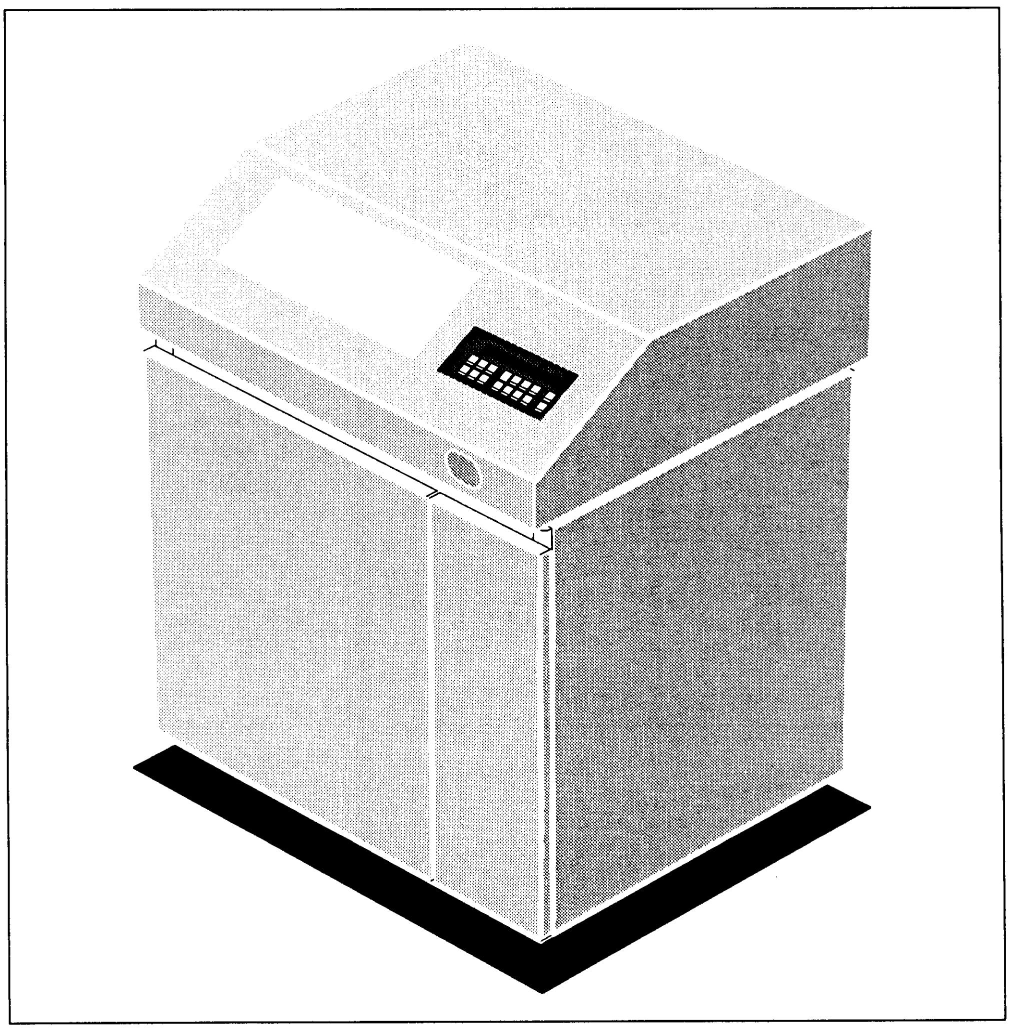
6412 Line Matrix Printer

G246–0055–00

Maintenance Information Manual



IBM

6412 Line Matrix Printer

G246–0055–00

Maintenance Information Manual

Note!

Before using the information and the product it works with, ensure that you read the general information under "Notices" on page vi.

First Edition (February 1994)

This edition applies to the IBM 6412 Line Matrix Printer, models A00 and CT0.

Pennant Systems has prepared this maintenance documentation for the use of Pennant service representatives for the installation, maintenance, and repair of the specific machine indicated. IBM/Pennant makes no representation that it is suitable for any other purpose.

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Electronic Emission Notices

Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canadian Department of Communications Compliance Statement

This equipment does not exceed Class A limits per radio noise emission for digital apparatus, set out in the Radio Interference Regulation of the Canadian Department of Communications.

Operation in a residential area may cause unacceptable interference to radio and TV reception requiring the owner or operator to take whatever steps are necessary to correct the interference.

Avis de conformité aux normes du ministère des Communications du Canada.

Cet équipment n dépasse pas les limites de Classe A d'émission de bruits radioélectriques pour les appareils numériques, telles que prescrites par le Réglement sur brouillage radioélectrique étabil par le ministére de Communications du Canada. Léxploitation faite en milieu résidential peut entraîner le brouillage des réceptions radio et télé, ce qui obligerait le propriétaire ou l'opérateur à prendre les dispositions nécessaires pour en éliminer les causes.

New Zealand Compliance Statement

This is a Class A computing device and shall not be located at a distance closer than 20 meters from the boundary of a residential property.

United Kingdom Telecommunications Compliance Act

This equipment is approved under approval number NS/G/23/J/100003 for indirect connections to the public telecommunications systems in the United Kingdom.

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IGP	Printronix, Inc.
Printronix	Printronix, Inc.

Safety Notices

DANGER

To prevent serious personal injury from electrical shock when connecting or disconnecting the signal cable, set the printer power switch to the off position and unplug the power cable.

DANGER

Always disconnect the AC power cord from the power source before performing any maintenance procedure. Failure to remove power could result in injury to persons or damage to equipment. If you must apply power during maintenance, you will be instructed to do so in the maintenance procedure.

DANGER

Always disconnect the AC power cord before cleaning the printer.

CAUTION

Over time, the upper edge of the paper ironer can become sharp. To avoid cutting yourself, handle the paper ironer on the sides.

CAUTION

Hold the printer cover securely while disengaging the gas spring assembly.

DANGER

Exercise caution when configuring the printer. Exposed moving parts can cause injury, and electrical currents are shock hazards.

CAUTION

The gear teeth on the flywheel are sharp and the flywheel can "jump" off the cam when it is rotated. To avoid hand injuries when rotating the flywheel, hold the flywheel with a cloth.

CAUTION

When the cam cover is removed from the printer, a rotating flywheel is hazardous and can cause personal injury. Keep hands, tools, and clothing away from the flywheel when the printer is on and the cam cover is removed.

Sikkerhedsinstruktioner

DANISH

FARE

Hver gang De vil sætte ledningen, der forbinder computeren og printeren, i eller tage den ud, skal De først slukke for printeren og tage stikket ud af stikkontakten for at forebygge alvorlig personskade der forvoldes af elektriske stød.

