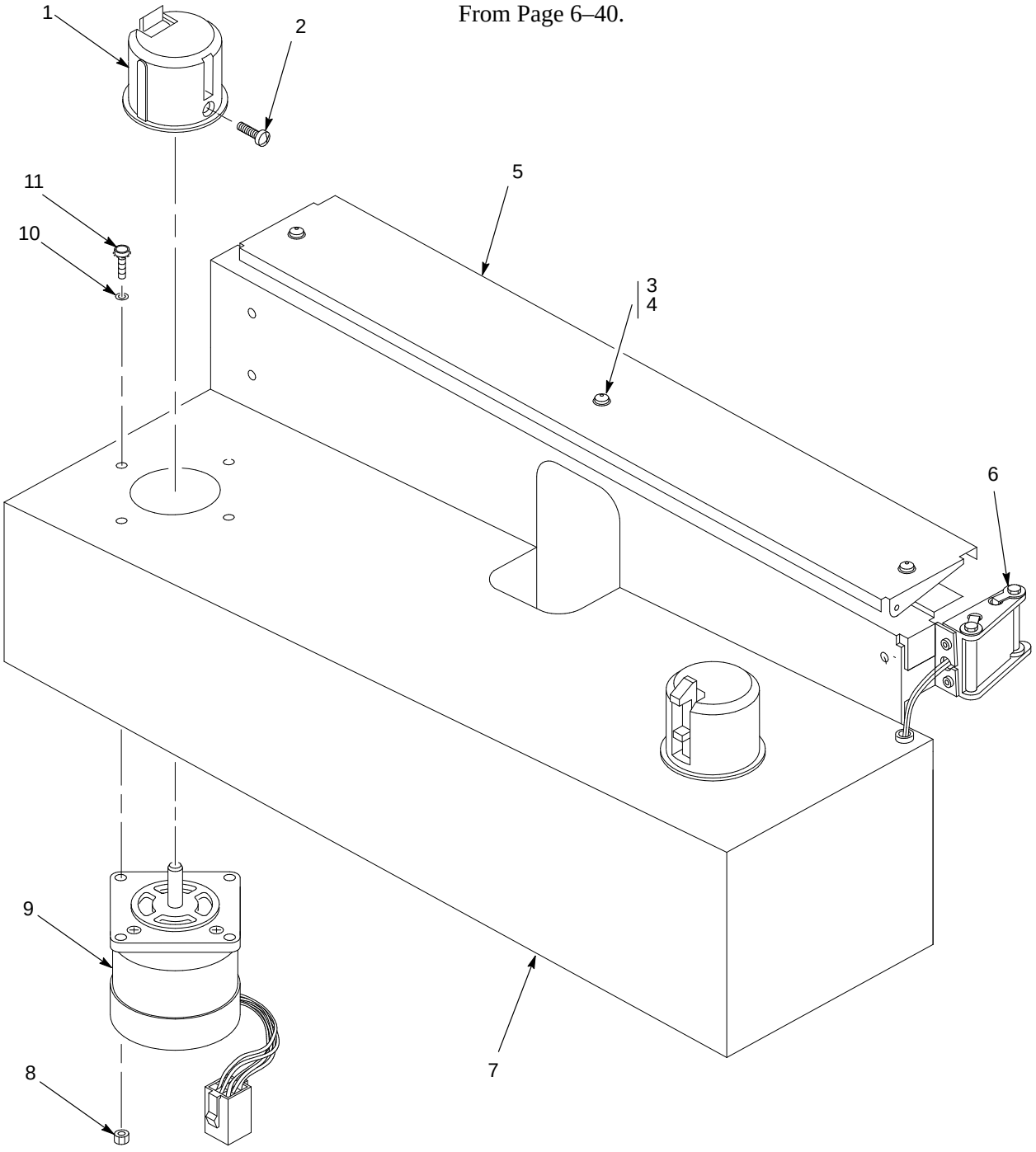


Figure 6–8. Ribbon Deck

Item No.	Part Number	Description	Notes
1	29–29296–01	Assembly, Ribbon Hub (2)	
2	103677–009	Screw, Cruciform, 6–19x.50 (2)	
3	102288–001	Screw, Btn Hd, Hex Dr, 6–32x.25 (3)	
4	101526–002	Washer, Flat #6 (3)	
5	133705–001	Deflector, Air, Revised	
6	133917–002 133917–001	Rbn Guide Assy, Stepper, Rt Rbn Guide Assy, Stepper, Left	(Left guide not shown.)
7	29–30896–01	Assembly, Ribbon Deck	
8	102788–600	Nut, Hex w/LW, 6–32 (8)	
9	29–30897–01	Assembly, Ribbon Motor (2)	
10	101526–002	Washer, Flat #6 (8)	
11	102786–608	Screw, Hex w/LW, 6x.50 (8)	

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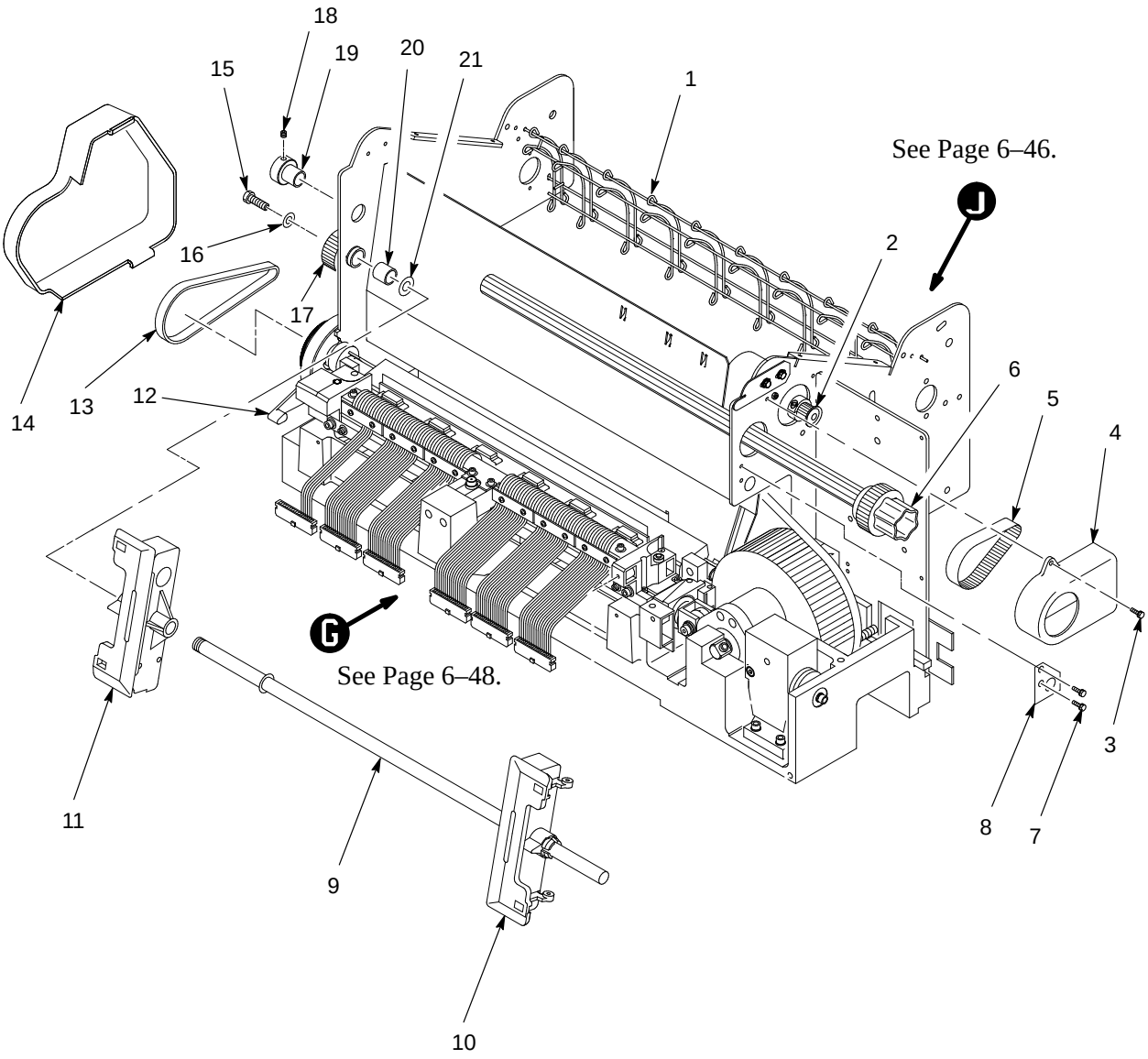

Figure 6–9. Tractor Shafts

Item No.	Part Number	Description	Notes
1	131152–001	Rear Paper Guide	
2	150521–001	Pulley, Paper Feed	Collar, Shaft, Alum 140763–002 next to pulley.
3	102786–610	Screw, Hex w/LW, 6x.62 (2)	
4	132312–001	Belt Guard	
5	FD–13861–01	Belt, Paper Feed	
6	108653–001	Splined Shaft Assy	
7	102786–605	Screw, Hex w/LW, 6x.31 (2)	
8	131158–001	Tractor Shaft Plate	
9	102095–002	Tractor Support Shaft	
10	29–30907–01	Tractor, Right Hand	
11	29–30906–01	Tractor, Left Hand	
12	134424–001	Lever, Platen Reverse	
13	29–30899–01	Belt, Platen Timing	
14	134533–001	Cover, Belt, RPF	
15	102786–605	Screw, Hex w/LW, 6x.31	
16	101526–002	Washer, Flat #6	
17	102100–001	Knob, Adjust	
18	102185–003	Setscrew	
19	101143–002	Left Bushing	
20	102094–001	Bushing, Tractor Adjust	
21	101547–003	Washer, Flat, Nylon, 1/2 inch	

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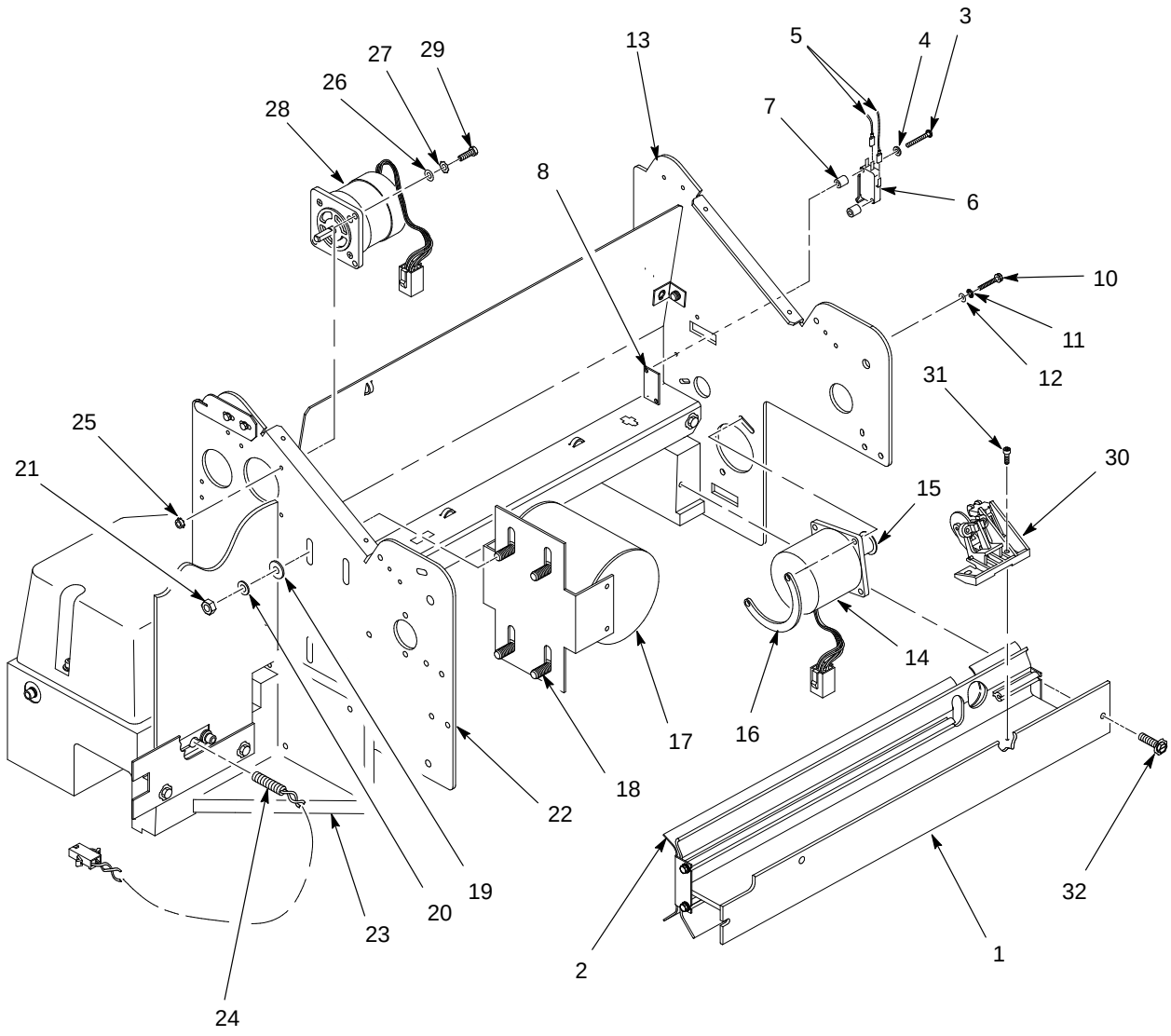

Figure 6–10. Paper Feed Motor, Platen Open Motor and Switch, and Paper Out Switch

Item No.	Part Number	Description	Notes
1	134647–001	Guide, Paper, Machined	Remove belt guard before removing this assy.
2	134646–001	Guide, Paper, Front	
3	102559–420	Screw, w/LW 4–40x1.00 (2)	Torque: 5 in–lb
4	101526–009	Washer, Flat #4 (2)	
5	Ref	Red and White leads	
6	FD–15791–01	Switch, Platen Open	1.0A, 125 VAC
7	102132–013	Spacer, Round (2)	.115/.375x.200 LN
8	104960–001	Nutplate, Switch Mating	
9	101554–001	Angle Clip, 90 degree (2)	
10	101514–063	Screw, Skt Hd Cap (2)	Torque: 11 ± 2 in–lb
11	102158–005	Washer, Split Lock #6 (2)	
12	101526–002	Washer, Flat #6 (2)	
13	134403–001	Side Plate, Left, RPF	
14	29–29282–01	Assembly, Platen Motor	No ferrite core used
15	150521–001	Pulley, Paper Feed	
16	150707–001	Nut Plate	
17	FD–32538–01	Assembly, Shuttle Motor	Ferrite core over red, blue, and black wires
18	108481–002	Carriage Bolt (4)	
19	101526–012	Washer, Flat #1/4 (4)	
20	102158–007	Washer, Split Lock, #1/4 (4)	
21	101525–010	Nut, Hex, 1/4–20 (4)	Torque: 105 in–lb
22	131147–002	Plate, Right Side	
23	133673–001	Base Support	
24	FD–15800–01	Assembly, Magnetic Pickup	
25	102788–600	Nut, Hex w/LW, 6–32 (4)	Torque: 14 in–lb
26	101526–002	Washer, Flat #6 (4)	
27	102158–005	Washer, Split Lock #6 (4)	
28	29–30894–01	Assembly, Paper Motor	Ferrite core over all wires
29	101514–063	Screw, Skt Hd Cap (4)	Torque: 14 in–lb
30	29–30805–01	Switch, Paper Detector	
31	105728–011	Screw, TF, 6–32x.375 (2)	Torque: 5 in–lb
32	140113–003	Screw, 5/16” Hex Hd (3)	Torque: 20 in–lb

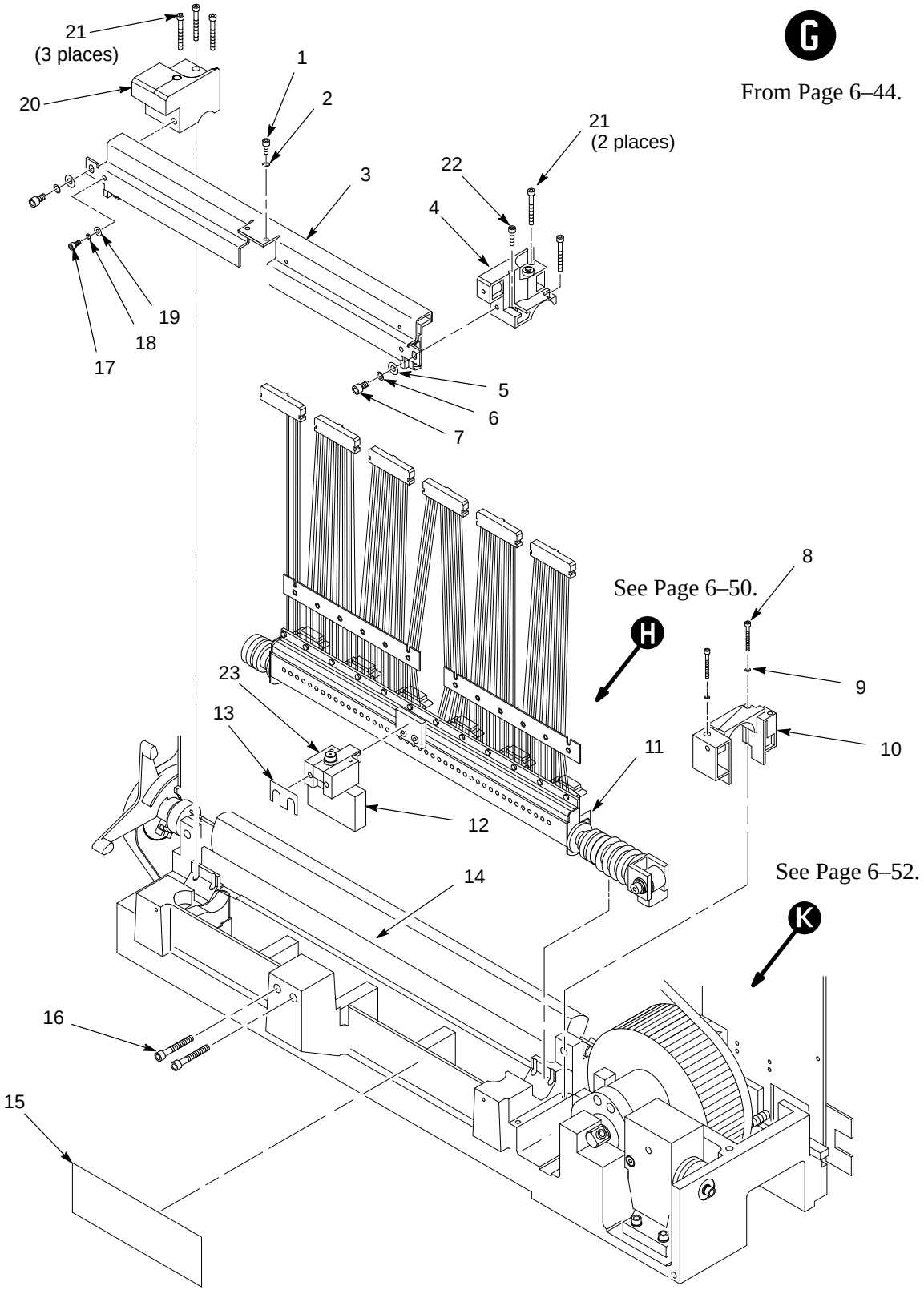

Figure 6–11. Hammer Bank Assembly

Item No.	Part Number	Description	Notes
1	101514–025	Screw, Skt Cap, 6x.31 (2)	Torque: 8 in–lb
2	102158–005	Washer, Split Lock, #6 (2)	
3	131998–001	Shroud, Shuttle	
4	140540–001	Cap, Bearing, Right	
5	101526–003	Washer, Flat #10 (2)	
6	102158–002	Washer, Split Lock #10 (2)	
7	101514–017	Screw, Skt Cap, 10x.38 (2)	Torque: 10 in–lb
8	101514–057	Screw, Skt Cap, 4x1.00 (2)	Torque: 8 in–lb
9	102158–001	Washer, Split Lock #4 (2)	
10	133442–001	Block, Dust Barrier, Machined	
11	134470–001	Hammerbank Assy	
12	131787–001	Foam, Air Seal	
13	29–30943–01 29–30944–01	Shim, Antirotation (0.010 in.) Shim, Antirotation, (0.005 in.)	
14	134571–001	Paper Ironer, P9212	
15	108297–001 108297–005	Tape, Hooks, 2.00 W Tape, Loops, 2.00 W	On top of coil leads. Attached to base support.
16	101514–054	Screw, Skt Cap, 10x1.375 (2)	Torque: 20 in–lb
17	101514–053	Screw, Skt Cap, 4x.31 (2)	Torque: 8 in–lb
18	102158–001	Washer, Split Lock #4	
19	101526–050	Washer, Flat #4	
20	140541–001	Cap, Bearing, Left	
21	101514–058	Screw, Skt Cap, 6x1.25 (5)	Torque: 15 in–lb
22	101514–028	Screw, Skt Cap, 6x.62 (1)	Torque: 15 in–lb
23	131494–001	Block, Antirotation	

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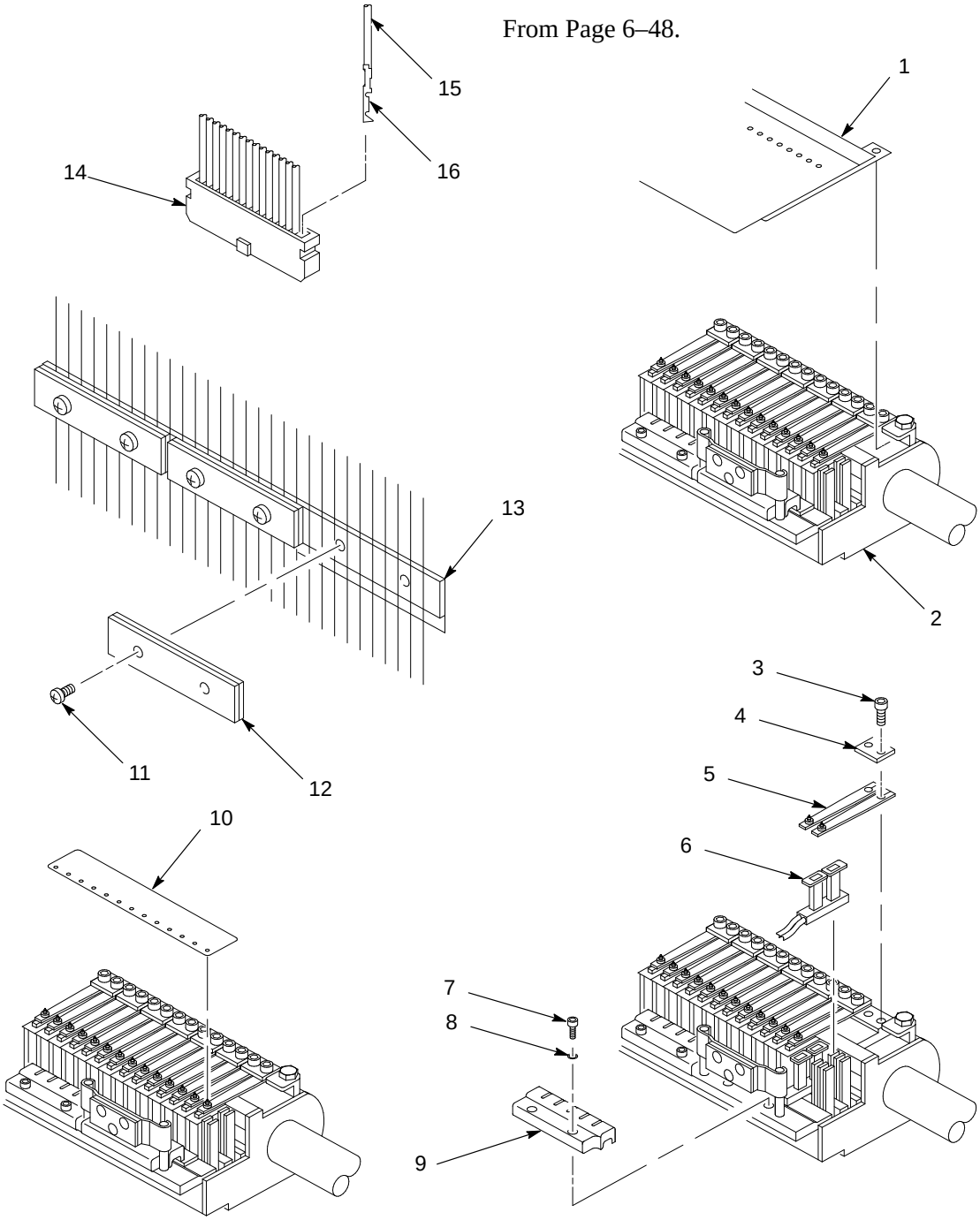

Figure 6–12. Hammer Springs and Coils

Item No.	Part Number	Description	Notes
1	FD–38422–01	Assembly, Hammer Cover	
2	29–30898–01	Assembly, Shuttle	
3	101514–055	Screw, Skt Cap–U (88)	Torque: 6–9 in–lb
4	131173–001	Plate, Clamp, Hmr Spring (44)	
5	FD–15794–01	Assembly, Hammer Spring (88)	
6	FD–15793–01	Assembly, Hammer Coil (88)	
7	101514–056	Screw, Skt Cap–U (22)	Torque: 12 ± 2 in–ounce
8	101526–039	Washer, Flat #2 (22)	
9	132001–001	Clamp, Coil (11)	
10	FD–28262–01	Tool, Short Alignment	
11	105947–001	Screw, Philips, Self–Lock (12) 6,4x.10	Torque: 10 in–lb
12	131934–001	Clamp Assy, Coil Leads (6)	
13	131937–001	Bracket Assy, Coil (2)	
14	109687–001	Conn, Socket, 34–pin (6)	
15	Part of item 6	Coil Lead Wire	
16	Part of item 6	Coil Lead Wire Connector	

From Page 6–48.