FARE

Afbryd altid strømmen ved at tage stikket ud af kontakten inden De foretager nogen form for vedligeholdelsesprocedure. Undlader man at afbryde strømmen kan det føre til maskin- eller personskade. Dersom der skal bruges strøm under vedligeholdelseseftersyn, vil De blive instrueret om at slutte den til i vedligeholdelsesvejledningen.

FARE

Tag stikket ud af kontakten inden De gør printeren ren.

FORSIGTIG

Med tiden kan overkanten af papirudglatteren blive skarp, så for ikke at skære sig, skal man kun holde papirudglatteren på siderne.

FORSIGTIG

Sørg for at printerdækslet holdes fast mens dækselpumpen frigøres.

FARE

Udvis forsigtighed mens printeren konfigureres. Blottede bevægelige dele kan forvolde skade og tændt strøm udgør risiko for stød.

Veiligheidsaanwijzingen

DUTCH

GEVAARLIJK

Om zwaar letsel door elektrische schok te voorkomen bij het aansluiten of loskoppelen van de signaalkabel, dient u de printer uit te schakelen en het netsnoer uit het stopcontact te nemen.

GEVAARLIJK

Neem het netsnoer altijd uit het stopcontact voordat u onderhouds-werkzaamheden gaat uitvoeren. Het niet afsluiten van de stroom kan persoonlijk letsel of beschadiging van de apparatuur tot gevolg hebben. Mocht u tijdens onderhoudswerkzaamheden toch netvoeding nodig hebben, dan worden daarover in de beschrijving van het onderhoud aanwijzingen gegeven.

GEVAARLIJK

Neem het netsnoer uit het stopcontact voordat u de printer gaat schoonmaken.

VOORZICHTIG

Na verloop van tijd kan de bovenkant van de papierstrijker scherp worden. Om te voorkomen dat u zich snijdt, dient u de papierstrijker bij de zijkanten beet te pakken.

VOORZICHTIG

Houd de printerkap goed op zijn plaats als u de gasveerconstructie loszet.

GEVAARLIJK

Ga bij het configureren van de printer voorzichtig te werk. Onbedekte bewegende onderdelen kunnen letsel veroorzaken en sommige onderdelen kunnen onder spanning staan.

Huomautuksia Turvallisuudesta

FINNISH

VAARA

Sähköisku voi aiheuttaa vakavia henkilövahinkoja. Tästä syystä täytyy kirjoittimesta aina katkaista virta ja irrottaa virtakaapeli, kun signaalikaapeli liitetään tai irrotetaan.

VAARA

Irrota aina vaihtovirtajohto virtalähteestä ennen huoltotoimenpiteitä. Laiminlyönti voi aiheuttaa henkilö– tai laitevahinkoja. Jos virtaa tarvitaan huollon aikana, huoltotoimenpiteiden ohjeissa on sitä koskevia neuvoja.

VAARA

Irrota vaihtovirtajohto ennen kirjoittimen puhdistamista.

VAROITUS

Ajan myötä voi paperinsilittäjän yläreuna terävöityä. Välttääksesi haavoja käsittele paperinsilittäjää sen reunoista.

VAROITUS

Tartu kirjoittimen kannesta tukevasti kiinni, kun irrotat kaasujousilaitetta.

VAARA

Noudata varovaisuutta kirjoitinta asennettaessa. Paljaat liikkuvat osat voivat aiheuttaa vahinkoja, ja sähköisissä osissa on sähköiskun vaara.

Consignes de Sécurité

FRENCH

DANGER

Afin d'éviter tout risque de blessure par électrocution lors du branchement ou du débranchement du câble de signal, mettre l'imprimante hors tension et débrancher le câble d'alimentation.

DANGER

Toujours débrancher le cordon d'alimentation en courant alternatif de la source d'alimentation avant d'effectuer toute opération d'entretien. Le fait de laisser le cordon branché peut provoquer des blessures ou endommager l'équipement. Si l'alimentation électrique est nécessaire durant l'entretien, les instructions à suivre vous renseigneront à ce sujet.

DANGER

Débrancher le cordon d'alimentation en courant alternatif avant de nettoyer l'imprimante.

ATTENTION

Après un certain temps, le bord supérieur du lisseur de papier peut devenir tranchant. Afin de ne pas se couper, manipuler le lisseur de papier par ses côtés.

ATTENTION

Bien tenir le couvercle de l'imprimante tout en désenclenchant le bloc–ressort à gaz.

DANGER

Prendre toutes les précautions nécessaires lors de la configuration de l'imprimante. Les pièces mobiles découvertes peuvent provoquer des blessures et les courants électriques présentent des dangers d'électrocution.

ATTENTION

Les dents de l'engrenage du volant sont acérées et lorsqu'en mouvement, celui–ci peut "sauter" hors de la came. Pour éviter de vous blesser les mains quand vous faites tourner le volant, portez dez gants ou tenez–le avec un chiffon.

ATTENTION

Quand le couvercle de le came est séparé de l'imprimante, un volant en mouvement est dangereux et peut entraîner des dommages corporels. Gardez les mains, les outils et les vêtements hors d'atteinte du volant quand l'imprimante est en marche et que le couvercle de la came est enlevé.

Hinweise zur Sicherheit

GERMAN

GEFAHR

Um ernstliche körperliche Verletzungen durch Stromschlag beim Anschließen oder Trennen des Signalton-Kabels zu vermeiden, muß der Drucker auf jeden Fall ausgeschaltet und der Netzstecker herausgezogen werden.

GEFAHR

Bevor Sie anfällige Wartungsarbeiten durchführen, müssen Sie zuerst immer das Netzkabel aus der Steckdose ziehen. Wird das Netzkabel nicht herausgezogen, können Verletzungen oder Geräteschäden entstehen. Falls die Wartungsarbeit Stromzufuhr erfordert, wird im Wartungsablauf darauf hingewiesen.

GEFAHR

Ziehen Sie das Netzkabel aus der Steckdose, bevor Sie den Drucker reinigen.

VORSICHT

Die obere Kante der Papierschiene wird mit der Zeit scharf. Halten Sie die Schiene deshalb an den Seiten, damit Sie sich nicht schneiden.

VORSICHT

Behalten Sie die Druckerabdeckung sicher im Griff, wenn Sie das Gasfederpaket entfernen.

GEFAHR

Beim Konfigurieren des Druckers ist Vorsicht geboten. Hervorstehende, bewegliche Teile können Verletzungen und Elektroschocks verursachen.

VORSICHT

Die Zahnradzähne des Schwungrads sind scharf, und das Schwungrad kann beim Drehen von der Nocke “springen.” Halten Sie das Schwungrad beim Drehen mit einem Tuch fest, um Handverletzungen zu vermeiden.

VORSICHT

Es besteht Verletzungsgefahr durch das in Betrieb befindliche Schwungrad, wenn die Nockenabdeckung von Drucker entfernt wird. Hände, Werkzeuge und Kleidung vom Schwungrad fernhalten, wenn der Drucker eingeschaltet un di Nockenabdeckung entfernt ist!

Avvisi di sicurezza

ITALIAN

PERICOLO

Durante la connessione o la disconnesione del cavo dei segnali, spegnere la stampante e scollegare il cavo di potenza, in modo da prevenire seri infortuni causati da scosse elettriche.

PERICOLO

Per evitare danni alle persone o alle apparecchiature, disconnettere sempre l'alimentazione prima di eseguire le operazioni di manutenzione. Se sarà necessario alimentare le apparecchiature durante la manutenzione, questo sarà indicato nella procedura di manutenzione.

PERICOLO

Disconnettere l'alimentazione prima di pulire la stampante.

ATTENZIONE

Col tempo la parte superiore della barra che fa pressione sulla carta può diventare tagliente. Per evitare di tagliarsi, maneggiare la barra tenendola dai lati.

ATTENZIONE

Tenere il coperchio della stampante ben saldo quando si smonta il dispositivo di ammortizzazione.

PERICOLO

Prestare attenzione durante la configurazione della stampante. Le parti mobili esposte possono causare danni alle persone e le correnti elettriche possono causare scosse elettriche.

安全上の注意点

JAPANESE

危険

保守作業を行なう前に、必ずAC電源ケーブルを抜いて、電源から切り離しておいてください。身体、または機器に損傷を与える場合があります。保守作業中に電源を必要とする場合は、その旨、保守作業操作手順に指示があります。

危険

プリンタを清掃する前に、AC電源ケーブルを抜いてください。

危険

感電事故を防ぐために、電気回路基盤を取り外す前に電源を切ってから少なくとも1分間待ってください。電気回路基盤を取り扱う際は、帯電防止リストストラップを着用してください。ボードを取り扱う際は、インジェクションレバーと両側面以外には触らないでください。また、ボードを着脱する際は、ボード上の部品に触ったり、ボードを曲げたりしないでください。

注意

時間が経つにつれて、用紙抑えの上端が鋭利になってくることがありますので、取り扱いには、十分に注意してください。

注意

ガススプリングアセンブリを取り外す際は、プリンタカバーをしっかりと抑えてください。

危険

プリンタの環境設定時は、必ず注意事項を守ってください。露出した部品によりケガをしたり、感電する危険があります。

危険

感電しないよう、シグナルケーブルを接続、または取りはずす際は、必ずプリンタの電源を切り、電源コードを抜いてください。

Sikkerhetsinformasjon

NORWEGIAN

ADVARSEL

Slå av skriveren og trekk ut strømledningens støpsel fra stikkontakten når du skal koble signalkabelen til eller fra, slik at alvorlige personskader unngås som følge av elektrisk støt.

ADVARSEL

Trekk alltid ut strømledningens støpsel fra stikkontakten før vedlikeholdsarbeid utføres på skriveren. Hvis man ikke bryter strømforbindelsen til lysnettet, kan det føre til skader pâ personer og utstyr. Hvis strømmen mâ stâ pâ under vedlikeholdet, vil dette fremgå av vedlikeholdsprosedyren.

ADVARSEL

Trekk alltid ut strømledningens støpsel fra stikkontakten før skriveren rengjøres.

OBS!

Med tiden kan den øvre kanten av papirutretteren bli skarp. Derfor må man ta tak i papirutretterens sider for ikke å skjære seg.

OBS!

Hold skriverdekslet på plass når den gassbaserte fjæropphengningen frigjøres.

ADVARSEL

Utvis forsiktighet under konfigureringen av skriveren. Bevegelige deler kan forårsake skader og elektrisk strøm kan gi støt.

Normas de Segurança

PORTUGUESE

PERIGO

Quando ligar ou desligar o cabo de sinal, a fim de evitar ferimentos graves devido a choque eléctrico, desligue sempre a impressora e remova o cabo de energia da tomada.

PERIGO

Desligue sempre o fio de corrente alternada da tomada, antes de executar qualquer trabalho de manutenção a fim de evitar a ocorrência de acidentes pessoais ou danificar o equipamento. Se fôr absolutamente necessário utilizar corrente durante o trabalho de manutenção, ser–lhe–ão dadas instruções específicas para os procedimentos dessa manutenção.

PERIGO

Antes de começar a limpar a impressora, desligue sempre o fio de corrente alternada da tomada.

ATENÇÃO

Com o tempo, a parte superior do engomador de papel, pode tornar–se aguçada. Para não se cortar, manuseie o engomador de papel pelas partes laterais.

ATENÇÃO

Ao desmontar o conjunto de peças da mola de gás, agarre sempre na cobertura da impressora.

PERIGO

Preste atenção sempre que reconfigurar a sua impressora. Quando expostas, algumas das partes da impressora podem causar ferimentos e lembre–se de que componentes eléctricos constituem perigo de choque.

Avisos de seguridad

SPANISH

PELIGRO

Para evitar daños personales causados por descarga eléctrica al conectar o desconectar el cable de señal, apague la impresora y desenchufe el cable de alimentación.

PELIGRO

Desconecte siempre el cable del enchufe antes de realizar cualquier operación de mantenimiento. El no cumplimiento de esta condición puede derivar en lesiones personales o daños en el equipo. Si tiene que utilizar la corriente durante el mantenimiento, el procedimiento se lo indicará.

PELIGRO

Desenchufe el cable antes de limpiar la impresora.

PRECAUCION

Con el tiempo, el borde superior de la plancha de papel, puede hacerse afilado. Para evitar cortarse, manipule la plancha por los lados.

PRECAUCION

Sujete firmemente la cubierta de la impresora cuando desmonte los muelles de suspensión.

PELIGRO

Tenga cuidado al configurar la impresora. Las partes móviles, cuando quedan al descubierto, pueden provocar lesiones y provocar descargas eléctricas.

Säkerhetsföreskrifter

SWEDISH

FARA

Undvik allvarliga personskador från elektriska stötar när du ansluter eller kopplar loss signalkablen, genom att stänga av strömmen till skrivaren och koppla loss nätkabeln.

FARA

Koppla alltid loss nätkabeln från strömkällan innan du utför underhåll. Om strömmen inte är avstängd kan det uppstå personskador eller skador på utrustning. Om strömmen måste vara påkopplad vid underhållsarbete anges detta i underhållsanvisningarna.

FARA

Koppla loss nätkabeln innan du rengör skrivaren.

VARNING

Efter längre tids användning kan pappersspressen bli vass. Undvik skärsår genom att endast hålla i pappersspressens sidor.

VARNING

Håll ordentligt i skrivarhuven när du kopplar loss gasfjädringsenheten.

FARA

Var försiktig när du utför ändringar på skrivaren. Rörliga delar som frilagts kan orsaka personskador. Dessutom kan elström ge upphov till elektriska stötar.