See Page 6–54.

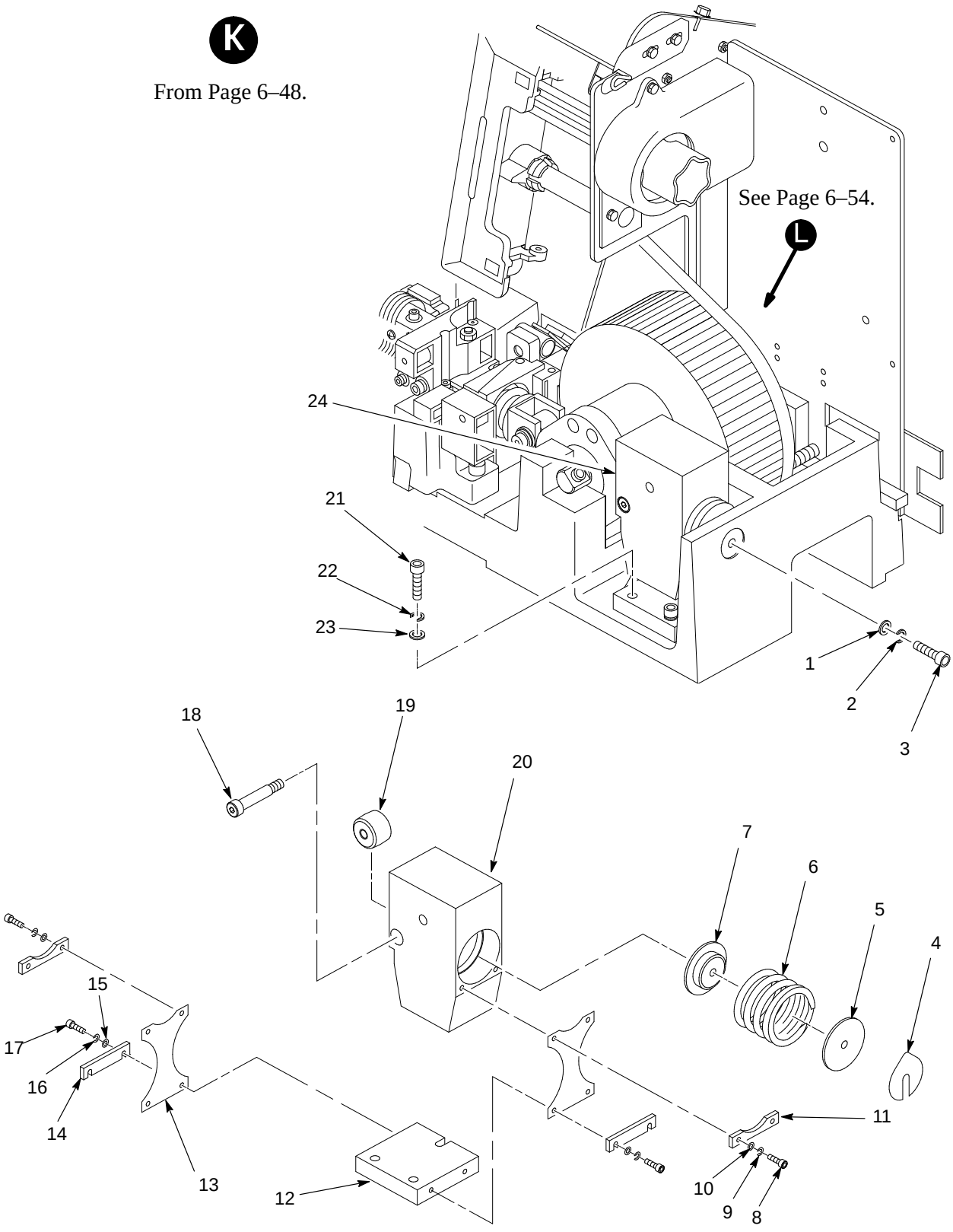

Figure 6–13. Shuttle Counterweight Assembly

Item No.	Part Number	Description	Notes
1	101526–003	Washer, Flat #10	
2	102158–002	Washer, Split Lock #10	
3	101514–041	Screw, Counterweight, 10x.75	Torque: 20 in–lb
4	101564–001	Shim, Counterweight, Spring Guide	
5	131960–001	Seat, Spring	
6	131053–001	Spring, Shuttle	
7	131960–001	Seat, Spring	
8	101514–002	Screw, Skt Cap, 4x.38 (4)	Torque: 8 in–lb
9	102158–001	Washer, Split Lock #4 (4)	
10	101526–009	Washer, Flat #4 (4)	
11	131954–001	Clamp, Upper (2)	
12	133588–001	Plate, Counterweight Mating	
13	131956–001	Spring, Flat, Counterweight (2)	
14	131956–001	Clamp, Lower (2)	
15	101526–009	Washer, Flat #4 (4)	
16	102158–001	Washer, Split Lock #4 (4)	
17	101514–002	Screw, Skt Cap, 4x.38 (4)	Torque: 8 in–lb
18	102453–003	Screw, Shoulder, Self–Locking	Torque: 11 in–lb
19	101315–006	Bearing, Roller	
20	133603–001	Counterweight, Machined	
21	101514–041	Screw, Skt Cap, 10x.75 (3)	Torque: 20 in–lb
22	102158–002	Washer, Split Lock #10 (3)	
23	101526–003	Washer, Flat #10 (3)	
24	29–30892–01	Assembly, Counterweight	

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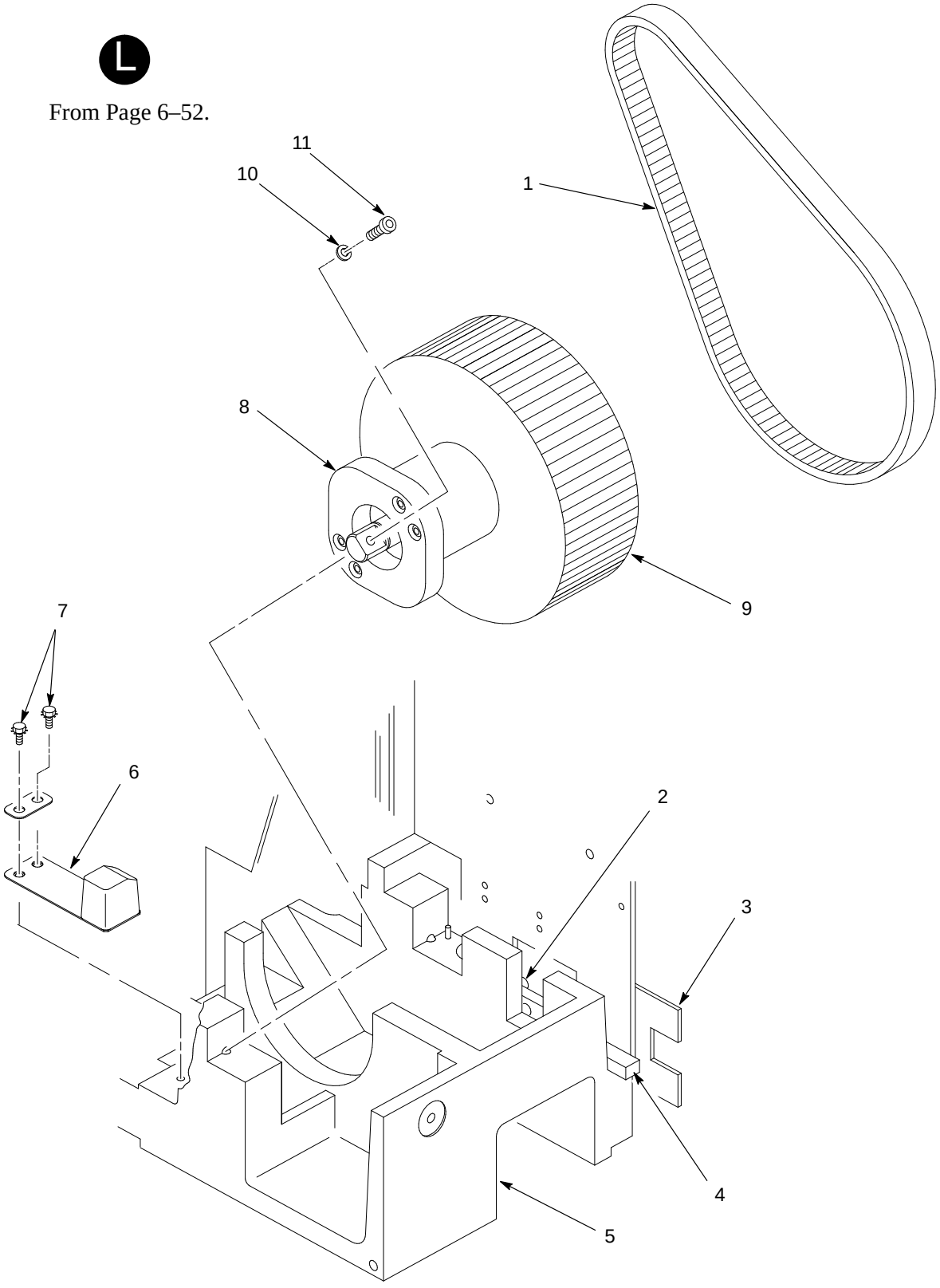


Figure 6–14. Shuttle Cam and Flywheel

Item No.	Part Number	Description	Notes
1	FD–34554–01	Belt, Shuttle	
2	101514–041	Screw, Skt Cap, 10x.75	
3	102633–001	Bracket, Guide, Mag Pickup	
4	101240–001	Magnetic Pickup Arm	
5	133673–001	Base Support, Machined	
6	29–30900–01	Oil Wick	
7	140133–001	Screw, w/LW (2)	Torque: 5 in–lb
8	Part of item 9	Cam	
9	FD–38890–01	Assembly, Flywheel	
10	102158–002	Washer, Split Lock #10 (2)	
11	101514–042	Screw, Skt Cap, 10x1.00 (2)	Torque: 40 ± 3 in–lb

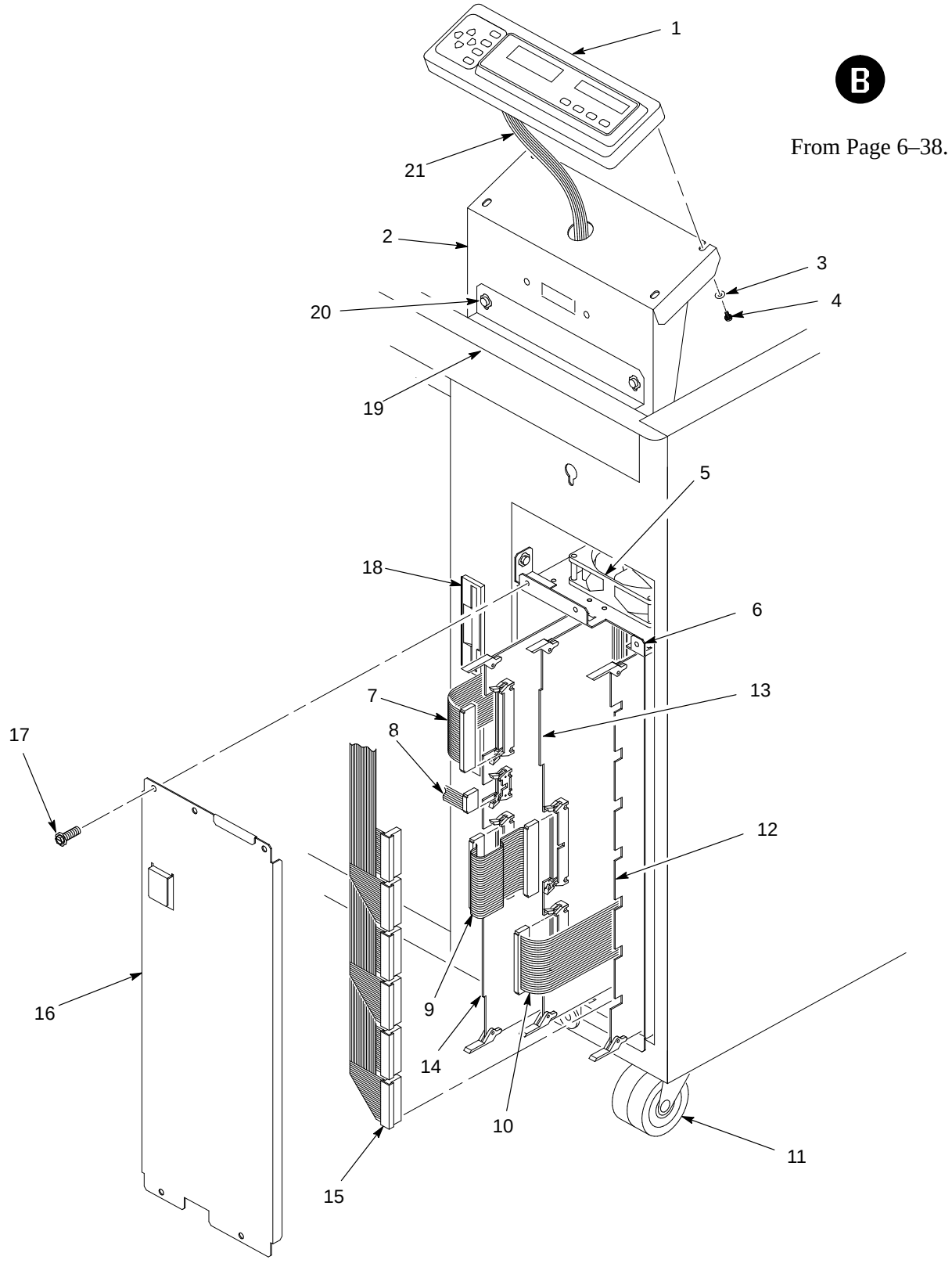


Figure 6–15. Card Cage and Control Panel

Item No.	Part Number	Description	Notes
1	29–29286–01	Assembly, Control Panel	
2	134287–001	Bracket, Control Panel, P9212	
3	101526–002	Washer, Flat #6	
4	102786–606	Screw, Hex w/LW, 6–32x.375	
5	29–29294–01	Assembly, Card Cage Fan	
6	134478–001	Weldment, Card Cage, P9212	
7	29–30893–01	Assembly, I/O Cable	
8	Part of item 1	Assembly, Control Panel	
9	150551–001	Cable Assy, CCB/Mech Dr	
10	133750–001	Cable Assy, Hmr Dr/Mech Dr	
11	141455–002 141455–001	Castor, P9212 w/Brake Castor, P9212, w/o Brake	Two front Two rear
12	29–30902–01	PCBA, Hammer Drive	
13	29–30903–01	PCBA, Mech Driver	
14	29–30901–01	PCBA, CCB DX	(CCB: Common Controller Board)
15	133753–001	Cable Assy, Hammer Bank	
16	134479–001	Cover, Card Cage, P9212	
17	140113–001	Screw, Hex w/Washer (5)	
18	202013–001	Dummy Panel, Disk Drive	
19	134296–001	Frame/Skin Assy, P9212	
20	140113–001	Screw, Hex w/Washer (4)	
21	Part of item 1	Cable, Control Panel Assy	

From Page 6–38.

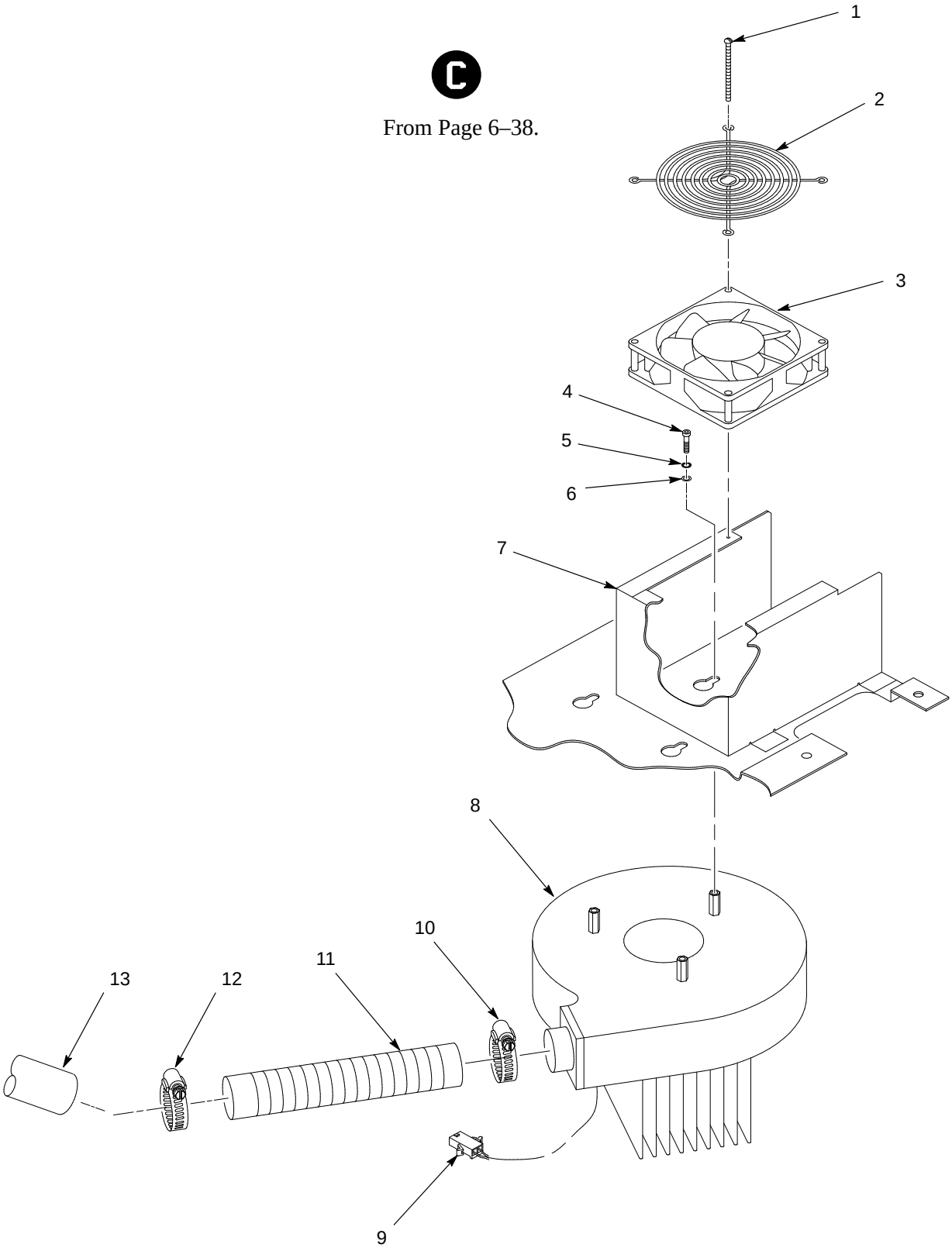


Figure 6–16. Blower Assembly

Item No.	Part Number	Description	Notes
1	102786–682	Screw, w/LW, 6x1.75 (2)	Torque: 11 in–lb
2	130025–001	Guard, Finger	
3	29–29294–01	Assembly, 48VDC Fan	
4	102998–001	Screw, Skt Cap, 10–32x.38 (3)	Torque: 14 in–lb
5	102158–002	Washer, Split Lock #10 (3)	
6	101526–003	Washer, Flat #10 (3)	
7	Ref	Frame Assy	
8	29–30891–01	Assembly, Blower	
9	Part of item 8	Connector, Blower Assy	
10	141532–001	Clamp, Hose, SS, 2 inch	
11	141402–002	Hose, Air Flow	
12	141532–001	Clamp, Hose, SS, 2 inch	
13	Ref	Frame Subassembly	

From Page 6–38.