1 Maintenance Overview

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About the Printer

The IBM 6412 Line Matrix Printer is a high speed line printer designed to perform a wide variety of high–volume printing tasks with minimum maintenance and maximum reliability.

The IBM 6412 printer incorporates the latest refinements in line matrix printing technology, yet is easy to use. The operator can select every printer function at the operator panel or by sending commands from the host computer.

The IBM 6412 Line Matrix Printer comes in two models:

- IBM 6412–A00 is an ASCII printer.
- IBM 6412–CT0 is a coax/twinax SCS printer.

About This Manual

This is a field service maintenance manual for the IBM 6412 Line Matrix Printer.

How to Use This Manual

1. Locate the procedure or information you need:

- 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.

2. Read the entire procedure before you do it.
3. Gather the parts and tools you will need.
4. Make sure you understand all notes and notices before you start a task. Notes and notices are defined below.

Notes and Notices

For your safety and to protect valuable equipment, it is important that you read and comply with the information highlighted under notes and notices:

DANGER

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people.

CAUTION

A caution notice calls attention to a situation that is extremely hazardous to people because of some existing condition.

WARNING

A warning notice indicates the possibility of damage to a program, device, system, or data.

IMPORTANT

Important draws your attention to information vital to proper operation of the printer.

NOTE: A note gives you helpful tips about printer operation and maintenance.

Related Documents

This manual does not explain how to operate or configure the printer. For that information, refer to the *Operator's Guide* and *Setup Guide* that accompany each model:

- *6408 / 6412–A00 Operator's Guide* (IBM Form Number G246–0017–01)
- *6408 / 6412–A00 Setup Guide* (IBM Form Number G246–0023–01)
- *6408 / 6412–CT0 Operator's Guide* (IBM Form Number G246–0030–01)
- *6408 / 6412–CT0 Setup Guide* (IBM Form Number G246–0036–01)

Information pertaining to printer control languages, emulations, and codes is in the applicable *Programmer's Reference Manual*:

- *6408 / 6412–A00 Programmer's Reference Manual* (IBM Form Number G246–0029–01)
- *6408 / 6412–CT0 Programmer's Reference Manual* (IBM Form Number G246–0042–01)

Information pertaining to the IGP** is in the applicable *IGP Reference Manual*:

- *IGP** Printronix** Emulation Reference Manual* (IBM Form Number G246–0015–01)
- *Code V** Printronix Emulation Reference Manual* (IBM Form Number G246–0016–01)

Printing Conventions in This Manual

- **Keys and indicators on the operator panel** — highlighted in bold.

  Example: Press the **Clear** key, then press the **Start** key.

- "Liquid Crystal Display (LCD) messages" — set off by quotation marks.

  Example: Press the **Stop** key. "NOT READY" appears on the LCD.

- Key combinations — denoted by the + (plus) symbol.

  Example: 'Press **Scroll↑** + **Scroll↓** ' means press the **Scroll↑** key and **Scroll↓** key at the same time.

Electrical Controls and Indicators: IBM 6412–A00 (Figure 1–1)

Key or Indicator	Function
Power Indicator	Lit when the printer is on.
Ready Indicator	Lit when the printer is in READY mode (on–line), no errors are pending, and the printer is ready to process data. Off when the printer is in NOT READY mode (off–line).
Processing Indicator	Flashes when the printer is receiving data from the host.
Attention Indicator	Lit when an error occurs. After correcting the error, press Clear to turn off this LED.
Power Switch	Applies power to the printer: This switch is also a circuit breaker.
LCD	The Liquid Crystal Display (LCD) shows printer status messages.
Start	Puts the printer in the READY mode (on–line). This key also clears fault conditions, exits program mode menus, and moves paper back to print position after View is pressed.
Stop	Puts the printer in the NOT READY mode (off–line). This key also silences the audible alarm, and stops a Printer Test. Stop + Enter resets the printer.
Form Feed	Advances paper to next Top–Of–Form, as defined by the current page length.
Set Top Of Form	Sets TOF and moves paper downward from the tractor alignment notches to the print position.
Line Feed	Moves paper up one line, as determined by current line spacing.
View	Press to move the current print position up to the tractor area for viewing. Press again to return paper to original print position.
Clear	Clears a fault condition and moves printer to NOT READY mode.
Menu	If in the NOT READY mode, this key puts the printer in the PROGRAM mode. If the configuration menus are locked, the LCD indicates the control panel is locked.
Enter	Selects the option displayed on the LCD. This action either sets a value, moves to the next lower level of configuration, or starts a self–test. Stop + Enter resets the printer.
Return	Returns to the next higher level of a configuration menu.
Micro↑	In the NOT READY mode, moves the paper upward 1/72 inch ("micro–step" function).
Micro↓	In the NOT READY mode, moves the paper downward 1/72 inch ("micro–step" function).
Scroll↑	In the PROGRAM mode, this key moves to the next menu ("Scroll" function).
Scroll↓	In the PROGRAM mode, this key moves to the previous menu ("Scroll" function).
Printer Configuration	Prints the current configuration.
Stop + Enter	Resets printer to last saved configuration, regardless of operational mode.
Scroll↑ + Scroll↓	Toggles the lock on the configuration menus.