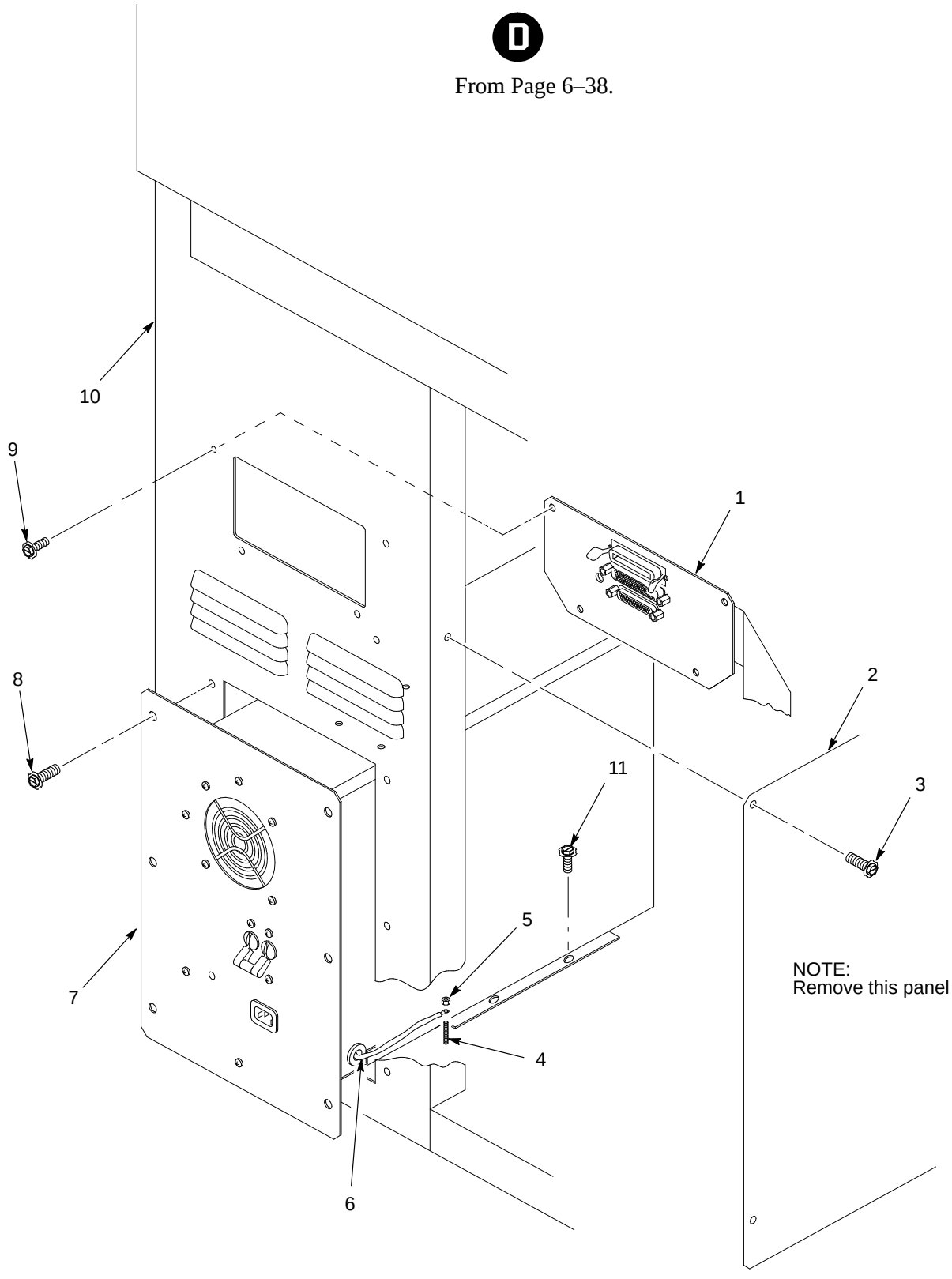


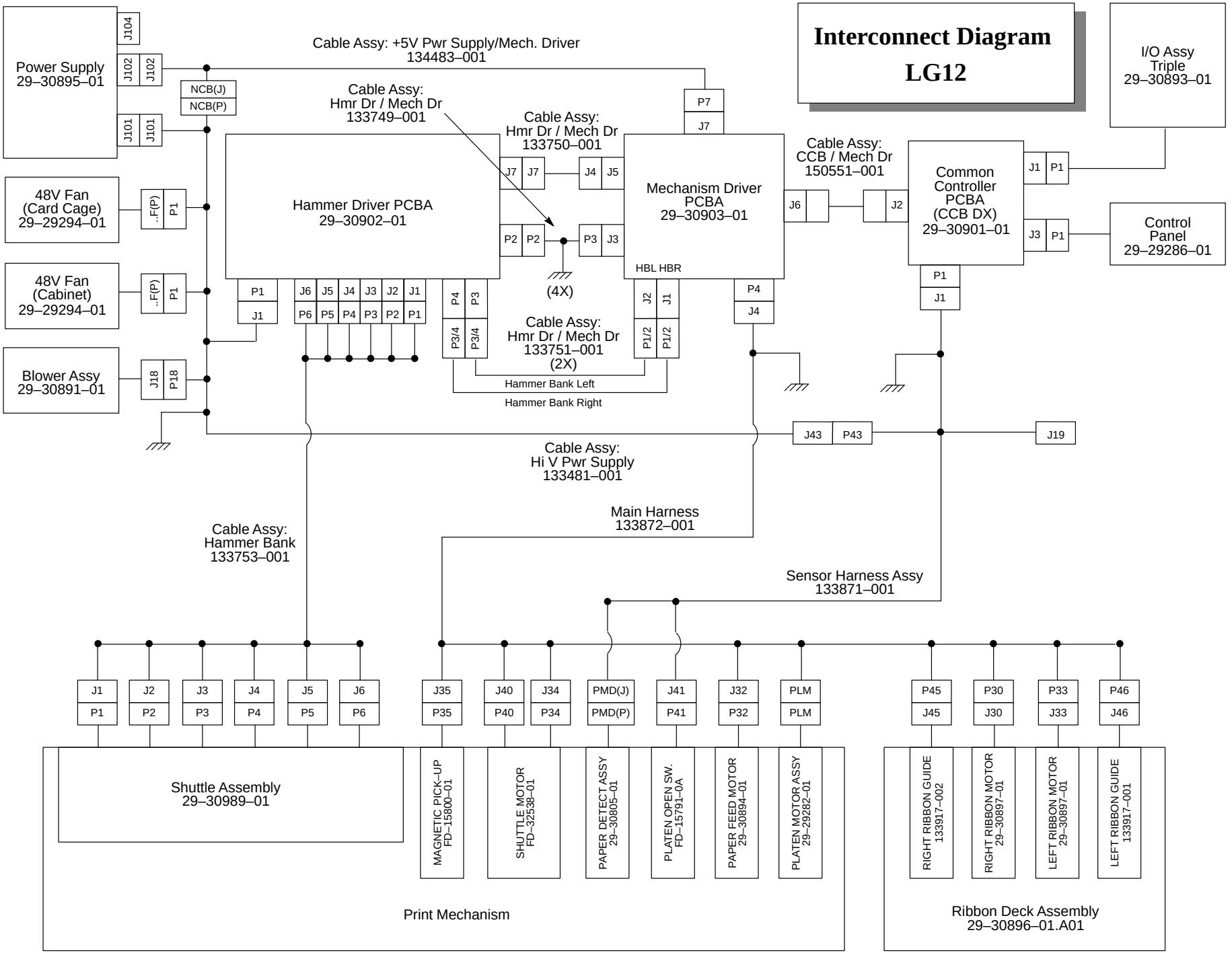
Figure 6–17. Power Supply and I/O Assemblies

Item No.	Part Number	Description	Notes
1	29–30893–01	Assembly, I/O Cable	
2	Ref	Access Panel	
3	140113–001	Screw, Hex, Washer (7)	Torque: 20 in–lb
4	Part of item 10	#6 Stud	
5	102788–600	Nut, Hex, w/LW, 6–32	Torque: 8 in–lb
6	Part of item 7	18 AWG wire, w/ring terminal	Green with yellow stripe.
7	29–30895–01	Assembly, Power Supply	
8	140113–001	Screw, Hex, w/Washer (6)	Torque: 20 in–lb
9	140113–001	Screw, Hex, w/Washer (4)	Torque: 20 in–lb
10	Ref	Frame/Skin Assy	
11	140113–001	Screw, Hex w/Washer (2)	Torque: 20 in–lb

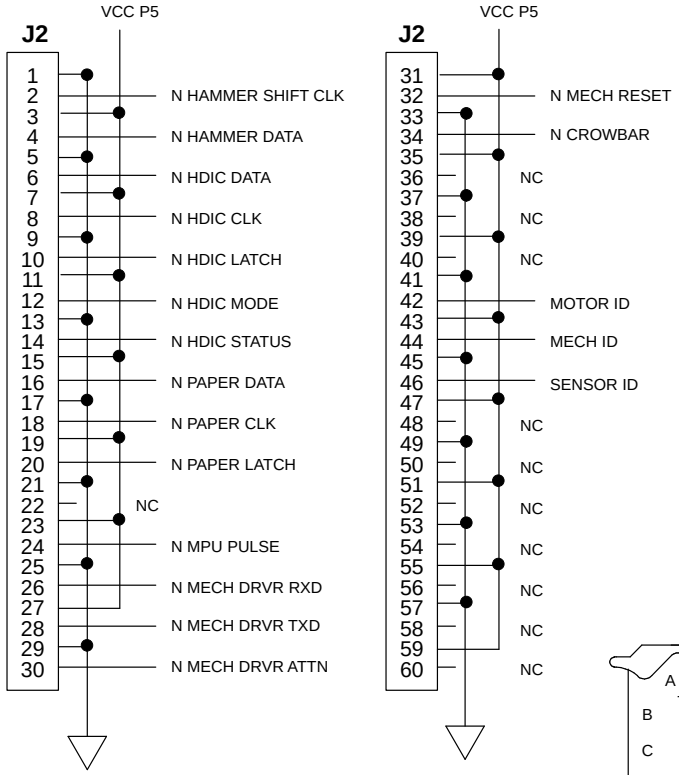
A Wire Data

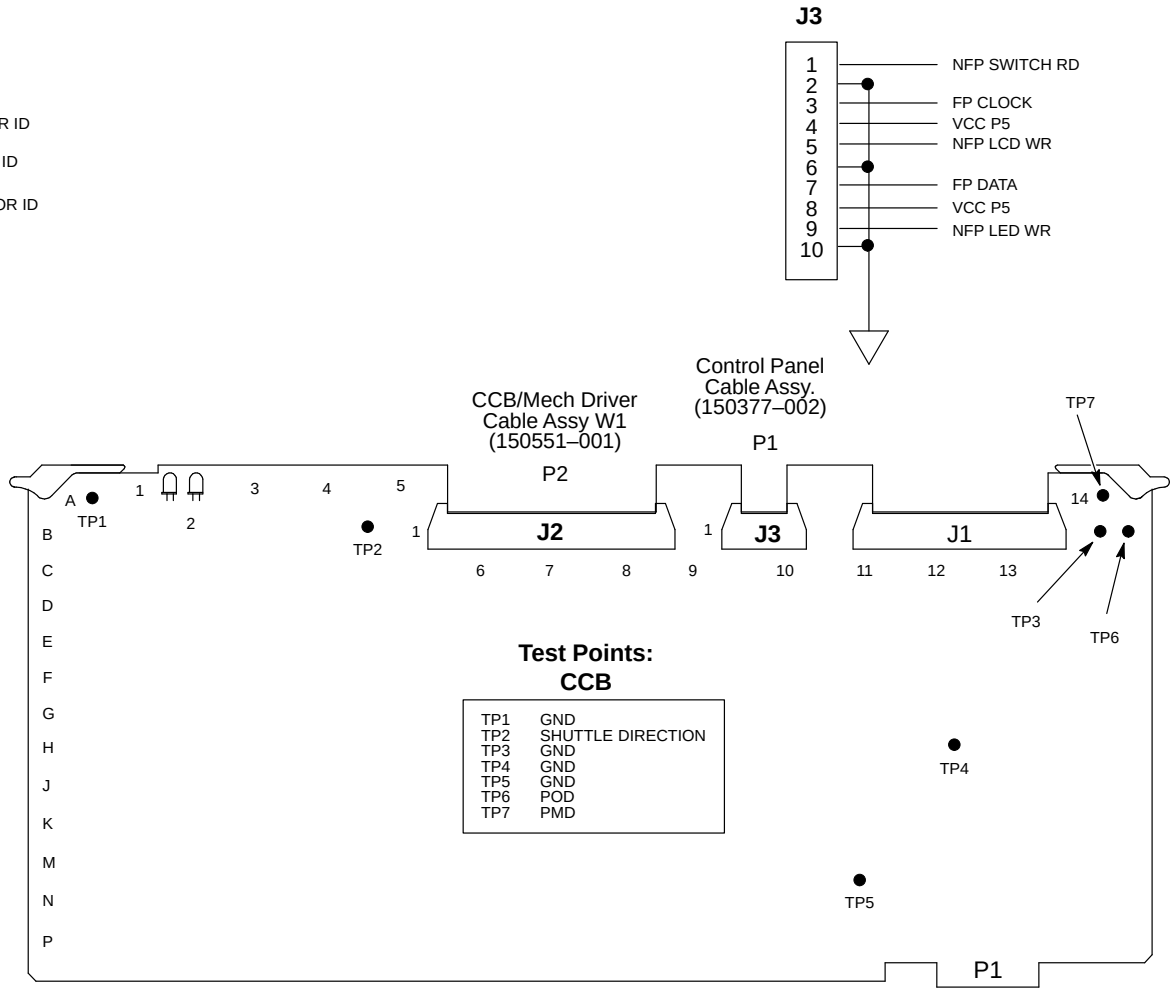
NOTE: Signal mnemonics and acronyms are defined in Appendix B.

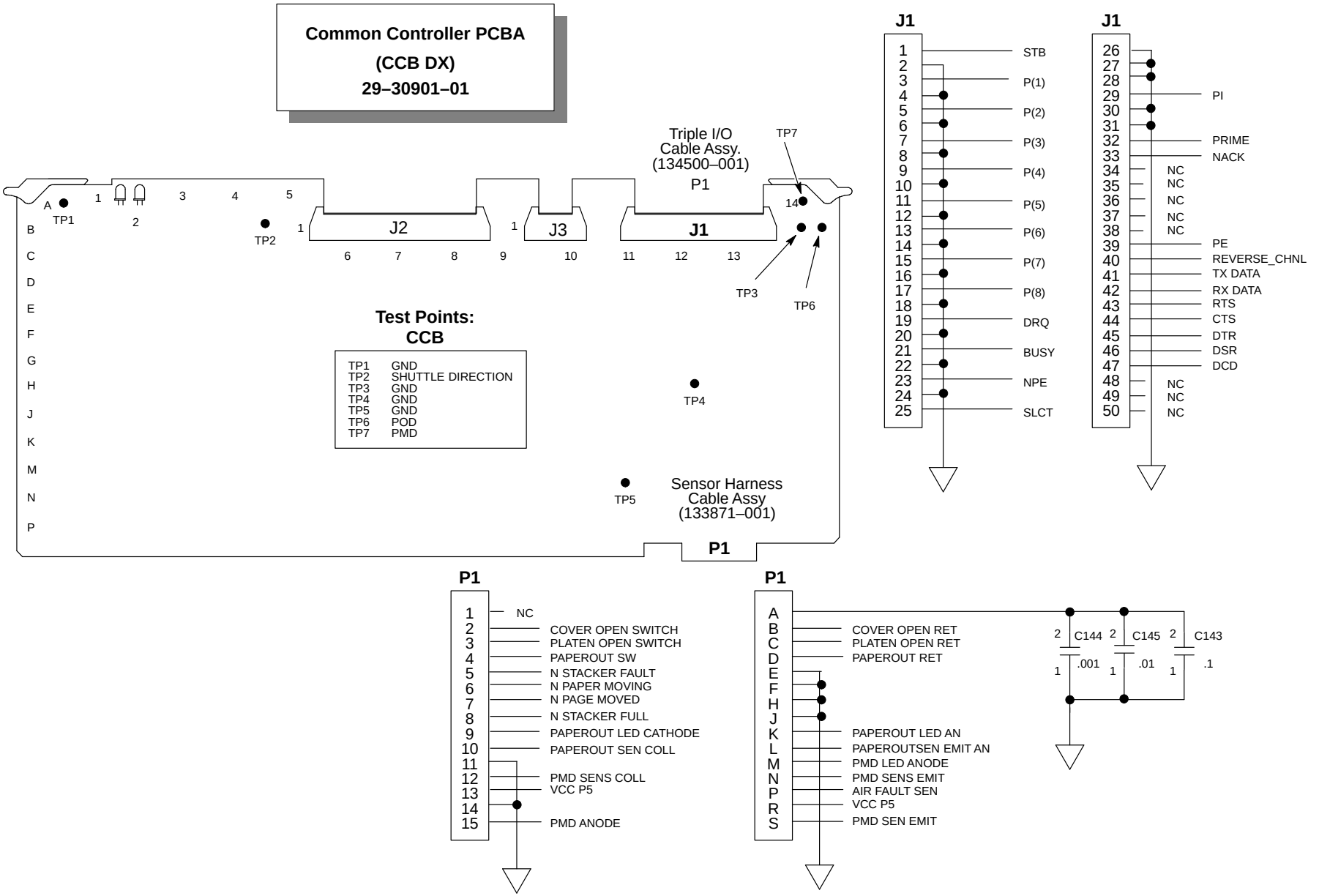
Interconnect Diagram
LG12

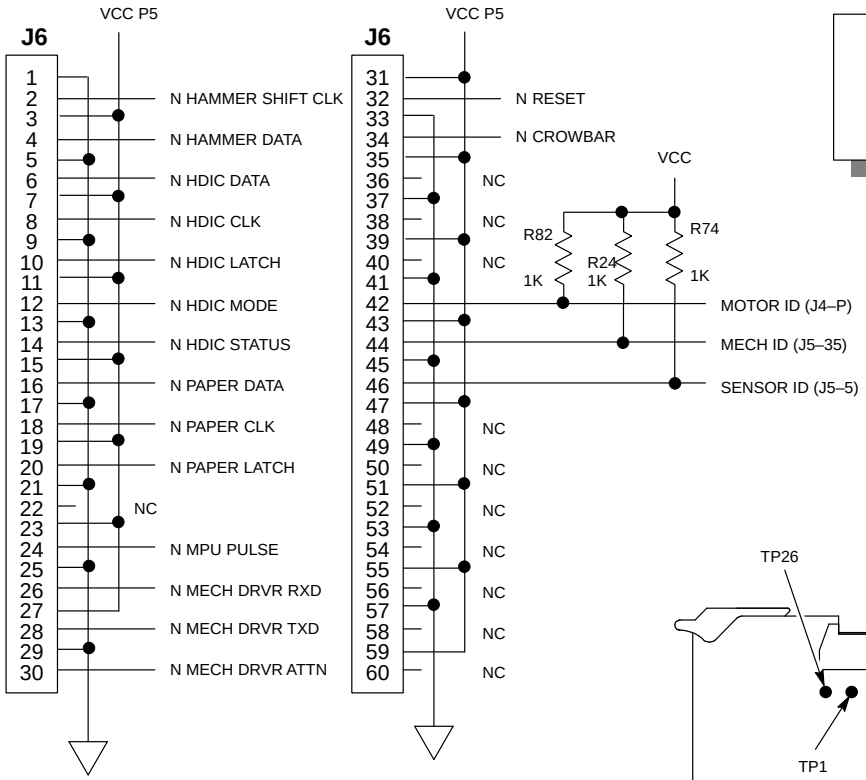


Common Controller PCBA
(CCB DX)
29–30901–01



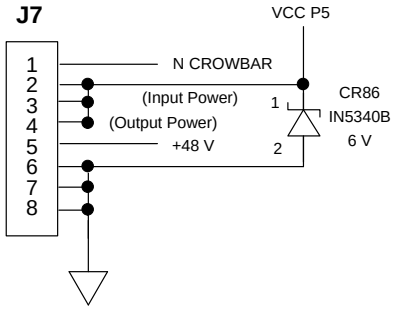



Common Controller PCBA
(CCB DX)
29–30901–01
Triple I/O
Cable Assy.
(134500–001)
P1
TP7
TP1
TP2
TP3
TP4
TP5
TP6
J2
J3
J1
Test Points:
CCB
TP1 GND
TP2 SHUTTLE DIRECTION
TP3 GND
TP4 GND
TP5 GND
TP6 POD
TP7 PMD
Sensor Harness
Cable Assy
(133871–001)
P1
J1
1 STB
2
3 P(1)
4
5 P(2)
6
7 P(3)
8
9 P(4)
10
11 P(5)
12
13 P(6)
14
15 P(7)
16
17 P(8)
18
19 DRQ
20
21 BUSY
22
23 NPE
24
25 SLCT
J1
26
27
28
29 PI
30
31
32 PRIME
33 NACK
34 NC
35 NC
36 NC
37 NC
38 NC
39 PE
40 REVERSE_CHNL
41 TX DATA
42 RX DATA
43 RTS
44 CTS
45 DTR
46 DSR
47 DCD
48 NC
49 NC
50 NC
P1
1 NC
2 COVER OPEN SWITCH
3 PLATEN OPEN SWITCH
4 PAPEROUT SW
5 N STACKER FAULT
6 N PAPER MOVING
7 N PAGE MOVED
8 N STACKER FULL
9 PAPEROUT LED CATHODE
10 PAPEROUT SEN COLL
11
12 PMD SENS COLL
13 VCC P5
14
15 PMD ANODE
P1
A COVER OPEN RET
B PLATEN OPEN RET
C PAPEROUT RET
D
E
F
H
J
K PAPEROUT LED AN
L PAPEROUTSEN EMIT AN
M PMD LED ANODE
N PMD SENS EMIT
P AIR FAULT SEN
R VCC P5
S PMD SEN EMIT
C144 .001
C145 .01
C143 .1

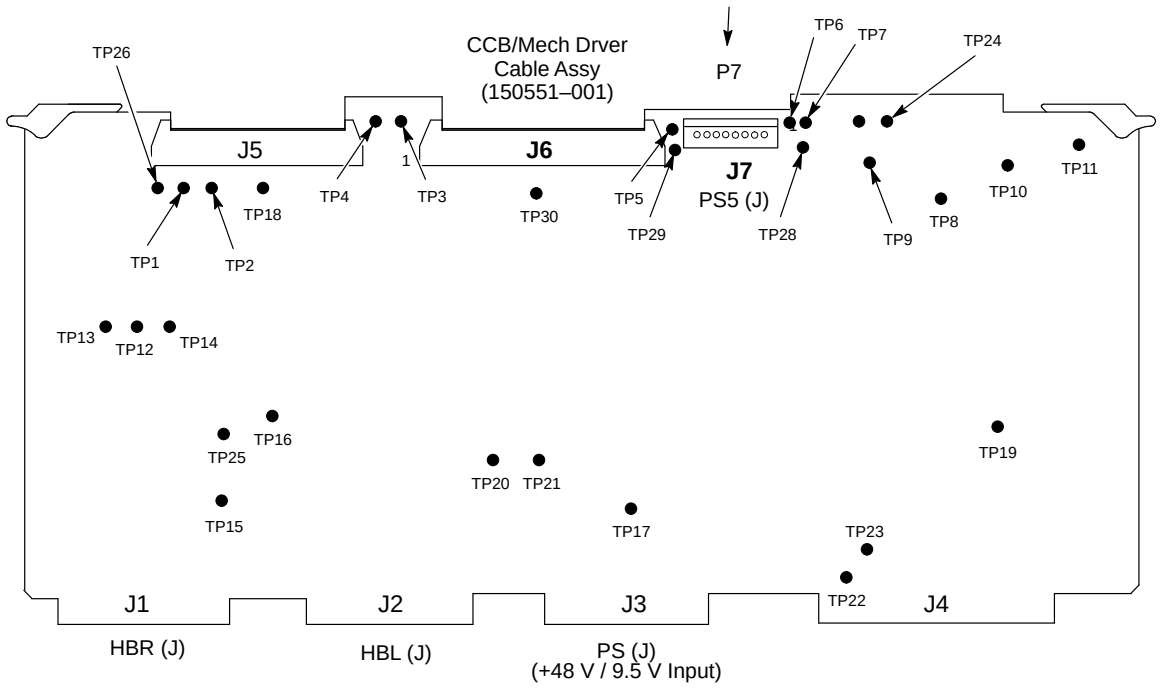


Mechanism Driver PCBA

29–30903–01



Cable Assy., +5V
Pwr Supply/Mech. Driver
(134483–001)

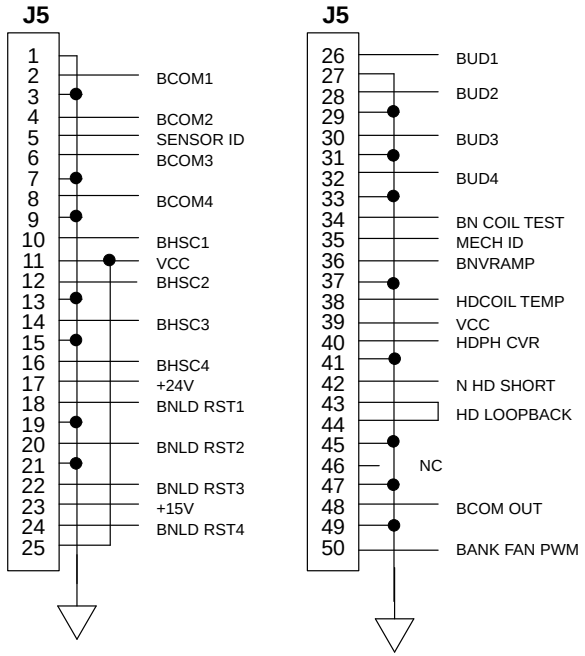


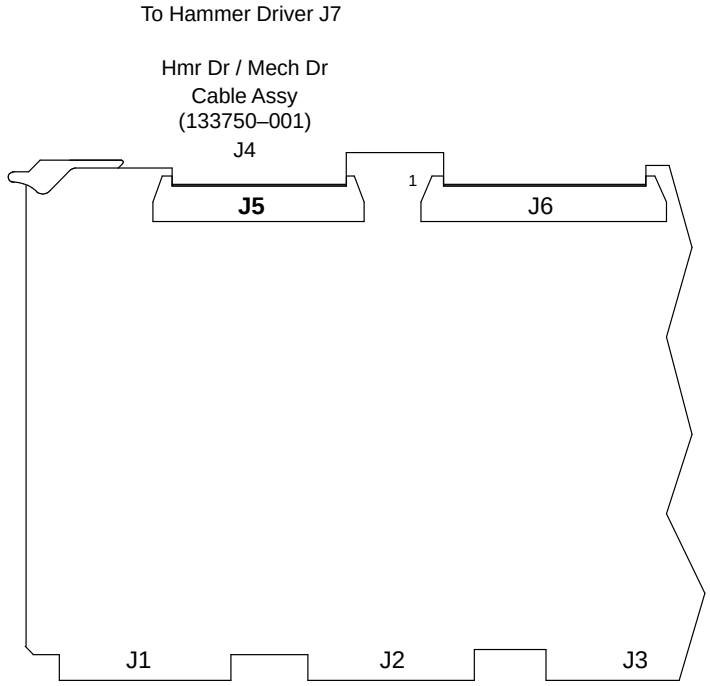
Test Points:
Mech. Driver

TP1	PAPER B AMPLITUDE
TP2	PAPER A AMPLITUDE
TP3	PAPER B CURRENT
TP4	PAPER A CURRENT
TP5	N MPU PULSE
TP6	VCC (+5V)
TP7	GND (+5V RET)
TP8	SHUT CLK
TP9	SHUT SPEED
TP10	SHUT ERR
TP11	HALL CLK
TP12	GND (PAPER FEED)
TP13	N COIL TEST
TP14	N SHORT
TP15	GND (HAMMER PWR)
TP16	COIL TEMP
TP17	+58V
TP18	N FAIL SAFE
TP19	GND (SHUTTLE)
TP20	PFM1
TP21	PFM2
TP22	PFM3
TP23	PFM4
TP24	+48V
TP25	+9.5V
TP26	+15V
TP27	+42V
TP28	N CROWBAR
TP29	N MD RESET
TP30	N FAULT

Mechanism Driver PCBA

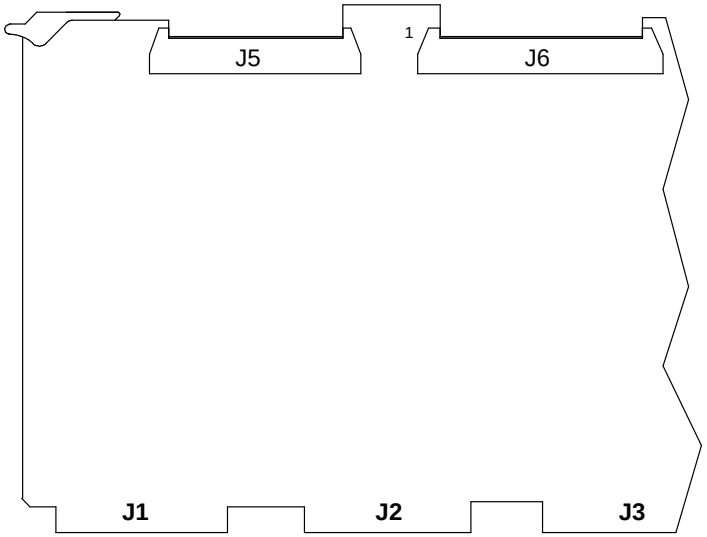
29–30903–01





Mechanism Driver PCBA

29–30903–01



Hmr Dr / Mech Dr Cable Assy 133751–001

Hmr Dr / Mech Dr Cable Assy 133751–001

Hmr Dr / Mech Dr Cable Assy 133749–001

HD P1 (HBR) **HD P1**

J1		J1	
1	N/C	26	MDCOIL 30N
2	N/C	27	(COIL 43)
3	UDPH 1B	28	(COIL 31)
4	(COIL 25)	29	MDCOIL 43N
5	MDCOIL 37N	30	MDCOIL 31N
6	MDCOIL 25N	31	(COIL 44)
7	UDPH2B	32	(COIL 32)
8	(COIL 26)	33	MDCOIL 44N
9	MDCOIL 38N	34	MDCOIL 32N
10	MDCOIL 26N	35	(COIL 45)
11	UDPH 3B	36	(COIL 33)
12	(COIL 27)	37	MDCOIL 45N
13	MDCOIL 39N	38	MDCOIL 33N
14	MDCOIL 27N	39	(COIL 46)
15	UDPH 4B	40	(COIL 34)
16	(COIL 28)	41	MDCOIL 46N
17	MDCOIL 40N	42	MDCOIL 34N
18	MDCOIL 28N	43	(COIL 47)
19	(COIL 41)	44	(COIL 35)
20	(COIL 29)	45	MDCOIL 47N
21	MDCOIL 41N	46	MDCOIL 35N
22	MDCOIL 29N	47	(COIL 48)
23	(COIL 42)	48	(COIL 36)
24	(COIL 30)	49	MDCOIL 48N
25	MDCOIL 42N	50	MDCOIL 36N

HD P2 (HBL) **HD P2**

J2		J2	
1	N/C	26	MDCOIL 6N
2	+58 V	27	(COIL 19)
3	UDPH1A	28	(COIL 7)
4	(COIL 1)	29	MDCOIL 19N
5	MDCOIL 13N	30	MDCOIL 7N
6	MDCOIL 1N	31	(COIL 20)
7	UDPH2A	32	(COIL 8)
8	(COIL 2)	33	MDCOIL 20N
9	MDCOIL 14N	34	MDCOIL 8N
10	MDCOIL 2N	35	(COIL 21)
11	UDPH 3A	36	(COIL 9)
12	(COIL 3)	37	MDCOIL 21N
13	MDCOIL 15N	38	MDCOIL 9N
14	MDCOIL 3N	39	(COIL 22)
15	UDPH 4A	40	(COIL 10)
16	(COIL 4)	41	MDCOIL 22N
17	MDCOIL 16N	42	MDCOIL 10N
18	MDCOIL 4N	43	(COIL 23)
19	(COIL 17)	44	(COIL 11)
20	(COIL 5)	45	MDCOIL 23N
21	MDCOIL 17N	46	MDCOIL 11N
22	MDCOIL 5N	47	(COIL 24)
23	(COIL 18)	48	(COIL 12)
24	(COIL 6)	49	MDCOIL 24N
25	MDCOIL 18N	50	MDCOIL 12N

J3

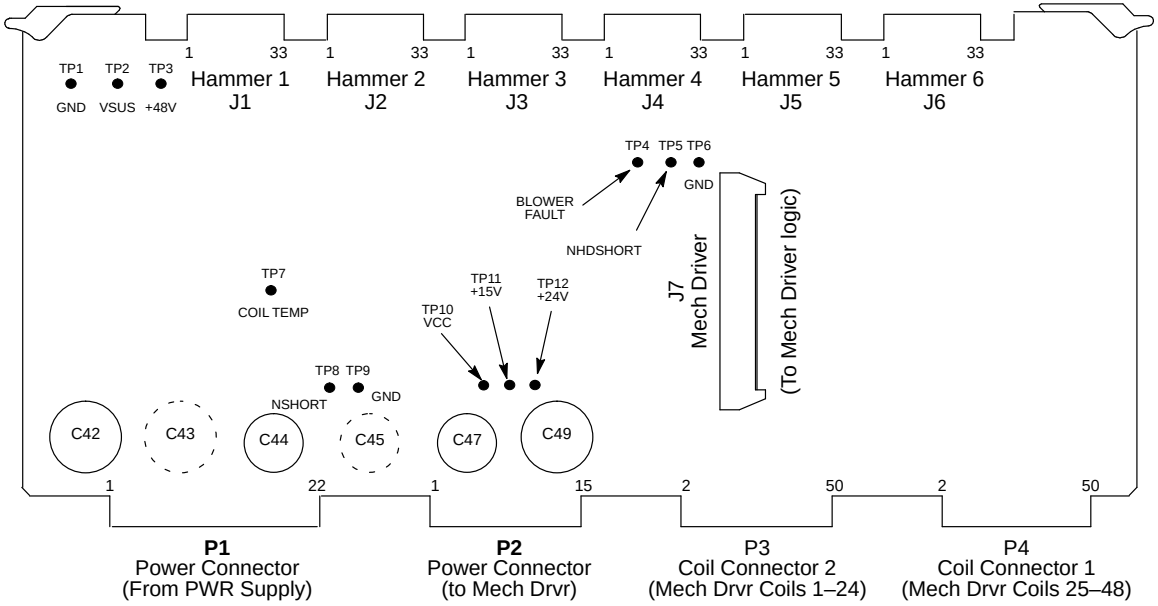
1	VSUS
2	INPUT POWER
3	
4	
5	
6	
7	
8	
9	+48V
10	INPUT POWER
11	
12	
13	
14	
15	

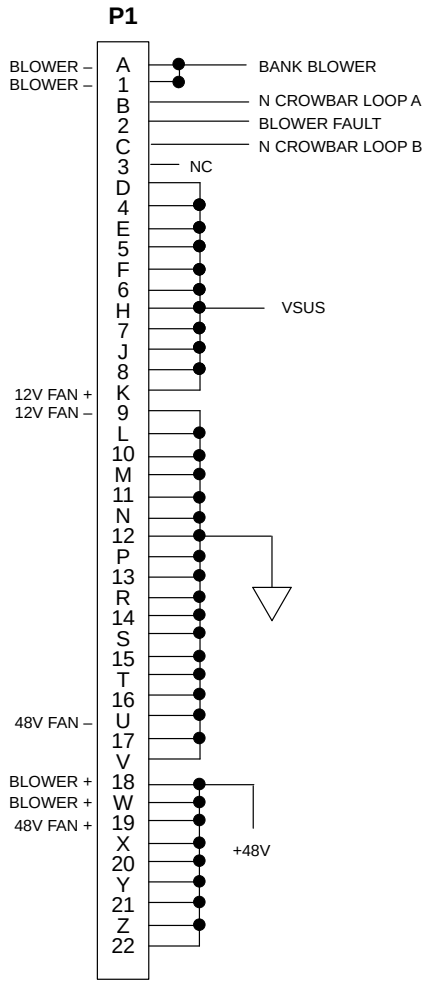
J3

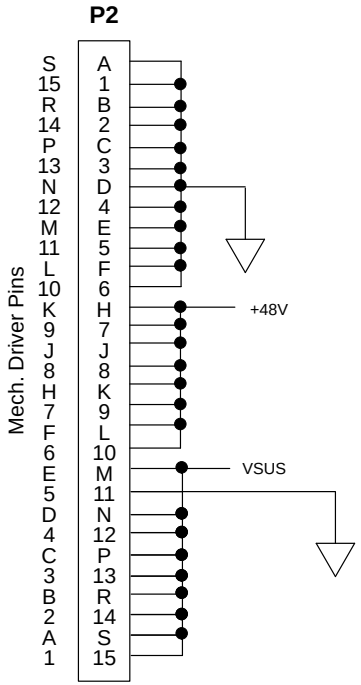
A	VSUS
B	INPUT POWER
C	
D	
E	
F	+48V
H	INPUT POWER
J	
K	
L	
M	
N	
P	
R	
S	

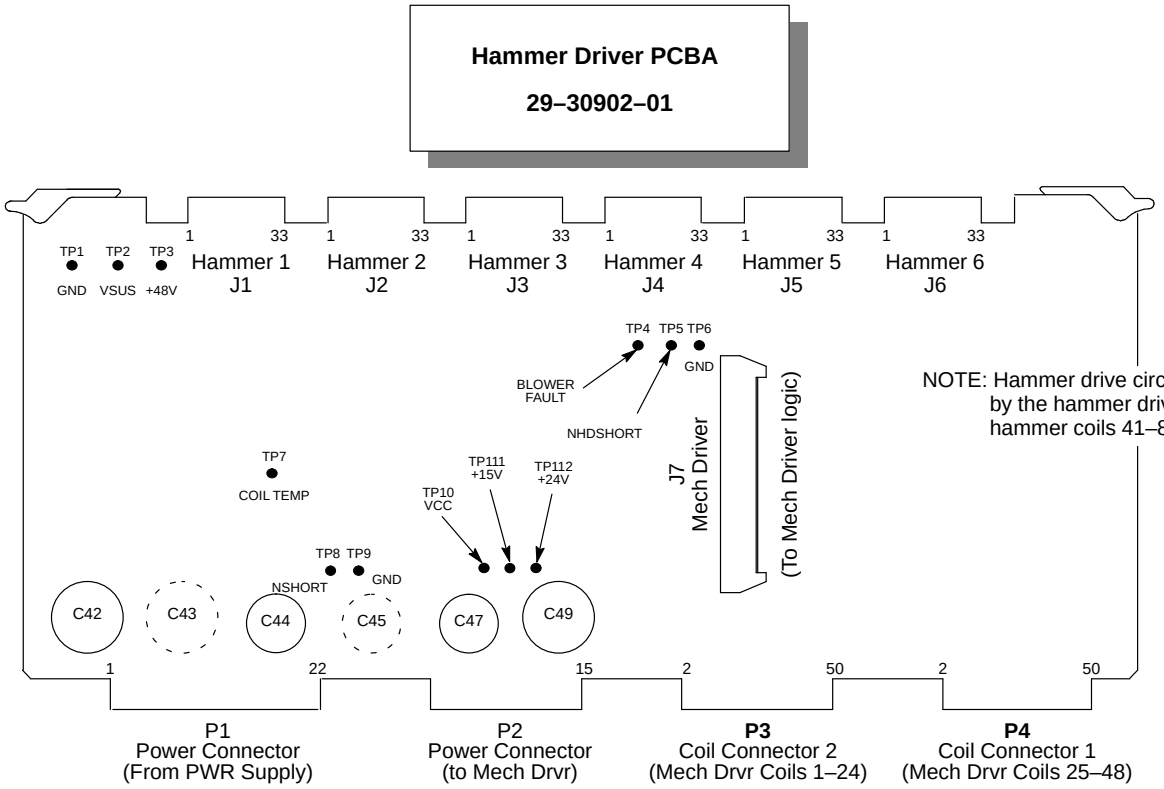
Hammer Driver PCBA

29–30902–01









P3
Coil Connector 2

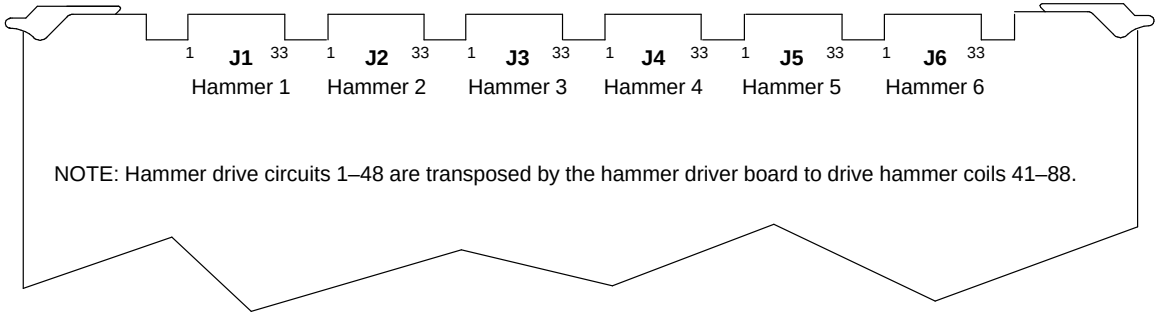
Mech. Driver Pins			Mech. Driver Pins		
50	1	MDCOIL12N	25	26	MDCOIL18N
49	2	MDCOIL24N	24	27	UDPH2C6
48	3	UDPH4C12	23	28	UDPH2C18
47	4	UDPH4C24	22	29	MDCOIL5N
46	5	MDCOIL11N	21	30	MDCOIL17N
45	6	MDCOIL23N	20	31	UDPH1C5
44	7	UDPH3C11	19	32	UDPH1C17
43	8	UDPH3C23	18	33	MDCOIL4N
42	9	MDCOIL10N	17	34	MDCOIL16N
41	10	MDCOIL22N	16	35	UDPH4C4
40	11	UDPH2C10	15	36	UDPH4C16
39	12	UDPH2C22	14	37	MDCOIL3N
38	13	MDCOIL9N	13	38	MDCOIL15N
37	14	MDCOIL21N	12	39	UDPH3C3
36	15	UDPH1C9	11	40	UDPH3C15
35	16	UDPH1C21	10	41	MDCOIL2N
34	17	MDCOIL8N	9	42	MDCOIL14N
33	18	MDCOIL20N	8	43	UDPH2C2
32	19	UDPH4C8	7	44	UDPH2C14
31	20	UDPH4C20	6	45	MDCOIL1N
30	21	MDCOIL7N	5	46	MDCOIL13N
29	22	MDCOIL19N	4	47	UDPH1C1
28	23	UDPH3C7	3	48	UDPH1C13
27	24	UDPH3C19	2	49	NC
26	25	MDCOIL6N	1	50	NC

P4
Coil Connector 1

Mech. Driver Pins			Mech. Driver Pins		
50	1	MDCOIL36N	25	26	MDCOIL42N
49	2	MDCOIL48N	24	27	UDPH2D30
48	3	UDPH4D36	23	28	UDPH2D42
47	4	UDPH4D48	22	29	MDCOIL29N
46	5	MDCOIL35N	21	30	MDCOIL41N
45	6	MDCOIL47N	20	31	UDPH1D29
44	7	UDPH3D35	19	32	UDPH1D41
43	8	UDPH3D47	18	33	MDCOIL28N
42	9	MDCOIL34N	17	34	MDCOIL40N
41	10	MDCOIL46N	16	35	UDPH4D28
40	11	UDPH2D34	15	36	UDPH4D40
39	12	UDPH2D46	14	37	MDCOIL27N
38	13	MDCOIL33N	13	38	MDCOIL39N
37	14	MDCOIL45N	12	39	UDPH3D27
36	15	UDPH1D33	11	40	UDPH3D39
35	16	UDPH1D45	10	41	MDCOIL26N
34	17	MDCOIL32N	9	42	MDCOIL38N
33	18	MDCOIL44N	8	43	UDPH2D26
32	19	UDPH4D32	7	44	UDPH2D38
31	20	UDPH4D44	6	45	MDCOIL25N
30	21	MDCOIL31N	5	46	MDCOIL37N
29	22	MDCOIL43N	4	47	UDPH1D25
28	23	UDPH3D31	3	48	UDPH1D37
27	24	UDPH3D43	2	49	NC
26	25	MDCOIL30N	1	50	NC