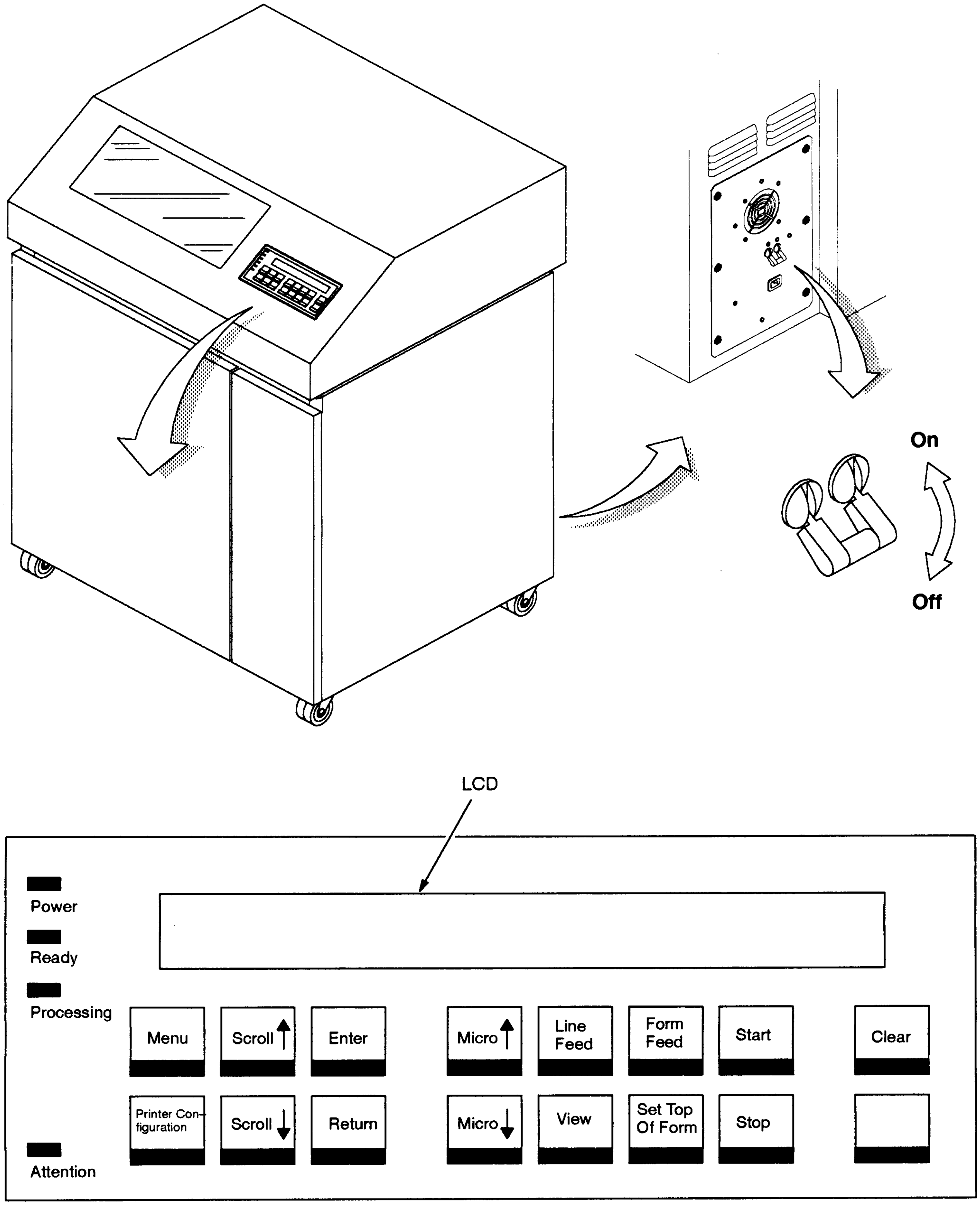

Figure 1–1. Electrical Controls and Indicators: IBM 6412–A00

Electrical Controls and Indicators: IBM 6412–CT0 (Figure 1–2)

Key or Indicator	Function
Power Indicator	Lit when the printer is on.
Ready Indicator	When lit, the printer is in the READY mode (on–line), no errors are pending, and the printer is ready to process data. Off when the printer is in NOT READY mode (off–line).
Processing Indicator	Lit when the printer is receiving data from the host.
Format Indicator	Coax only: lit when the printer is set to SCS mode. When on, the Cancel Print, PA1, and PA2 keys are active.
Online Indicator	Twinax only: lit when the host computer communicates with the printer.
Attention Indicator	Lit when an error occurs. After correcting the error, press Stop to turn off this LED.
Power Switch	Applies power to the printer. This switch is also a circuit breaker.
LCD	The Liquid Crystal Display (LCD) shows printer status messages.
Start	Puts the printer in the READY mode (on–line). This key also exits program mode menus.
Stop	Puts the printer in the NOT READY mode (off–line). Stops printer tests. This key also clears a fault and moves the printer from the FAULT mode to the NOT READY mode.
Form Feed	Advances paper to next Top–Of–Form, as defined by the current page length.
Set Top Of Form	Sets TOF and moves paper downward from the tractor alignment notches to the print position.
Line Feed	Moves paper up one line, as determined by current line spacing.
View	Press to move the current print position up to the tractor area for viewing. Press again to return paper to original print position.
Cancel Print	Cancels a print job.
Test	Enters the PROGRAM mode and jumps to the “Printer Tests” menu.
Menu	If in the NOT READY mode, this key puts the printer in the PROGRAM mode. If the configuration menus are locked, the LCD indicates the control panel is locked.
Enter	Selects the option displayed on the LCD. This action either sets a value, moves to the next lower level of configuration, or starts a self–test.
Return	Returns to the next higher level of a configuration menu.
Micro Scroll ↑	In the PROGRAM mode, advances to the next menu (“Scroll” function). In the NOT READY mode, advances the paper upward 1/72 inch (“micro–step” function).
Micro Scroll ↓	In the PROGRAM mode, advances to the previous menu (“Scroll” function). In the NOT READY mode, advances the paper downward 1/72 inch (“micro–step” function).
Printer Configuration	Prints the current configuration.
PA 1	In SCS mode, sends “PROGRAM ATTENTION 1” to the host. First, a message is placed on the LCD requesting the operator to verify choice to send program attention. NOTE: This key valid only in Coax.
PA 2	In SCS mode, sends “PROGRAM ATTENTION 2” to the host. First, a message is placed on the LCD requesting the operator to verify choice to send program attention. NOTE: This key valid only in Coax.
Stop + Enter	Resets printer to last saved configuration, regardless of operational mode.
Micro Scroll ↑ + Micro Scroll ↓	Toggles the lock on the configuration menus.