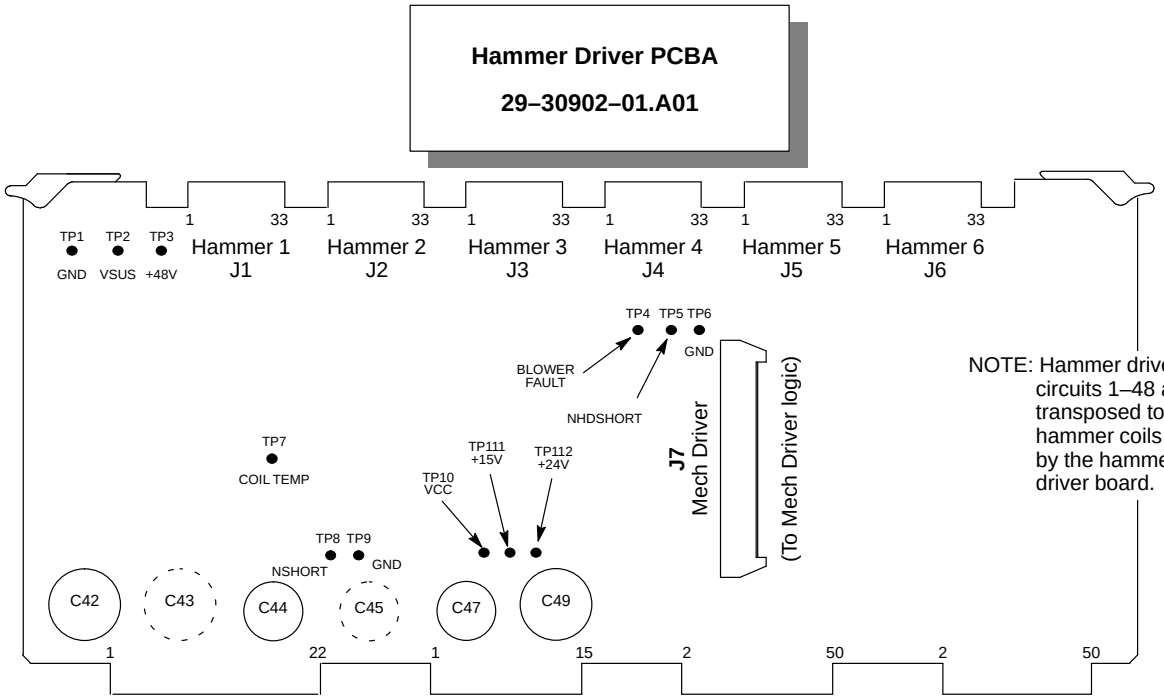
Hammer Driver PCBA

29–30902–01.A01

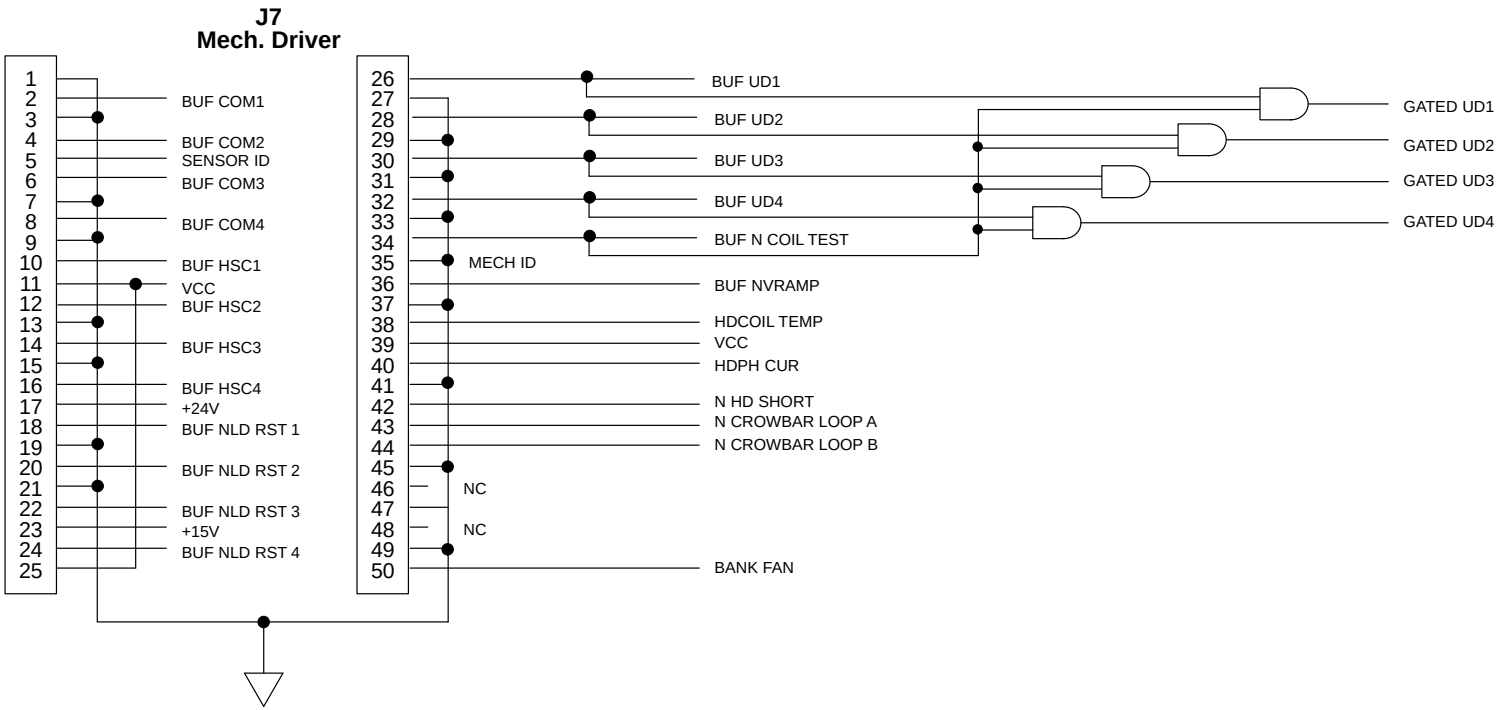


J1 Hammer1	J2 Hammer2	J3 Hammer3	J4 Hammer4	J5 Hammer5	J6 Hammer6
1	HDCOIL7N	HDCOIL23N	HDCOIL40N	MDCOIL16N	MDCOIL33N
2	UDPH3	UDPH3	UDPH4	UDPH4C16	UDPH1D33
3	HDCOIL8N	HDCOIL24N	MDCOIL1N	MDCOIL17N	MDCOIL34N
4	UDPH4	UDPH4	UDPH1C1	UDPH1C17	UDPH2D34
5	HDCOIL9N	HDCOIL25N	MDCOIL2N	MDCOIL18N	MDCOIL35N
6	UDPH1	UDPH1	UDPH2C2	UDPH2C18	UDPH3D35
7	HDCOIL10N	HDCOIL26N	MDCOIL3N	MDCOIL19N	MDCOIL36N
8	UDPH2	UDPH2	UDPH3C3	UDPH3C19	UDPH4D36
9	HDCOIL11N	HDCOIL27N	MDCOIL4N	MDCOIL20N	MDCOIL37N
10	UDPH3	UDPH3	UDPH4C4	UDPH4C20	UDPH1D37
11	HDCOIL12N	HDCOIL28N	MDCOIL5N	MDCOIL21N	MDCOIL38N
12	UDPH4	UDPH4	UDPH1C5	UDPH1C21	UDPH2D38
13	HDCOIL13N	HDCOIL29N	MDCOIL6N	MDCOIL22N	MDCOIL39N
14	UDPH1	UDPH1	UDPH2C6	UDPH2C22	UDPH3D39
15	HDCOIL14N	HDCOIL30N	MDCOIL7N	MDCOIL23N	MDCOIL40N
16	UDPH2	UDPH2	UDPH3C7	UDPH3C23	UDPH4D40
17	HDCOIL15N	HDCOIL31N	MDCOIL8N	MDCOIL24N	MDCOIL41N
18	UDPH3	UDPH3	UDPH4C8	UDPH4C24	UDPH1D41
19	HDCOIL16N	HDCOIL32N	MDCOIL9N	MDCOIL25N	MDCOIL42N
20	UDPH4	UDPH4	UDPH1C9	UDPH1D25	UDPH2D42
21	HDCOIL17N	HDCOIL33N	MDCOIL10N	MDCOIL26N	MDCOIL43N
22	UDPH1	UDPH1	UDPH2C10	UDPH2D26	UDPH3D43
23	HDCOIL1N	HDCOIL18N	HDCOIL34N	MDCOIL11N	MDCOIL27N	MDCOIL44N
24	UDPH1	UDPH2	UDPH2	UDPH3C11	UDPH3D27	UDPH4D44
25	HDCOIL2N	HDCOIL19N	HDCOIL35N	MDCOIL12N	MDCOIL28N	MDCOIL45N
26	UDPH2	UDPH3	UDPH3	UDPH4C12	UDPH4D28	UDPH1D45
27	HDCOIL3N	HDCOIL20N	HDCOIL36N	MDCOIL13N	MDCOIL29N	MDCOIL46N
28	UDPH3	UDPH4	UDPH4	UDPH1C13	UDPH1D29	UDPH12D46
29	HDCOIL4N	HDCOIL21N	HDCOIL37N	MDCOIL14N	MDCOIL30N	MDCOIL47N
30	UDPH4	UDPH1	UDPH1	UDPH2C14	UDPH2D30	UDPH3D47
31	HDCOIL5N	HDCOIL22N	HDCOIL38N	MDCOIL15N	MDCOIL31N	MDCOIL48N
32	UDPH1	UDPH2	UDPH2	UDPH3C15	UDPH3D31	UDPH4D48
33	HDCOIL6N	NC	HDCOIL39N	NC	MDCOIL32N	NC
34	UDPH2	NC	UDPH3	NC	UDPH4D32	NC

NC

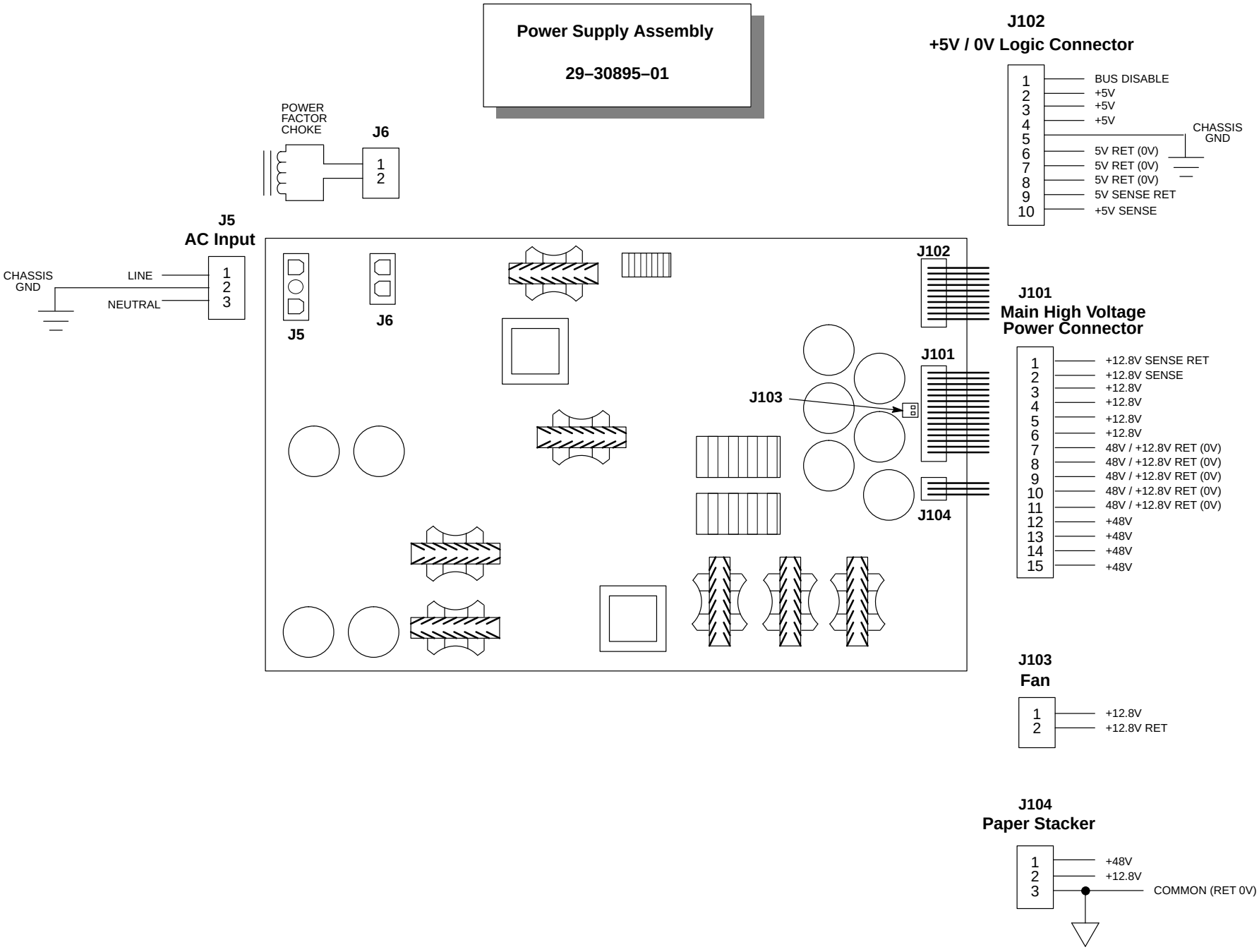


NOTE: Hammer drive circuits 1–48 are transposed to drive hammer coils 41–88 by the hammer driver board.



Power Supply Assembly

29–30895–01



J102
+5V / 0V Logic Connector

1	BUS DISABLE
2	+5V
3	+5V
4	+5V
5	CHASSIS GND
6	5V RET (0V)
7	5V RET (0V)
8	5V RET (0V)
9	5V SENSE RET
10	+5V SENSE

J101
Main High Voltage Power Connector

1	+12.8V SENSE RET
2	+12.8V SENSE
3	+12.8V
4	+12.8V
5	+12.8V
6	+12.8V
7	48V / +12.8V RET (0V)
8	48V / +12.8V RET (0V)
9	48V / +12.8V RET (0V)
10	48V / +12.8V RET (0V)
11	48V / +12.8V RET (0V)
12	+48V
13	+48V
14	+48V
15	+48V

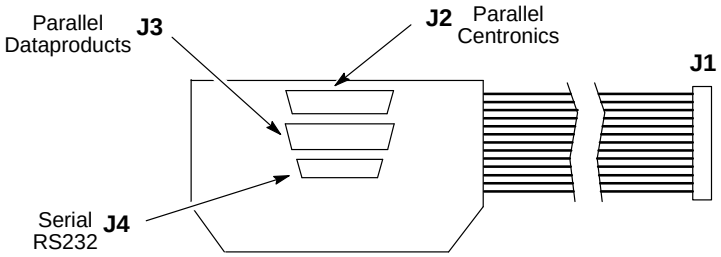
J103
Fan

1	+12.8V
2	+12.8V RET

J104
Paper Stacker

1	+48V
2	+12.8V
3	COMMON (RET 0V)

I/O Cable Assembly
29–30893–01



Parallel Centronics

J2

1	DATA STROBE
2	DB1
3	DB2
4	DB3
5	DB4
6	DB5
7	DB6
8	DB7
9	DB8
10	NACK
11	BUSY
12	PE
13	ONLINE
14	GND
15	PI
16	PE RET
17	CHASSIS GND
18	NC

J2

19	DS RET
20	DB1 RET
21	DB2 RET
22	DB3 RET
23	DB4 RET
24	DB5 RET
25	DB6 RET
26	DB7 RET
27	DB8 RET
28	BUSY RET
29	PI RET
30	NC
31	NC
32	ONLINE
33	NACK RET
34	NC
35	NC
36	NC

Parallel Dataproducts

J3

1	DB3
2	DB3 RET
3	DB1 RET
4	DB2 RET
5	OL RET
6	READY RET
7	DEMAND RET
8	NC
9	NC
10	VFU RET (N/C)
11	PAR ERR RET (N/C)
12	NC
13	PARITY RET (N/C)
14	PI RET
15	BUF CLR (N/C)
16	NC
17	NC
18	DB5 RET
19	DB1
20	DB2
21	ONLINE
22	READY
23	DEMAND
24	NC
25	NC

J3

26	VFU READY (N/C)
27	PAR ERROR (N/C)
28	DB8
29	PARITY (N/C)
30	PI
31	BUF CLR (N/C)
32	NC
33	NC
34	DB5
35	DB7 RET
36	DB7
37	DS RET
38	DATA STROBE
39	GND
40	DB4 RET
41	DB4
42	DB6 RET
43	DB6
44	DB8 RET
45	CABLE VER
46	
47	NC
48	NC
49	NC
50	NC
51	NC
52	CHASSIS GND

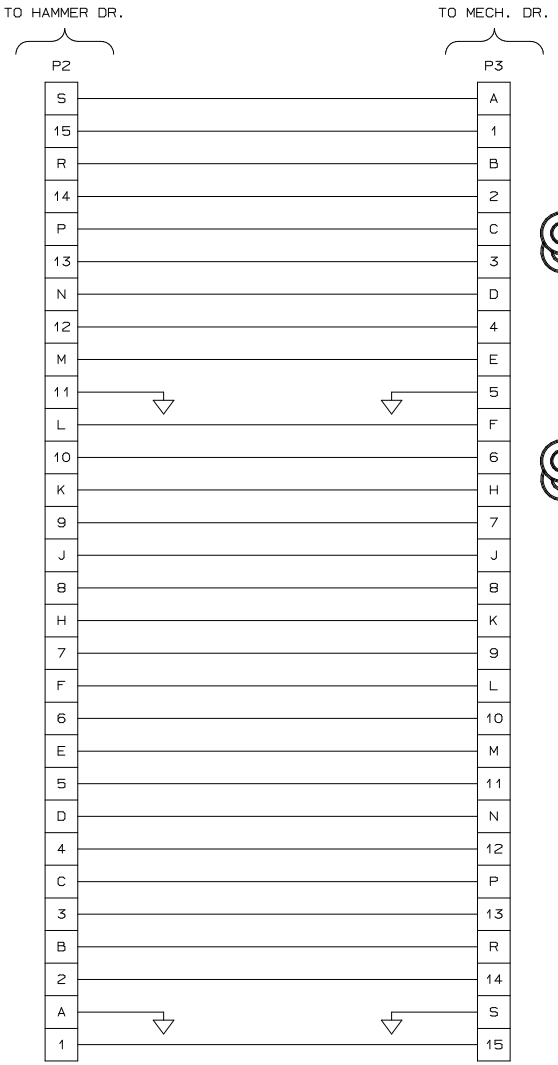
Serial RS232

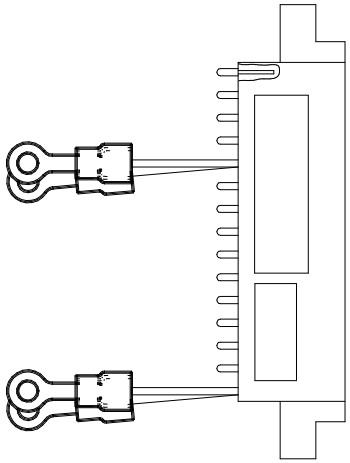
J4

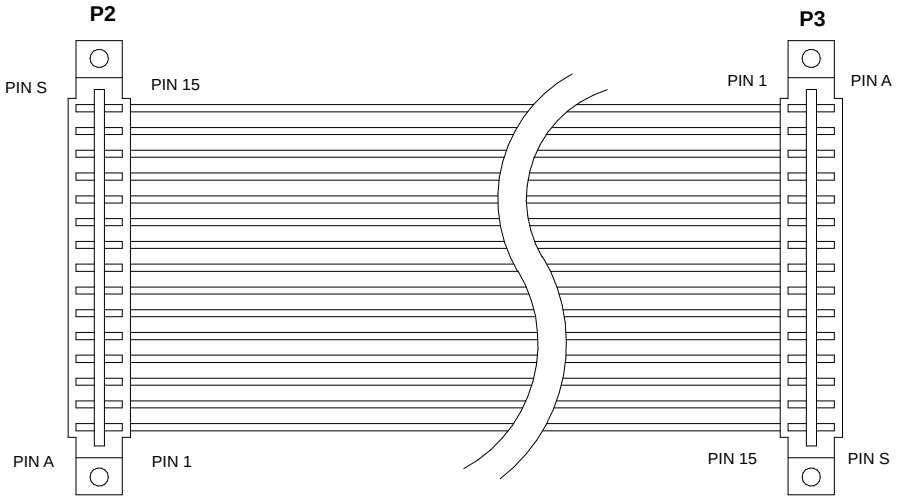
1	CHASSIS GND
2	TD
3	RD
4	RTS
5	CTS
6	DSR
7	GND
8	DCD
9	NC
10	NC
11	NC
12	NC
13	NC
14	REV CHNL
15	TX CLK
16	NC
17	RCV CLK
18	NC
19	NC
20	DTR
21	NC
22	NC
23	NC
24	NC
25	EXT CLK

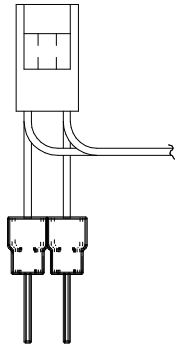
J1

1	DATA STROBE
2	DSRET
3	DB1
4	DB1RET
5	DB2
6	DB2RET
7	DB3
8	DB3RET
9	DB4
10	DB4RET
11	DB5
12	DB5RET
13	DB6
14	DB6RET
15	DB7
16	DB7RET
17	DB8
18	DB8RET
19	DEMAND
20	DEMAND RET
21	BUSY
22	BUSY RET
23	READY
24	READY RET
25	ONLINE
26	OLRET
27	PE RET
28	GND
29	PI
30	PI RET
31	NACK RET
32	PRIME
33	NACK
34	SPARE2
35	NC
36	SPARE3
37	SPARE4
38	SPARE5
39	PE
40	REVCHNL
41	TD
42	RD
43	RTS
44	CTS
45	DTR
46	DSR
47	DCD
48	TXCLK
49	RCVCLK
50	EXTCLK

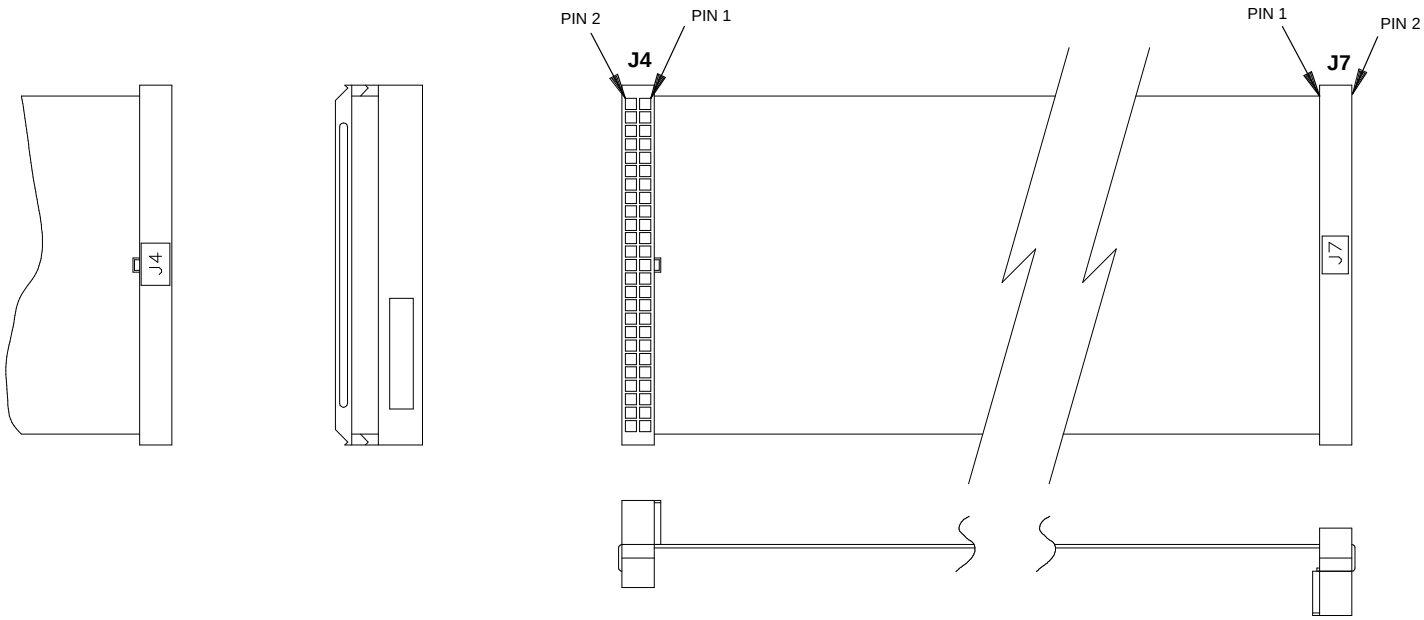




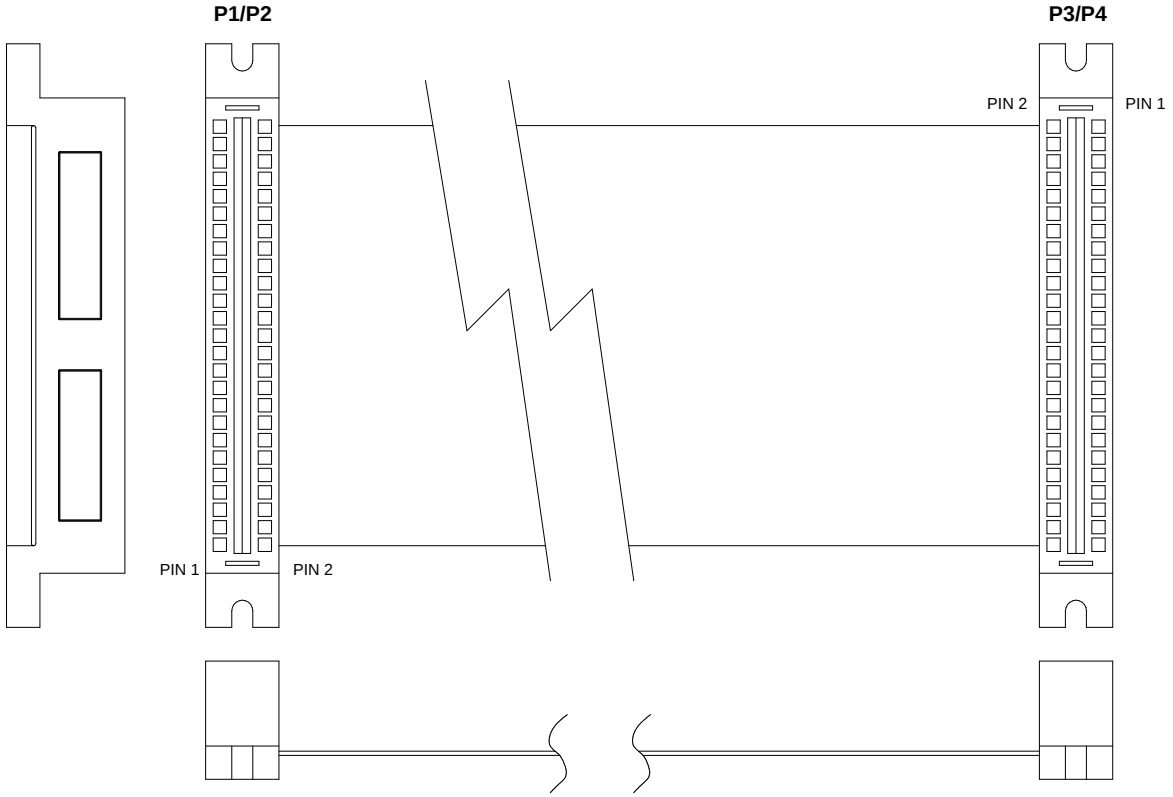




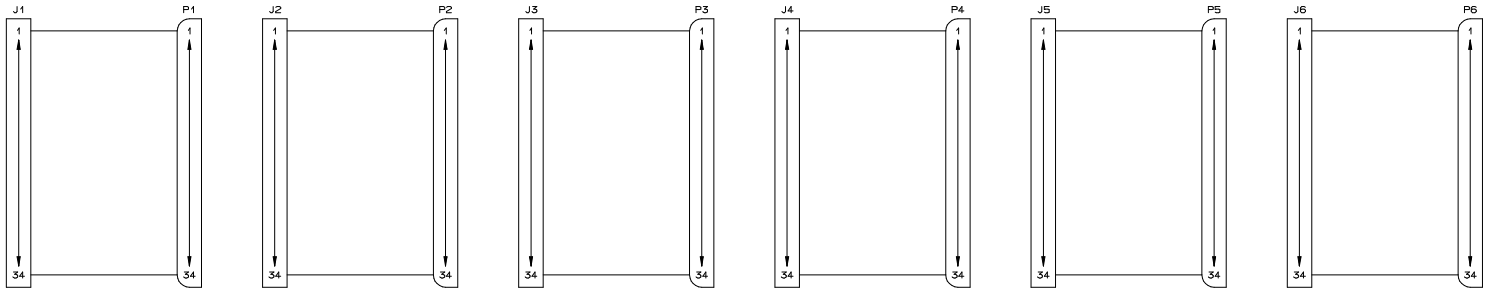
Part No.	Description
133749–001	Cable Assembly, Hmr Dr/Mech Dr 2

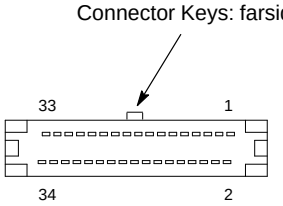


Part No.	Description
133750–001	Cable Assembly, Hmr Dr/Mech Dr

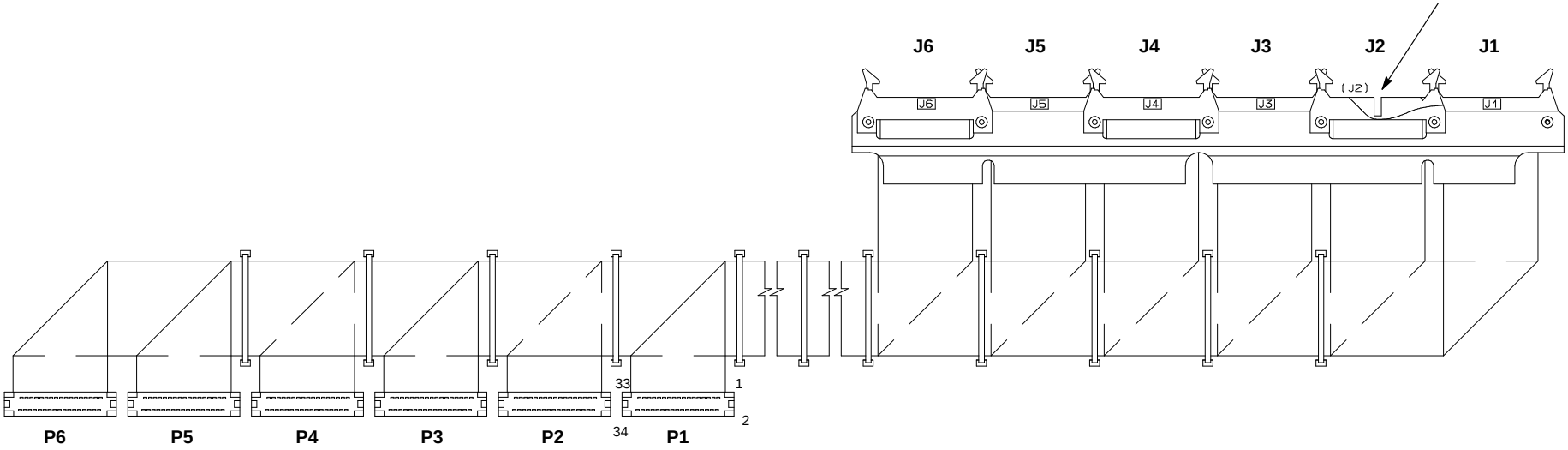


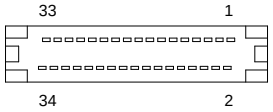
Part No.	Description
133751–001	Cable Assembly, Hmr Dr/Mech Dr 1





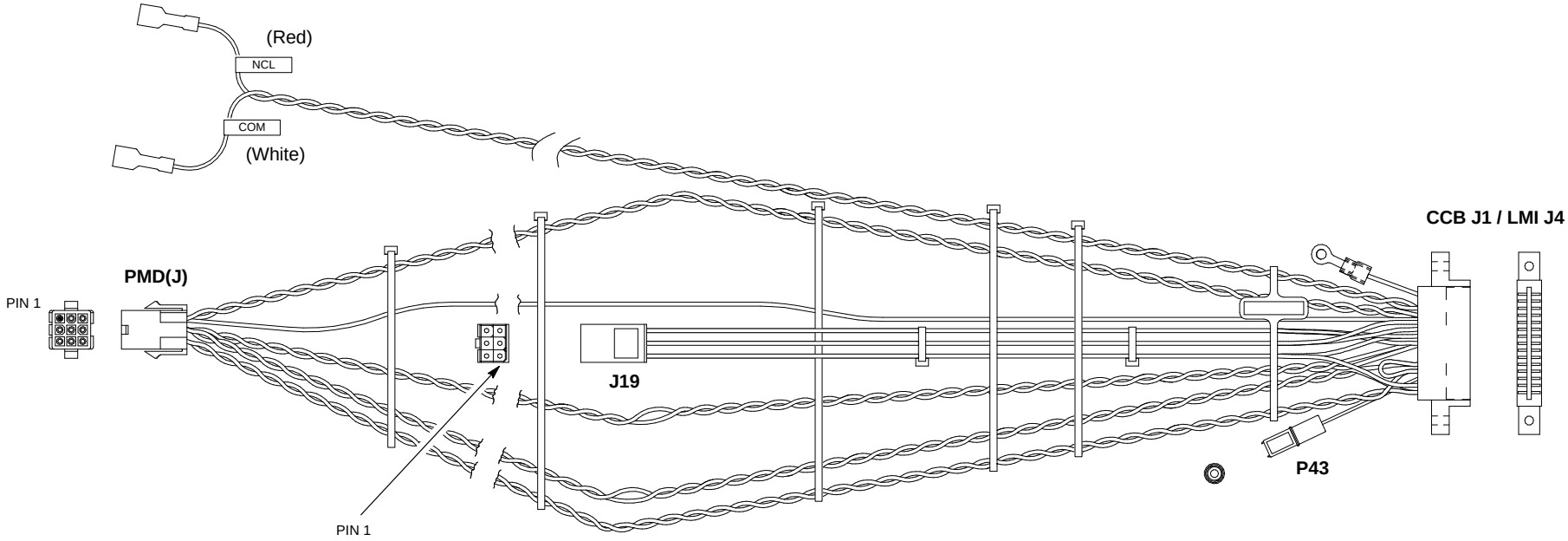
J1 – J6





P1 – P6

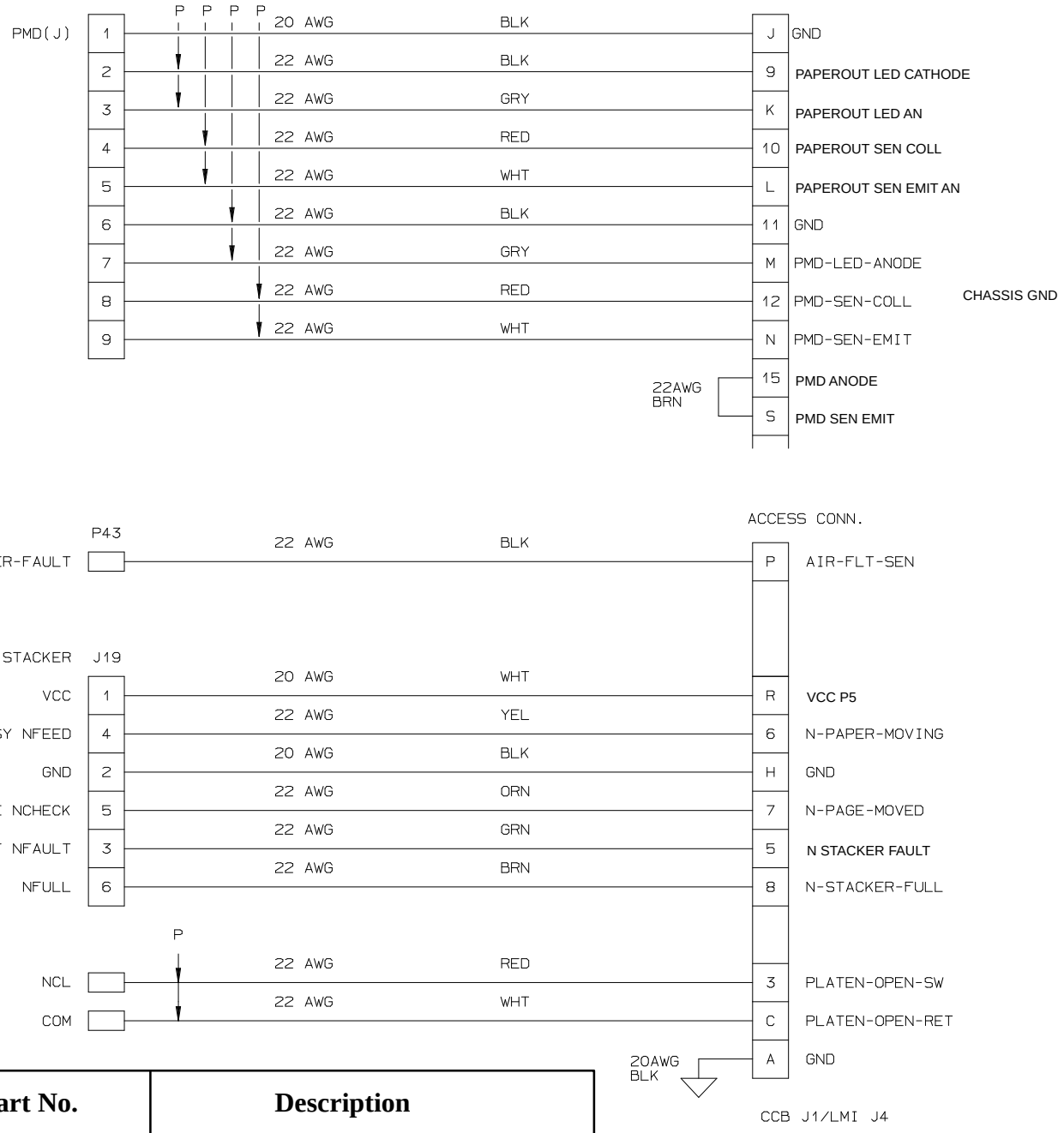
Part No.	Description
133753–001	Cable Assembly, Hammer Bank



Termination Table

CONN	TO
J1/J4	CCB / LMI
J19	PAPER STACKER
P43	BLOWER FAULT
PMD(J)	PMD, PPR OUT
NCL	NORMALLY CLOSED TERMINAL, PLATEN SWITCH
COM	COMMON TERMINAL, PLATEN SWITCH

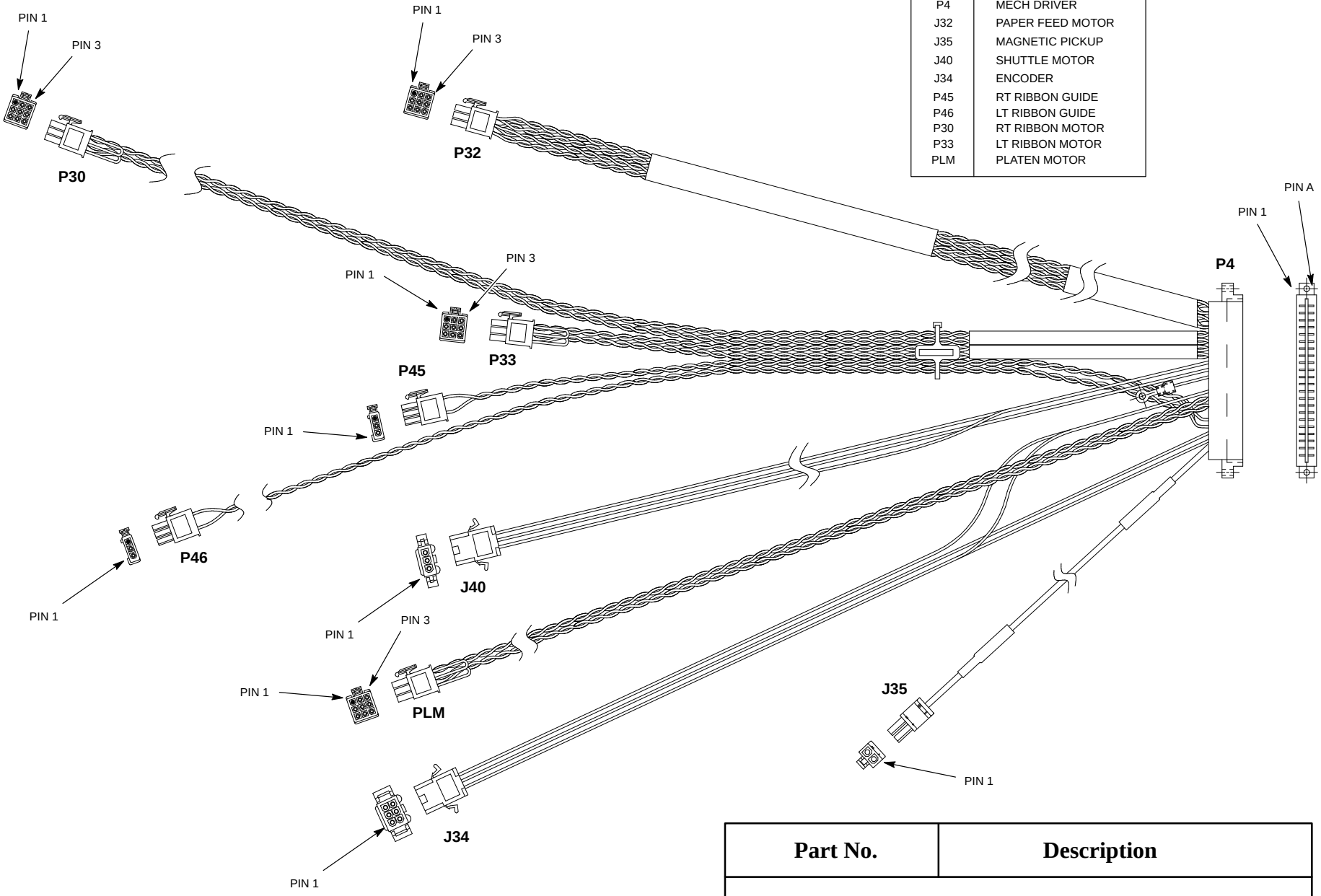
Part No.	Description
133871–001	Sensor Harness Assembly (Continued on next page.)



Part No.	Description
133871–001	Sensor Harness Assembly (Continued from previous page.)