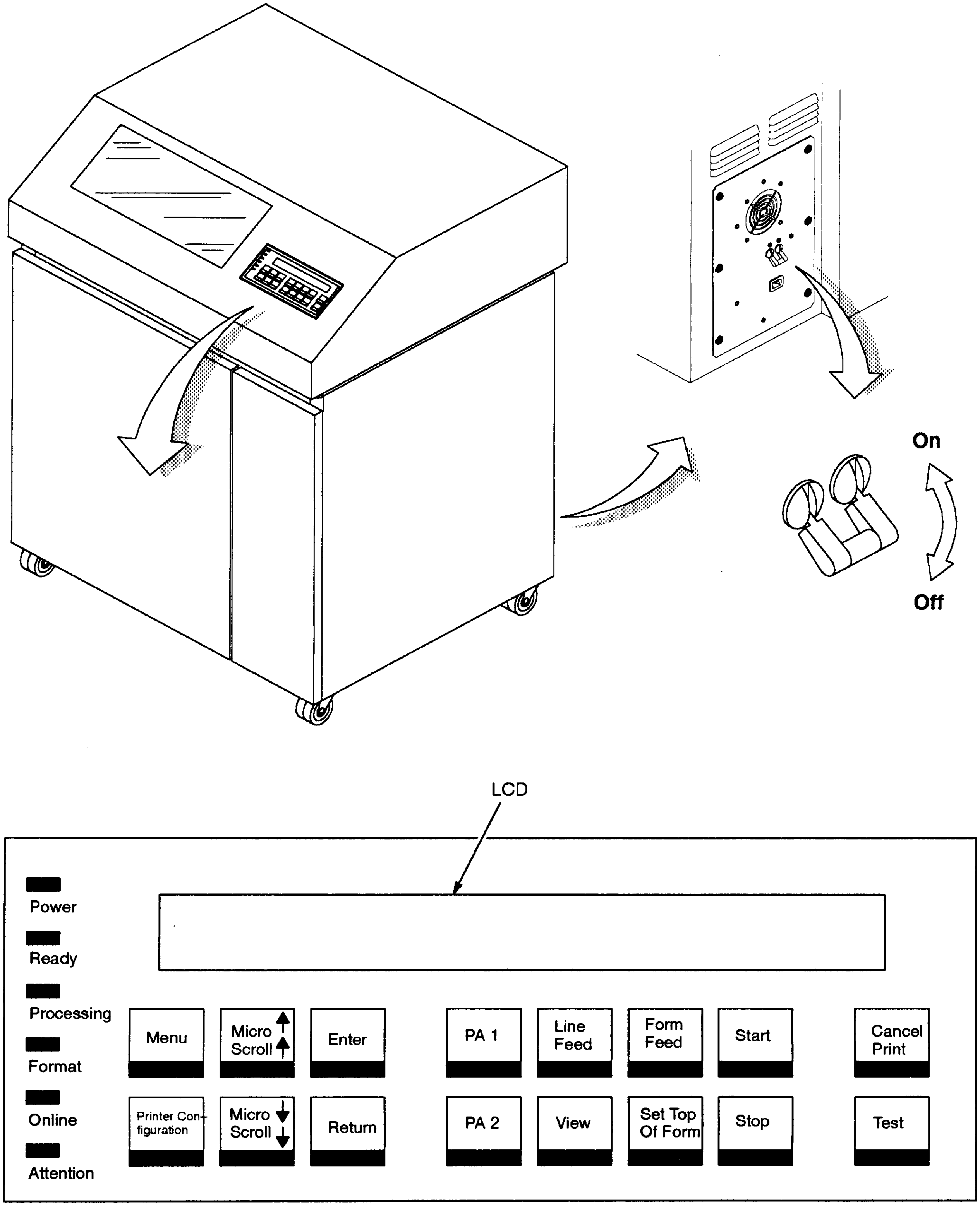

Figure 1–2. Electrical Controls and Indicators: IBM 6412–CT0

Mechanical Controls

Figure 1–3 shows the mechanical controls on the IBM 6412 printer. Mechanical controls are the same on the Model A00 and Model CT0.

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 platen release lever at A for thin (single–part) forms, B for thicker forms, and so on.
Tractors (2)	Hold and feed paper.
Tractor locks (2)	Lock tractor on support shaft.
Horizontal adjustment knob	Allows fine positioning of left print margin. Moves paper left or right.
Vertical position knob	Used to set top of form or first line to be printed. Rotate to move paper vertically.

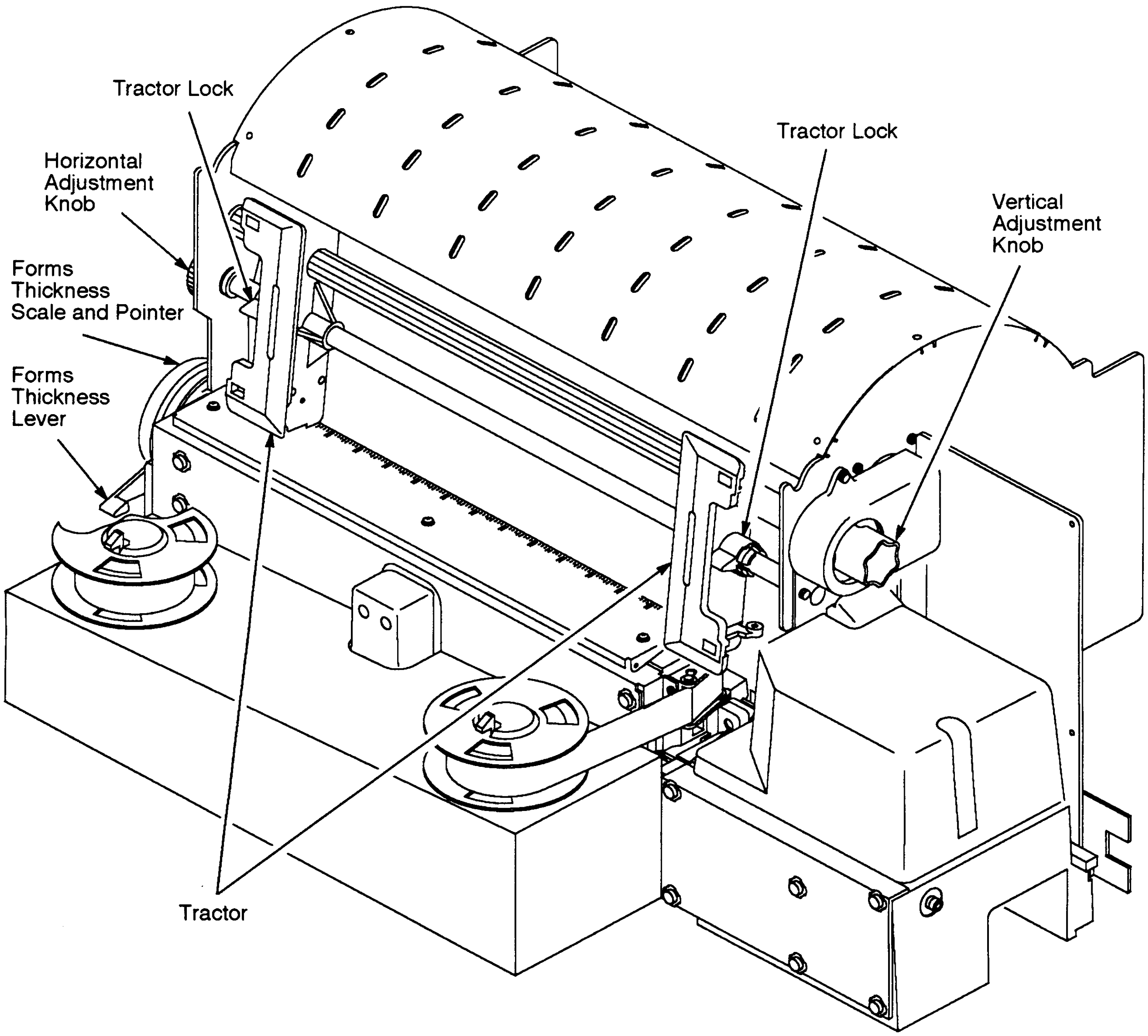

Figure 1–3. Mechanical Controls

Tools, Test Equipment, and Supplies

The tools and equipment required for field level maintenance of IBM 6412 printers are listed below.