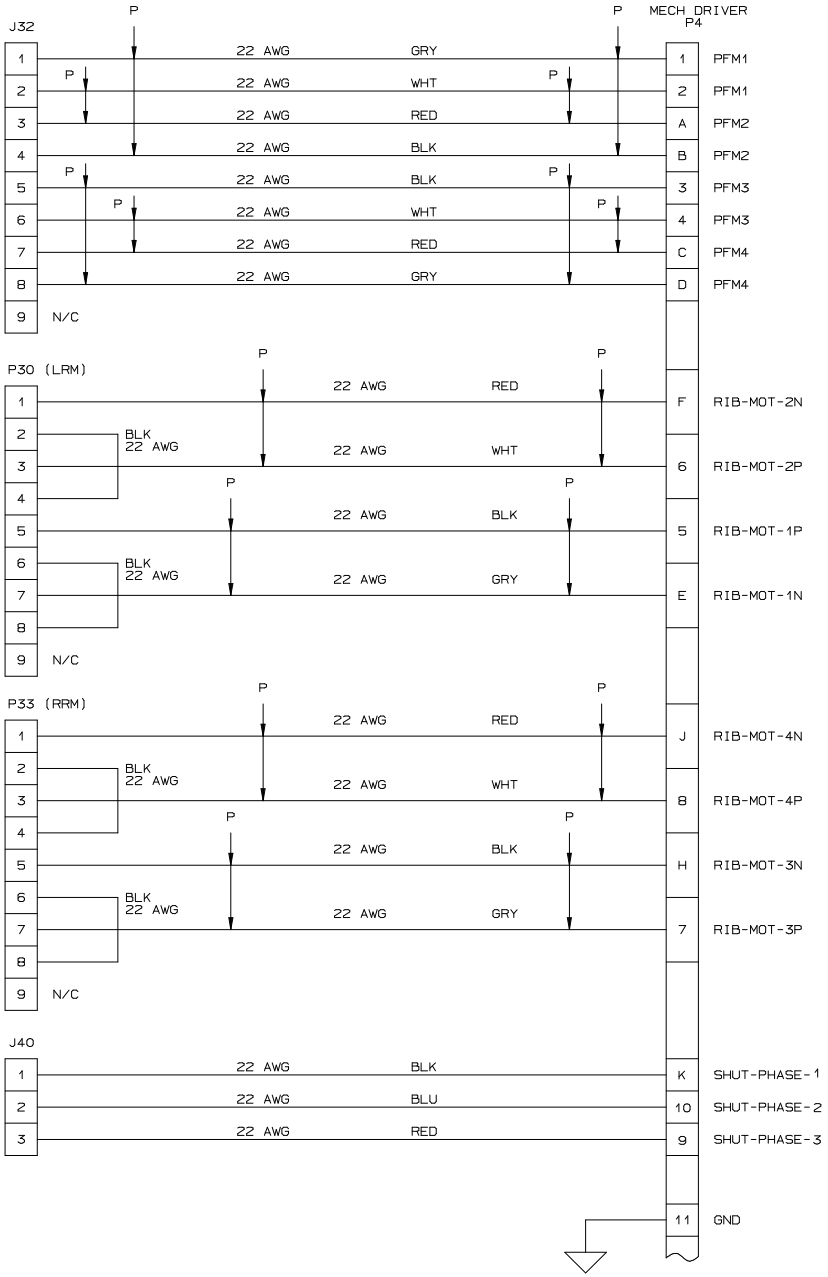
Termination Table

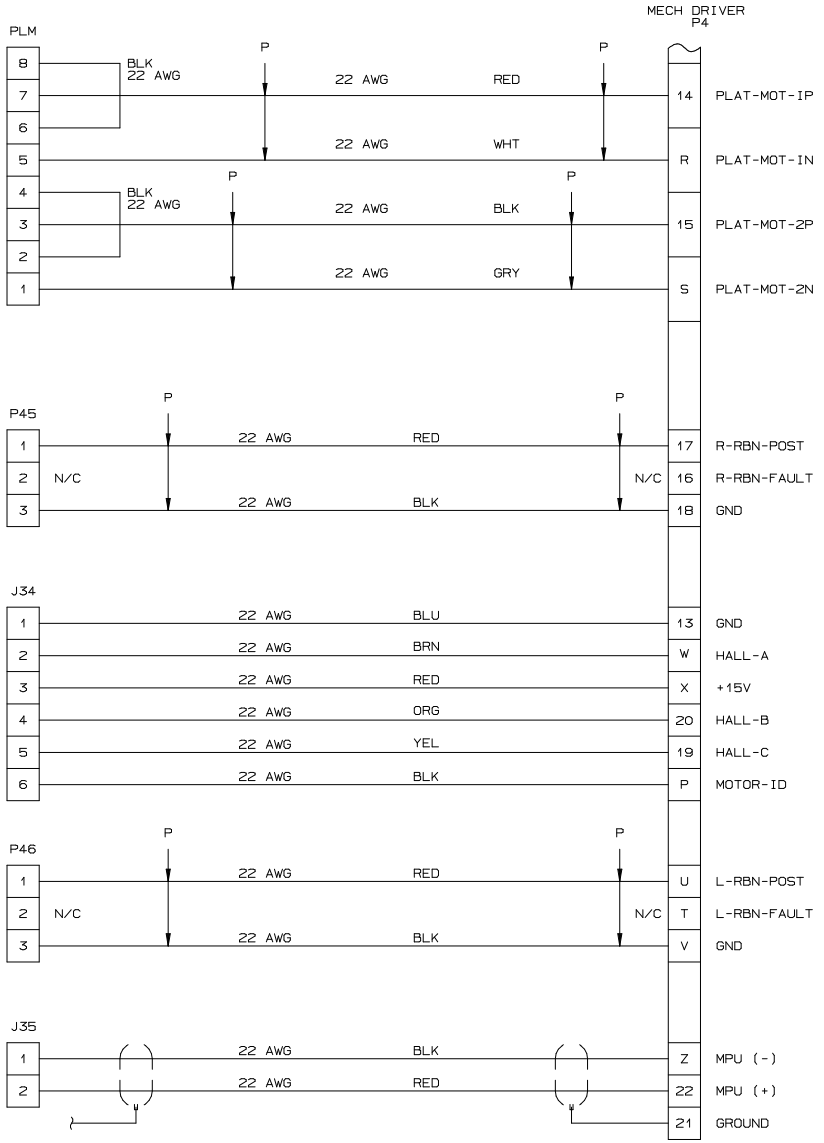
CONN	TO
P4	MECH DRIVER
J32	PAPER FEED MOTOR
J35	MAGNETIC PICKUP
J40	SHUTTLE MOTOR
J34	ENCODER
P45	RT RIBBON GUIDE
P46	LT RIBBON GUIDE
P30	RT RIBBON MOTOR
P33	LT RIBBON MOTOR
PLM	PLATEN MOTOR



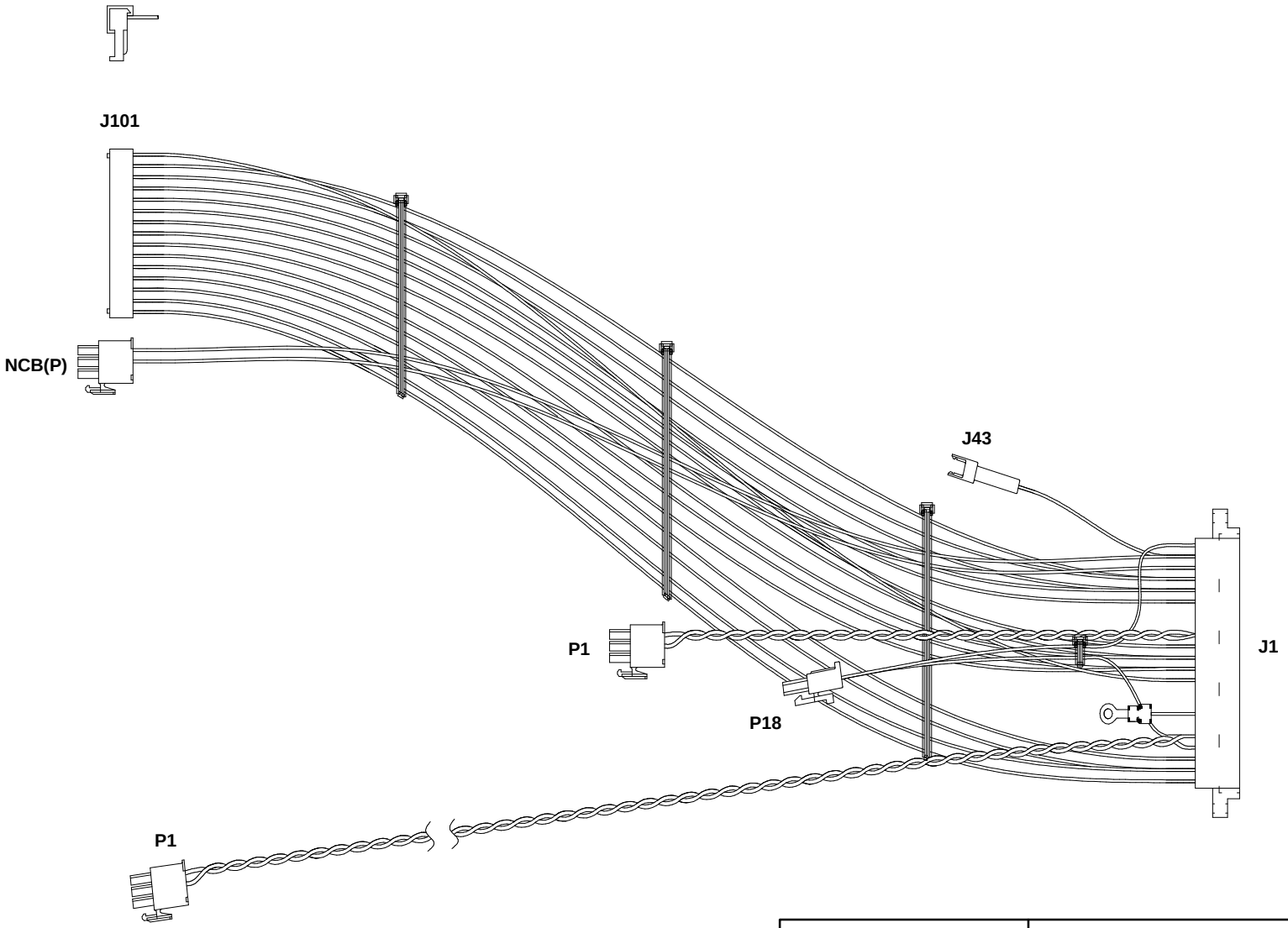
Part No.	Description
133872–001	Wire Harness, Main

(Continued on next page.)

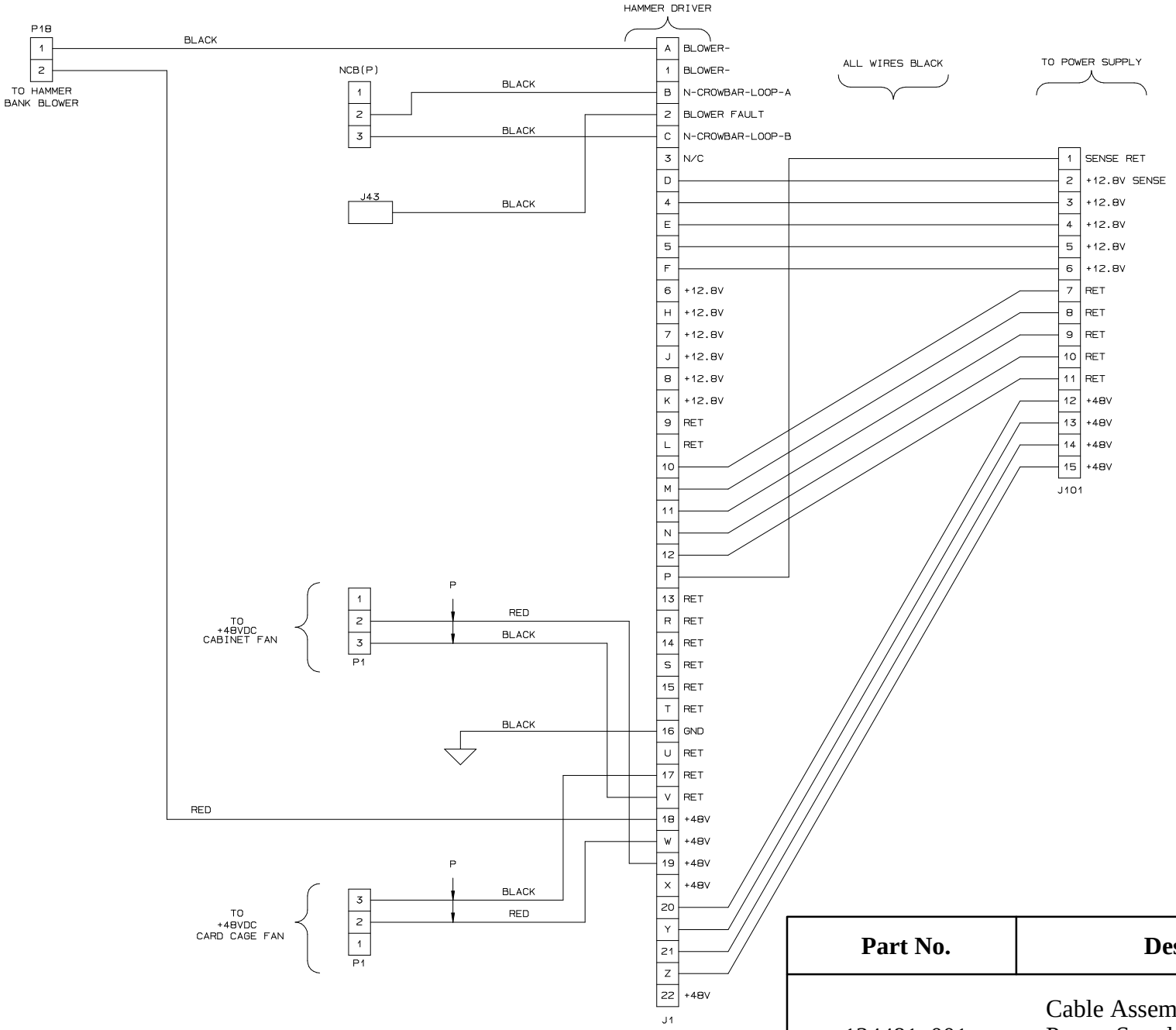




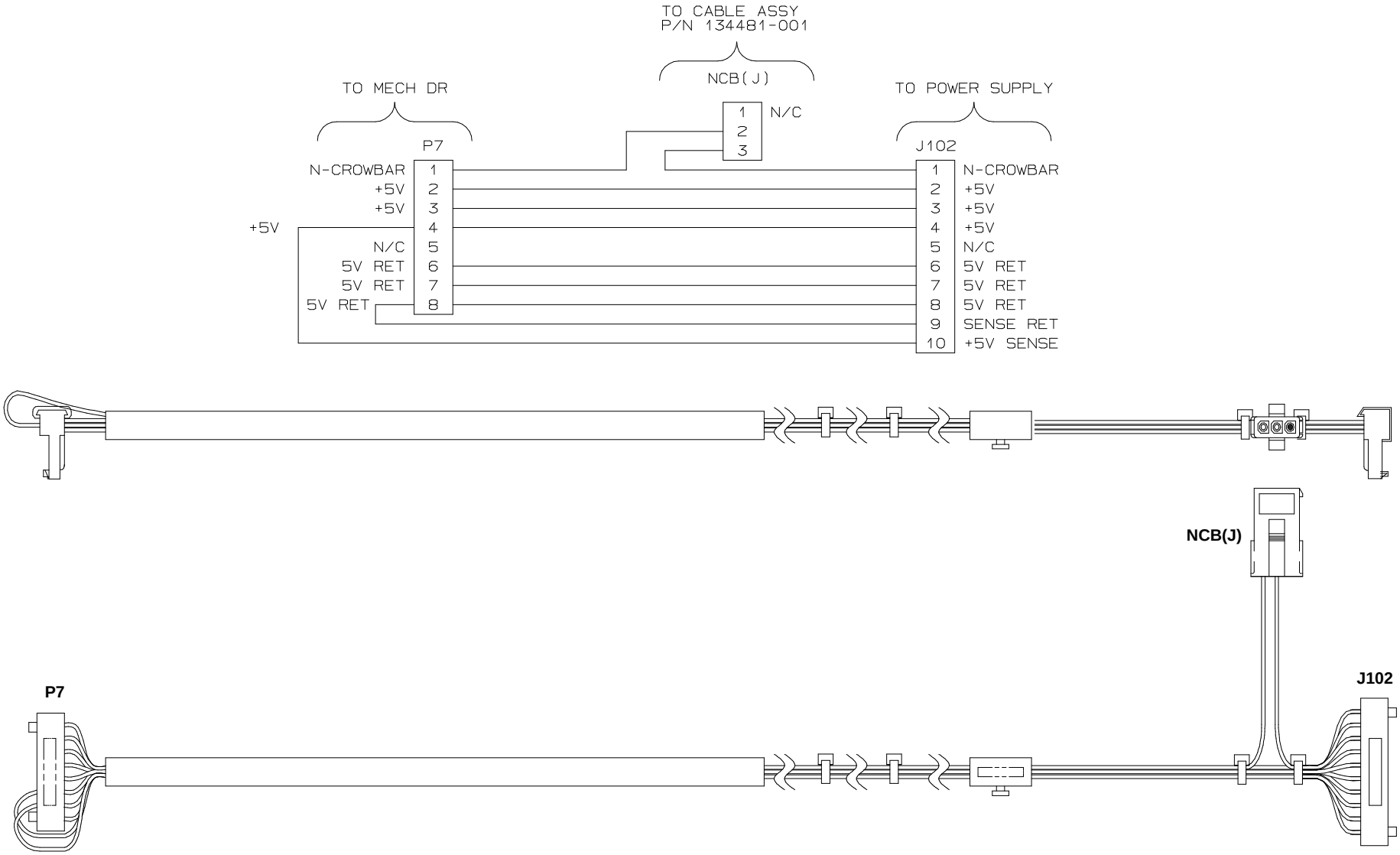
Part No.	Description
133872–001	Wire Harness, Main (Continued from previous page.)



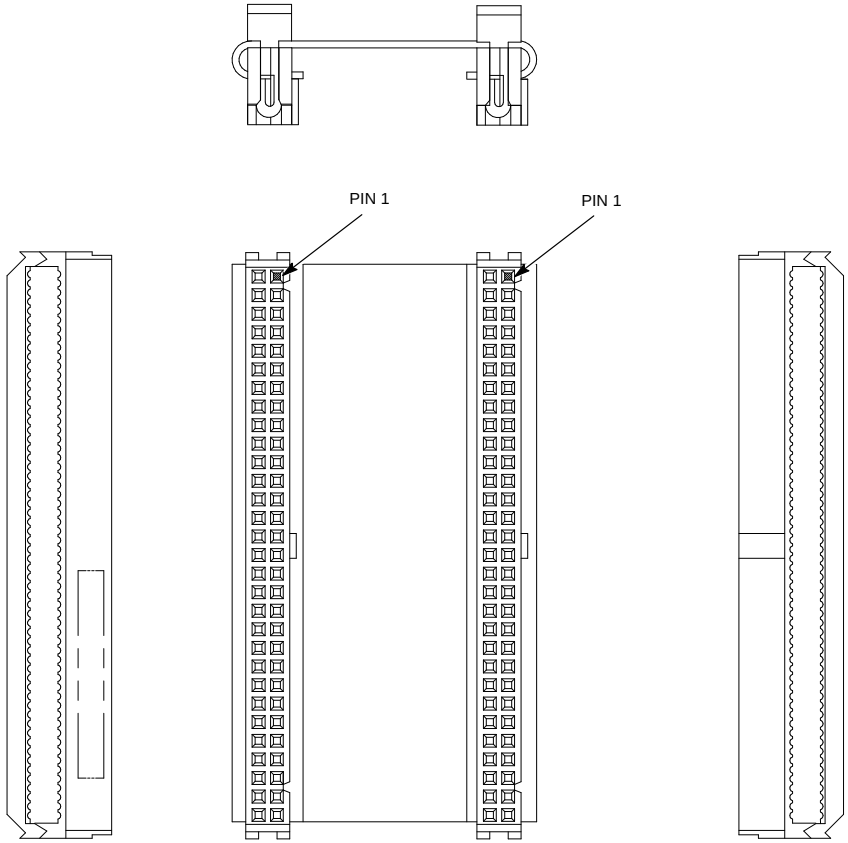
Part No.	Description
134481–001	Cable Assembly, High Voltage, Power Supply (Continued on next page.)



Part No.	Description
134481–001	Cable Assembly, High Voltage, Power Supply (Continued from previous page.)



Part No.	Description
134483–001	Cable Assembly, +5 V, Power Supply/ Mech



Part No.	Description
150551–001	Cable Assembly, CCB/Mech. Dr.

B Abbreviations, Acronyms, and Signal Mnemonics

Signal mnemonics with initial letter “N” are negative true, all others are positive true.

ACRONYM/ MNEMONIC	DEFINITION
+5VHL	Isolated +5V from –12V
ACK	Acknowledge
AIRFLT	Cooling Fan Fault
ASIC	Application–Specific Integrated Circuit
Assy	Assembly
BA0–15	Buffered Address 0 to 15
BD0–7	Buffered Data 0 to 7
BFC0–2	Function Code 0–2
BHSC	Buffered Hammer Shift Clock
BIORQ	Input Output Cycle
BLR	Blower
Btn	Button
BUSRQ	DMA Bus Request
BUSY	Busy
BUZZ	Buzzer On
BR/NW	Buffered Read/Not Write
CAS	Column Address Strobe
CDEN	Control Code Detect Enable
CDIR1,2	Ribbon Color Direction Sense
CLK	Clock
CNTLCD	Control Code Detected (Parallel)

COLL . . . . . Collector
COM . . . . . Communication to Hammer Drivers
COM1 . . . . . COM Data Line Optically Isolated
COMOUT . . . . . COM Data Output to Next H.D.
CTS . . . . . Clear to Send

DB1, 2, etc. . . . . Data Bit 1, 2, etc.
DBA1–23 . . . . . Buffered Address 1–23
DBD0–15 . . . . . Buffered Data 0–15
DCD . . . . . Data Carrier Detect
DCMOD . . . . . DC Motor Modulation
DCUDATA . . . . . DCU Data Ready for MCU
DEC . . . . . Decode
DEL . . . . . Delete Code Detected (Parallel)
DELEN . . . . . Delete Code Detect Enable
DMA . . . . . Direct Memory Access
DPMC . . . . . Dot Plucker Memory Controller
DPU . . . . . Data Processing Unit
DRAM . . . . . Dynamic Random–Access Memory
DRQ . . . . . Data Request
DRQPOL . . . . . Data Request Strobe Polarity
DRQSTB . . . . . Data Request Strobe
DS . . . . . Data Strobe
DSR . . . . . Data Set Ready
DSRET . . . . . Data Strobe Return
DTR . . . . . Data Terminal Ready
DUART . . . . . Dual Universal Asynchronous Receiver/Transmitter

ENC . . . . . Encode
EXTCLK . . . . . External Clock

FIRE0–2 . . . . . Hammer Fire 0 to 2
FL . . . . . Floppy Drive
FLT . . . . . Fault
FP . . . . . Front Panel (Control Panel)
FTIC . . . . . Fire Timer Integrated Circuit

GND . . . . . Ground

HD . . . . . Hammer Driver
Hd . . . . . Head
HESA,B,C . . . . . Hall Sense A,B,C
HESPWR . . . . . Hall Sense Power
HRS . . . . . Hammer Reset
HSC . . . . . Shift Clock for communication to Hammer Drivers

IC . . . . . Integrated Circuit
IL . . . . . Interlock Switch
INT . . . . . Interface, Interrupt
INTPOL . . . . . Interface Polarity
IPL2 . . . . . Interrupt Level 2

LATSTB . . . . . Latch Strobe
LATPOL . . . . . Latch Strobe Polarity
LCD . . . . . Liquid Crystal Display
LED . . . . . Light Emitting Diode
LRM . . . . . Left Ribbon Motor
LW . . . . . Lock Washer

MA0–8 . . . . . Memory Address 0 to 8
MOSFET . . . . . Metal Oxide Semi–conductor Field Effect Transistor
MPU . . . . . Magnetic Pick Up
Mtr . . . . . Motor
MUX . . . . . Multiplex

N . . . . . Negative True
N_ . . . . . Negative True
NACK . . . . . Acknowledge
NBAS . . . . . Address Strobe
NBG . . . . . Bus Grant
NBGACK . . . . . Bus Grant Acknowledge
NBLDS . . . . . Lower Data Strobe
NBR . . . . . Bus Request

NBUDS . . . . . Upper Data Strobe
NBUFCLR . . . . . Buffer Clear
NBRDBWR . . . . . Read or Write
NBRKRTRP . . . . . Breaker Trip
NC, N/C . . . . . Not Connected
NCASOL . . . . . Column Address Strobe Lower
NCASOU . . . . . Column Address Strobe Upper
NCIACK . . . . . Interrupt Acknowledge
NCNTCLR . . . . . Dot Count Clear
NCTC0–2 . . . . . Counter/Timer Chip 0–2 Select
NCTRO . . . . . Dot Count Read
NDAV . . . . . Data Available
NDMACS . . . . . DMA Chip Select (68B44)
NDSTBOUT . . . . . Data Strobe Out
NDTEXD . . . . . Data Transfer Extend
NEMDIS . . . . . Memory Disable (Vcc ≤ 3.4V)
NENABLE . . . . . Enable Front Panel
NEEPROM . . . . . EEPROM Device Select
NEPROM0 . . . . . EPROM 0 Device Select
NEPROM1 . . . . . EPROM 1 Device Select
NEPROM2 . . . . . EPROM 2 Device Select
NFDWR . . . . . Hammer Fire Data Write
NFIRE . . . . . Summation of Hammer Fire
NFLT . . . . . Fault
NFONT0 . . . . . Font 0 Device Select
NFONT1 . . . . . Font 1 Device Select
NHCK . . . . . Hammer Clock
NHMC . . . . . Hammer Master Clear
NHMCNF1N . . . . . Hammer Load Configuration 1 Write
NHMCNF3W . . . . . Hammer Load Configuration 3 Write
NHMRBLK . . . . . Hammer Data Blank
NHSCB . . . . . Hammer Shift Clock Optically Isolated/Buffered
NINT . . . . . CTC Interrupt to CPU
NIO0–2,5 . . . . . I/O Addresses 0–2 and 5 Select
NIRQ . . . . . Interrupt Request (Parallel)
NLD . . . . . Load Hammers
NMC . . . . . Not Master Clear (Buffered Reset)