Item	Part Number
Alcohol	2200200
ECOS Electrical Safety Tester (or equivalent)	6339695
Electrical Safety for IBM Customer Engineers	S229–8124
ESD Wrist Strap	6405959
Fluke Meter (or equivalent)	8496278
Lubricant, Bearing	IBM #20
Pliers, Grip Ring	9900317
Screwdriver, Torque, 1–30 Inch–pound	16F1661
Screwdriver, Torque, Adapter	39F8449
Screwdriver, Torque, Hex Adapter 3/32 inch	39F8451
Screwdriver, Torque, Hex Adapter 5/32 inch	39F8450
Screwdriver, Torque, Hex Adapter 3/16 inch	1650831
Screwdriver, Torque, Hex Adapter 5/64 inch	16F1662
Shim, Antirotation (.010 in.)	57G7248
Shim, Antirotation (.005 in.)	57G7249
Shim, Counterweight Spring Guide	45F3753
Shims, Shuttle Spring	57G7258
Shim, Thrust, Shuttle	57G7219
Tie Wraps	75X5972
Tool, Antirotation	57G7259
Tool, Hammer Tip Alignment	57G7257
Tool, Module Extracting	9900764

2 Installation

Installation of the IBM 6412 printer is covered in the *Setup Guide*. Refer to the following documents:

- *IBM 6408 / 6412–A00 Setup Guide* (Form Number G246–0023–01)
- *IBM 6408 / 6412–CT0 Setup Guide* (Form Number G246–0036–01)

3 Principles of Operation

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Line Matrix Printing

The IBM 6412 is an impact printer. It 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.

Every text character is stored in memory as a pattern of dots on a logical grid called the *dot matrix*. (See Figure 3–1.) 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.

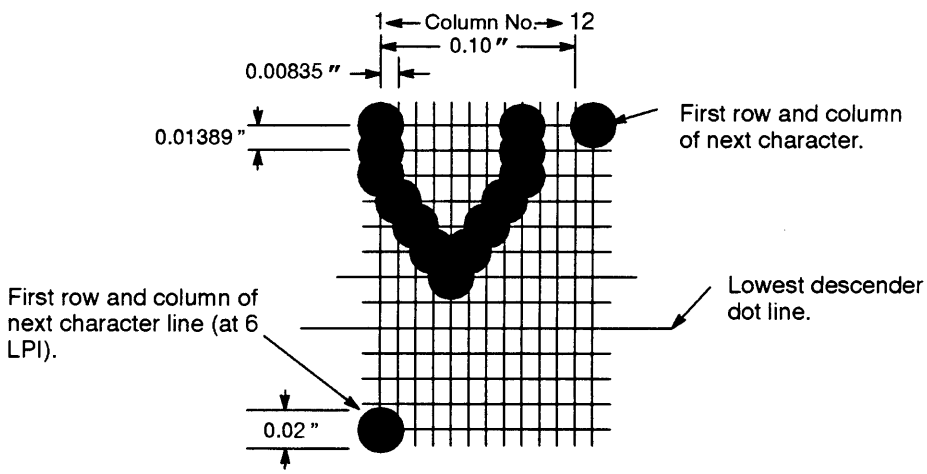


Figure 3–1. A Dot Matrix

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 depending on the font to be printed. 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 3–1 and Figure 3–2.) At eight lpi there are nine dot rows per character line, at nine lpi eight dot rows per character line, and so on.

Elongated characters are made by printing all but the first and last dot rows twice. (See Figure 3–3.)

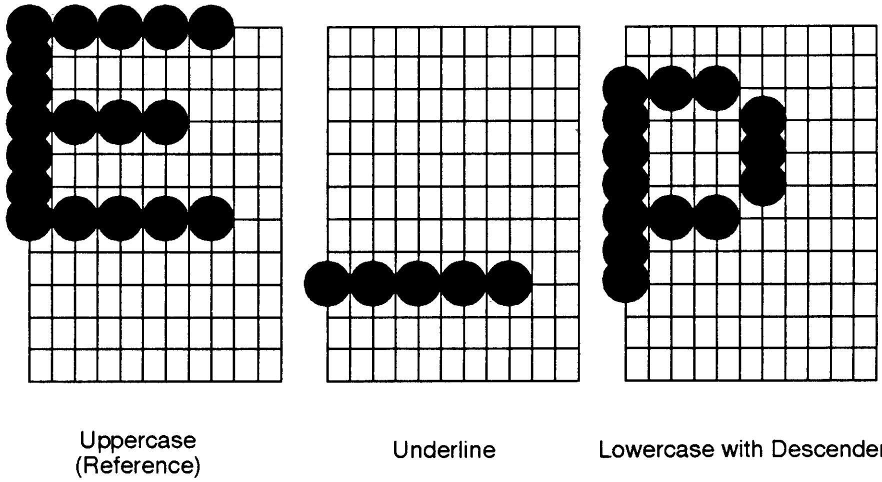


Figure 3–2. Typical Characters

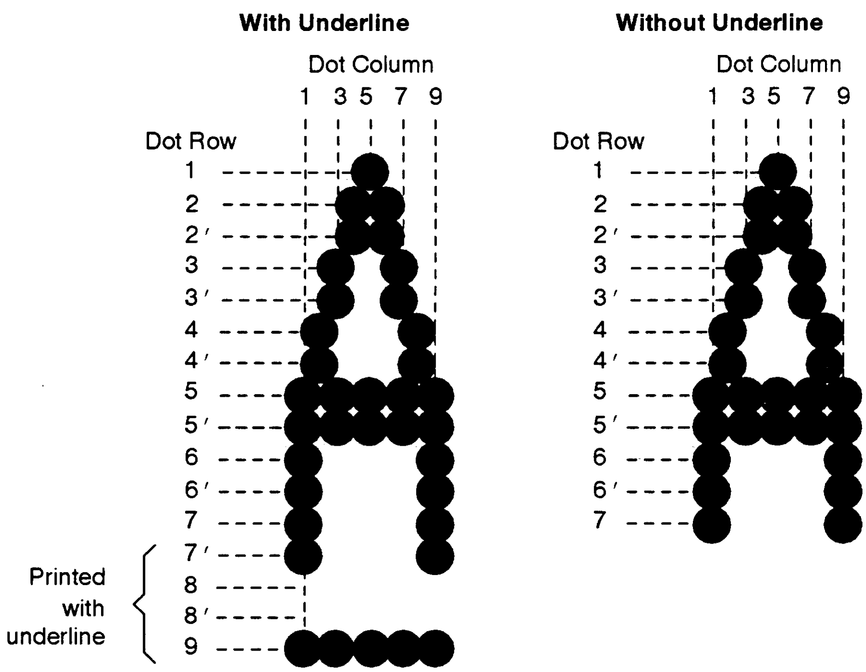


Figure 3–3. Elongated Characters

The Hammer Bank

The IBM 6412 uses a hammer bank to print dots. The hammer bank consists of 88 hammer springs mounted on a shuttle that moves horizontally a short distance 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 3–4.)

A permanent magnet keeps the hammer springs retracted and under tension. Behind every hammer is a pair of electrical 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 3–5.)