NMFPE . . . . . Multi Function Peripheral (68901) Device Enable
NOHSTWR . . . . . No Host Writes Allowed
NOVRAM . . . . . Nonvolatile Random–Access Memory
NPAPO . . . . . Paper Out Switch
NPAPOSW . . . . . Paper Out Switch
NPCLOCK . . . . . Serial Shift Clock for Front Panel
NPE . . . . . No Paper Empty
NPLAO . . . . . Platen Open Switch
NPLOAD . . . . . Load Switch Data into Shift Register
NPLAOSW . . . . . Platen Open Switch
NPULEN . . . . . Paper Puller Enable
NRAM . . . . . RAM Bank Device Select
NRESET . . . . . Reset
NRIBEN . . . . . Ribbon Tense
NRIBFLT . . . . . Ribbon Fault
NRIBM . . . . . Ribbon Move
NRIBMOV . . . . . Ribbon Move
NRST . . . . . Reset
NRUN1,2 . . . . . Enable Paper Feed 1, 2
NSTAT . . . . . Releases NUD, HRS, DCMOD from Reset State
NSWITCH . . . . . Switch Depressed
NTOF . . . . . Top of Form
NTXSTB . . . . . DMA Transmit Data Strobe
NUD . . . . . Upper Hammer Drive
NUDTOSPD . . . . . Shuttle Up to Speed
NVRAM . . . . . Nonvolatile Random–Access Memory

OD . . . . . Over Drive
OE . . . . . Output Enable
OVEREN . . . . . Overrun Detect Enable

P1–P8 . . . . . Data 1 to 8
PAL . . . . . Programmable Array Logic
PAPIN . . . . . Paper Instruction Detected (Parallel)
PAREN . . . . . Parity Check Detect Enable
PARER . . . . . Parity Error Detected (Parallel)
PARXFER . . . . . Parallel DMA Data Transfer

PB . . . . . Parity Bit
PBE . . . . . Parity Bit Error
PCBA . . . . . Printed Circuit Board Assembly
PDATA . . . . . Front Panel Data
PE . . . . . Printer Error, Paper Empty
PF1,2 . . . . . Paper Feed 1, 2
PFC . . . . . Paper Feed Controller
PFM . . . . . Paper Feed Motor
PI . . . . . Paper Instruction
PIEN . . . . . Paper Instruction Detect Enable
PM1–4 . . . . . Paper Motion 1 to 4
PMD . . . . . Paper Motion Detect
PMDA,C,K . . . . . Paper Motion Detector A, C, K
PO . . . . . Paper Out
PP . . . . . Parallel Port
PROM . . . . . Programmable Read–Only Memory
PUF,G . . . . . Pull Up F, G

RBN . . . . . Ribbon
RCV . . . . . Receive
RD . . . . . Read
Ref . . . . . Shown for reference
REGSEL . . . . . Select LCD Register
RET . . . . . Return
REVCHNL . . . . . Reverse Channel
RIB MOT . . . . . Ribbon Motor
RIBSW1,2 . . . . . Ribbon Switch 1 & 2
RRM . . . . . Right Ribbon Motor
RSP . . . . . Ribbon/Shuttle Processor
RST . . . . . Reset
RTPU . . . . . Real Time Processing Unit
RTS . . . . . Request to Send
RXCLK . . . . . Receive Clock
RXD . . . . . Receive Detect
RXDATA . . . . . Receive Data

SDIR . . . . . Sense Direction

SEN . . . . . Sensor
SENS . . . . . Sensor
SERXFER . . . . . Serial I/O DMA Data Transfer
SHT PROP . . . . . Proportional Speed Error
SHT INTEG . . . . . Integral Speed Error
SHUT . . . . . Shuttle
Skt . . . . . Socket
SLCT . . . . . Select (On–line)
SPARE . . . . . Spare circuit or chip location
SPSHAM . . . . . Spare Sense Hammer Driver 0, 1, 2
SRAM . . . . . Static Random–Access Memory
STB . . . . . Data Strobe
Stp . . . . . Step, stepper
SW . . . . . Switch

TF . . . . . Thread Forming
THAM0–2 . . . . . Test Hammer Driver Test 0–2
TXCLK . . . . . Transmit Clock
TXD . . . . . Transmit Detect
TXDATA . . . . . Transmit Data
TXREQ01 . . . . . DMA Transmit Request

UART . . . . . Universal Asynchronous Receiver/Transmitter

V_{CC} . . . . . 5 Volts
V_{DD} . . . . . Voltage at Drain
V_{SS} . . . . . Voltage at Source

XMT . . . . . Transmit

C PROM and Chip Locations

Contents

PROM Kit

The PROM Kit (P/N 29–3094–01) for the LG12 printer contains the following items:

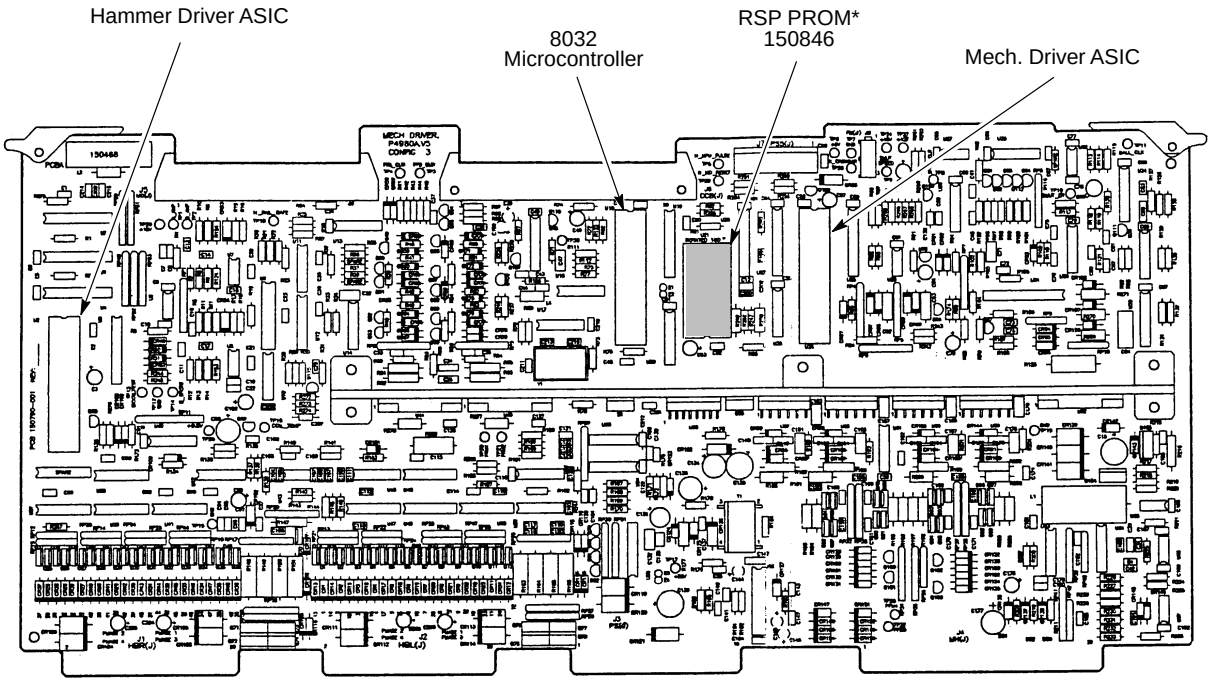
PROM	DPU	Font	RTPU	PFC	RSP
Part No.	151043–001 (Hi–1) 151043–002 (Lo–1) 151043–003 (Hi–2) 151043–004 (Lo–2)	151029–001 (Hi–1) 151029–002 (Lo–1) 151029–003 (Hi–2) 151029–004 (Lo–2)	134610	151006	150916

NOTE: PROMs are shaded on the location drawings.

LEGEND

RSP = Ribbon/Shuttle Processor

ASIC = Application–Specific Integrated Circuit



* RSP oriented 180 degrees
opposite other ICs.

Figure C–1. Mechanism Driver Board

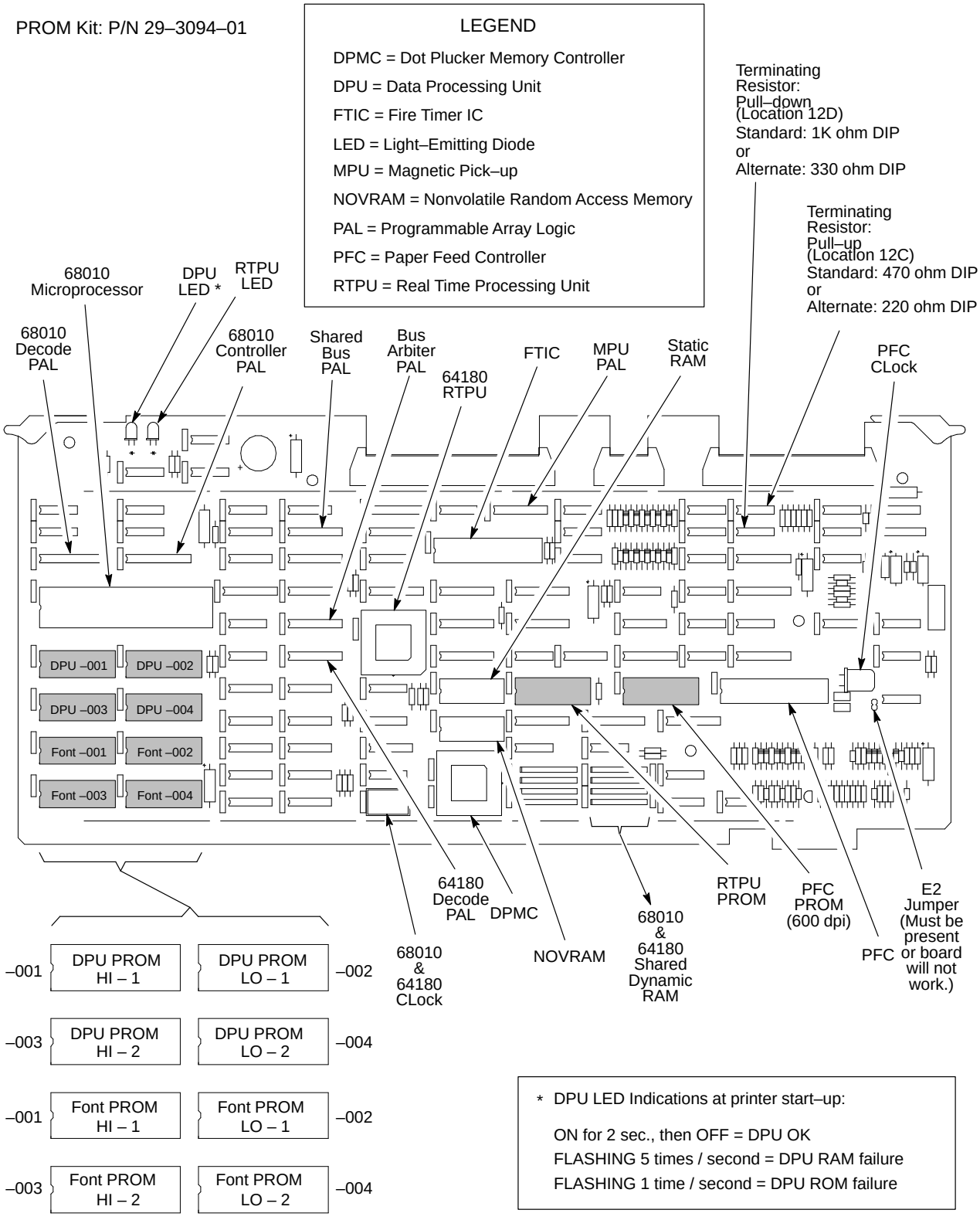


Figure C–2. Common Controller Board (CCB)

D Torque Table

Table C–1 establishes the torque requirements for routine installation of threaded fasteners. These requirements apply to fasteners made of steel, at a minimum engagement of 3.5 threads, including chamfer and countersink. Fastener sizes are listed as Numbered Size – Threads Per Inch.

Torque Table

Carbon Steel Fasteners (ANSI B18.6.3 – 1972)				
Fastener Size	**Into Alum. or Brass** 25 000 psi ultimate tensile strength	**Into Steel** 60 000 psi ultimate tensile strength	**Into Weld/Press Studs or Nuts**	**Into Medium Carbon Steel Fasteners** 105,000 psi ultimate tensile strength
2–56	25 ± 2 in oz	36 ± 2 in oz	30 ± 2 in oz	—
4–40	62 ± 4 in oz	75 ± 5 in oz	70 ± 5 in oz	—
6–32	122 ± 7 in oz	150 ± 10 in oz	135 ± 10 in oz	—
8–32	11 ± 1 in lb	18 ± 1 in lb	18 ± 1 in lb	—
10–24	20 ± 1 in lb	25 ± 1.5 in lb	21 ± 1 in lb	—
10–32	15 ± 1 in lb	29 ± 2 in lb	29 ± 1 in lb	—
1/4 – 20	40 ± 3 in lb	62 ± 4 in lb	62 ± 4 in lb	105 ± 5 in lb

Fastener Size	**Torque for Routine Tightening of Threaded Fasteners**
4–40 UNC & 4–48 UNF	4 ± 1 in lb
6–32 UNC & 6–40 UNF	11 ± 1 in lb
8–32 UNC & 8–36 UNF	19 ± 1 in lb
10–24 UNC & 10–32 UNF	25 ± 1 in lb

E Metric Conversion Tables

Length

Multiply	By	To Obtain
foot	0.3048*	meter (m)
foot	30.48*	centimeter (cm)
foot	304.8*	millimeter (mm)
inch	0.0254*	meter (m)
inch	2.54*	centimeter (cm)
inch	25.4*	millimeter (mm)
meter	3.280840	foot
centimeter	0.03280840	foot
millimeter	0.003280840	foot
meter	39.37008	inch
centimeter	0.3937008	inch
millimeter	0.03937008	inch
	* Figure is exact.	

Torque

Multiply	By	To Obtain
pound/inch	175.1268	newton/meter (N•m)
pound/foot	14.59390	newton/meter (N•m)
newton/meter (N•m)	0.005710148	pound/inch
newton/meter (N•m)	0.06852178	pound/foot

Mass and Density

Multiply	By	To Obtain
pound*	0.4535924	kilogram (kg)
ounce*	28.34952	gram (g)
kilogram	2.204622	pound*
gram	0.03527397	ounce*
	* avoirdupois	

Temperature

To Convert From	To	Use Formula
temperature Celsius (t_C)	temperature Fahrenheit (t_F)	$t_F = 1.8t_C + 32$
temperature Fahrenheit (t_F)	temperature Celsius (t_C)	$t_C = (t_F - 32)/1.8$

Power

Multiply	By	To Obtain
Btu (International Table)/hour	0.2930711	watt (W)
watt (W)	3.412141	Btu (International Table)/hour
watt (W)	0.001359621	horsepower (metric)
horsepower (metric)	735.499	watt (W)

F Printer Specifications

Contents

Ribbon Specifications

Carbon Black, OCR: LG12R–BC

Fabric: Nylon, 1 inch x 100 yards spool–to–spool; metal reversing tabs on each end

NOTE: For best print quality, only use ribbons that meet these specifications. Use of ribbons that do meet Digital specifications may void your printer warranty.

Paper Specifications

Paper

Type:	Edge–perforated, fan–folded, 3 to 16 inches wide
Thickness:	Single–part, 15 to 100 pound stock; Multi–part, 1– to 6–part forms, carbon and carbonless
Sheet Thickness:	0.025 inches maximum
Drive:	Adjustable tractors, 8–pin engagement
Slew Rate:	20 inches–per–second maximum

Labels

On Backing:	One–part continuous perforated fan–folded back form. Labels must be placed at least 1/6 inch from the fold perforation. Backing adhesive must not be squeezed out during printing.
Sheet Size:	Three to 16 inches wide, including the two standard perforated tractor feed strips. A maximum sheet size of 12 inches between top and bottom perforations.
Thickness:	Not to exceed 0.025 inch (including backing sheet)

Printer Dimensions

Height:	105.9 cm (42 inches)
Width:	86.4 cm (34 inches)
Depth:	72.4 cm (29 inches)
Weight:	Approximately 150 kg (330 lbs.) – Unpacked Approximately 201 kg (450 lbs.) – Packaged for shipping

Interfaces

Type:	Two parallel and one serial, all resident
Logic Levels:	TTL/EIA–232D
Data Format:	ASCII
Compatibility:	Centronics, Dataproducts, EIA–232D
Buffer Size:	2 lines parallel, 1 Kilobyte serial

Environmental Characteristics

Temperature

Operating	10° C to 35° C (50° F to 95° F)
Storage	– 40° C to 70° C (–40° F to 158° F)

Relative Humidity

Operating	10% to 90% (noncondensing)
Storage	5% to 95% (noncondensing)

Acoustic Noise Level

Less than 55 dBA (tested per ISO 7779)

Electrical Characteristics

Input Power

Voltage	100–120 / 200–240 Vac
Phase	Single
Frequency	50 Hz or 60 Hz (47 Hz to 62 Hz)

Power Rating

Standby	330 VA 60 Hz (200 Watts)
Operating	830 VA 60 Hz (520 Watts)

Data Input Rate (maximum)

Dataproducts	Up to 500,000 characters per second
Centronics	Up to 200,000 characters per second
RS–232	Up to 19.2K Baud

Radio Frequency Interference (RFI)

Radio Frequency Interference tested/certified to RFI standards FCC 15.B Class A; VDE 0871 Class B; CISPR–22.

Print Rates

The printing speed of text characters is a function of the selected font and dot density, and is measured in lines per minute (LPM). Print speed is independent of the number of characters configured in the character set. Text attributes such as bold or emphasized printing, superscripts, subscripts, or elongated characters cause print rates to decrease to not less than half the rates of the font without such attributes. Table F–1 charts typical LG12 printing rates. The plotting speed of graphics is measured in inches per minute (ipm), and is calculated as follows:

$$\frac{1}{\text{Shuttle Speed} \times \text{Vertical Density}} \times 60{,}000 = \text{Plotting speed in inches/minute}$$

Shuttle speed varies with the horizontal dot density:

	Horizontal Density (dots/inch)	Shuttle Speed (milliseconds/stroke)
Selectable by graphics control codes	50	6.25
	60	6.25
	70	6.25
	80	6.25
	90	6.25
	100	6.25
	110	6.25
	120	6.25
	130	6.75
	140	7.25
	150	7.8
	180	9.375
	200	10.4

NOTES:

1. The theoretical plot speed is reduced by half if there are adjacent dots in a dot row (as in the case of RASTER plot). This limitation is due to the hammer fire cycle time.
2. The theoretical plot speed is again reduced by half if the number of non–adjacent dots in a row exceeds 86% of the maximum number of non–adjacent dots for a given horizontal print resolution (this limitation is due to power consumption requirement).

Table F–1. Printing Rates

Print Application			Performance	
Emulation, Font, and Characters /inch (cpi)	**Dot Density[1]**	**Dot Matrix[2]**	**Uppercase Only (lines/minute)**	**Descenders & Underline (lines/minute)**
LG06 DP 5	60 (120) x 66.6	10 (18) x 7 + 2	900	720
LG06 DP 6	60 (120) x 66.6	8 (14) x 7 + 2	900	720
LG06 DP 10	60 (120) x 66.6	5 (9) x 7 + 2	900	720
Pro[3] DP 10	60 (120) x 75	5 (9) x 7 + 2	900	720
LG06 DP 12	60 (120) x 66.6	4 (7) x 7 + 2	900	720
Pro DP 12	60 (120) x 75	4 (7) x 7 + 2	900	720
LG06 DP 15	60 (120) x 100	3 (5) x 7 + 2	900	720
Pro DP 17	60 (120) x 75	3 (5) x 7 + 2	900	720
Pro DP 20	60 (120) x 75	3 (5) x 7 + 2	900	720
LG06 NLQ[4] 5	90 (180) x 85.7	14 (26) x 9 + 3	480	370
LG06 NLQ 6	90 (180) x 85.7	12 (22) x 9 + 3	480	370
LG06 NLQ 10	90 (180) x 85.7	7 (13) x 9 + 3	480	370
Pro NLQ 10	90 (180) x 100	7 (13) x 9 + 3	480	370
LG06 NLQ 12	90 (180) x 85.7	6 (11) x 9 + 3	480	370
Pro NLQ 12	90 (180) x 100	6 (11) x 9 + 3	480	370
LG06 NLQ 15	90 (180) x 85.7	5 (9) x 9 + 3	480	370
LG06 CMP 6.6	60 (120) x 85.7	4 (7) x 7 + 2	900	720
LG06 CMP 8.3	75 (150) x 85.7	4 (7) x 7 + 2	720	575
LG06 CMP 13.3	60 (120) x 85.7	4 (7) x 7 + 2	900	720
LG06 CMP 16.6	75 (150) x 85.7	4 (7) x 7 + 2	720	575
LG06 HS 10	60 (120) x 50	5 (9) x 5 + 1	1200	1030
LG06 OCR–A 10	120 (120) x 150	12 (12) x 15 + 1	300 (best) 450 155 (worst) 232	
LG06 OCR–B 10	120 (120) x 150	12 (12) x 15 + 1	300 (best) 450 155 (worst) 232	

[1] A (B) x C where: A = maximum horizontal dot density; B = horizontal dot placement density; C = vertical dot density.

[2] D (E) x F + G where: D = maximum number of dots to be placed on horizontal dot positions; E = horizontal dot positions; F = number of vertical dots for uppercase symbols; G = number of dots available for descenders.

[3] Pro = Proprinter emulation

[4] NLQ = correspondence, CMP = compressed, HS = high speed

Duty Cycle

The LG12 can print 150,000 pages per month under the following conditions:

1. Uppercase only
2. 6 lines per inch (lpi)
3. 10 characters per inch (cpi)
4. 50% character density, or 66 characters per line
5. 50% line density, or 33 lines per 11–inch page
6. Single part (18 lb) paper
7. Printer is maintained in good operating condition.
8. Printer is installed as directed in the *User's Manual*.

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