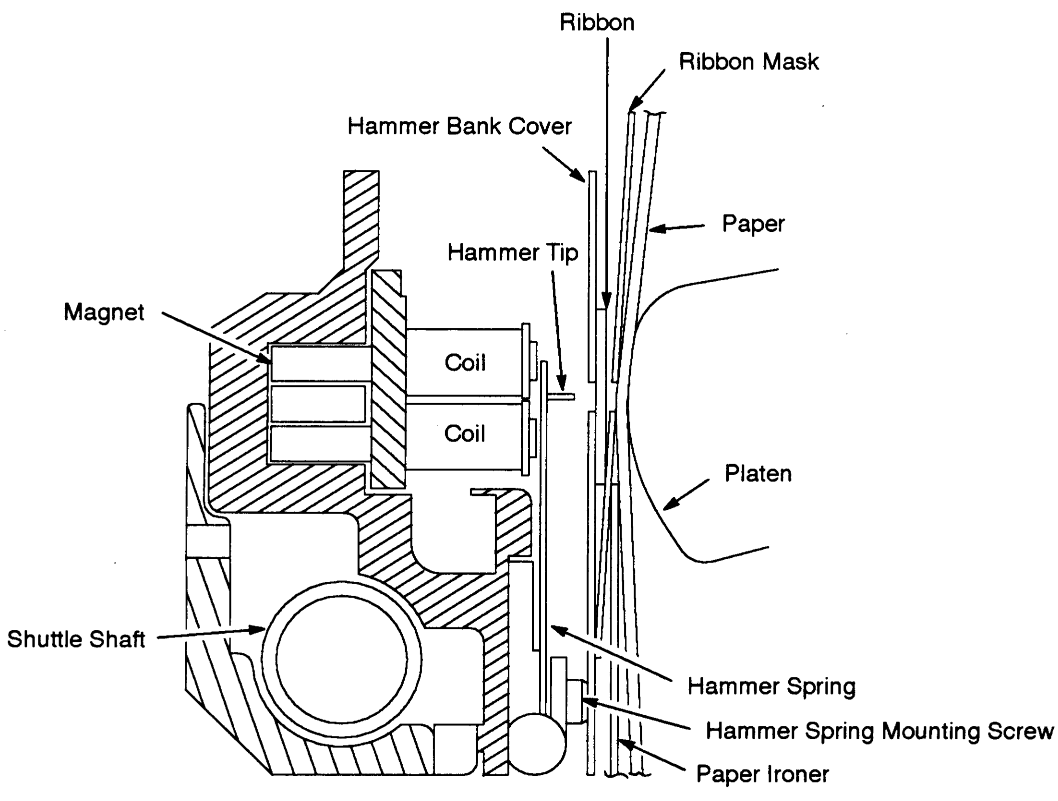


Figure 3–4. Cross Section of Hammer Bank, showing Hammer Spring and Shuttle Arrangement

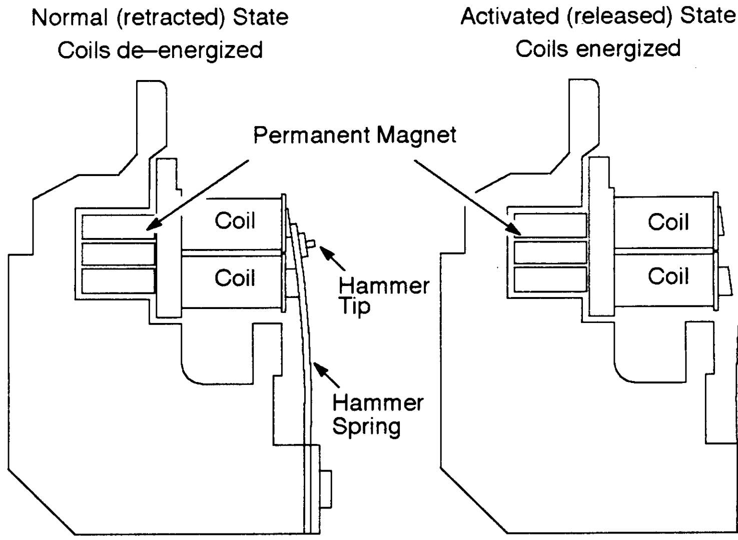


Figure 3–5. Hammer Spring Action

Character Generation

Paper advances one dot row after each horizontal sweep of the shuttle. (See Figure 3–6 and Figure 3–7.)

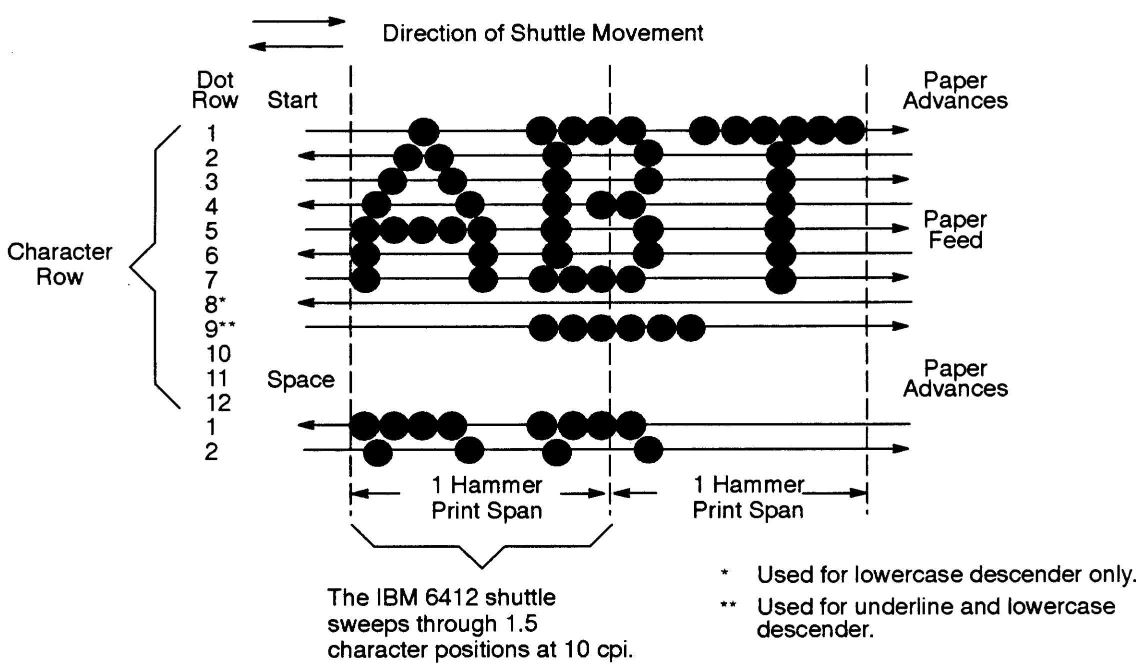
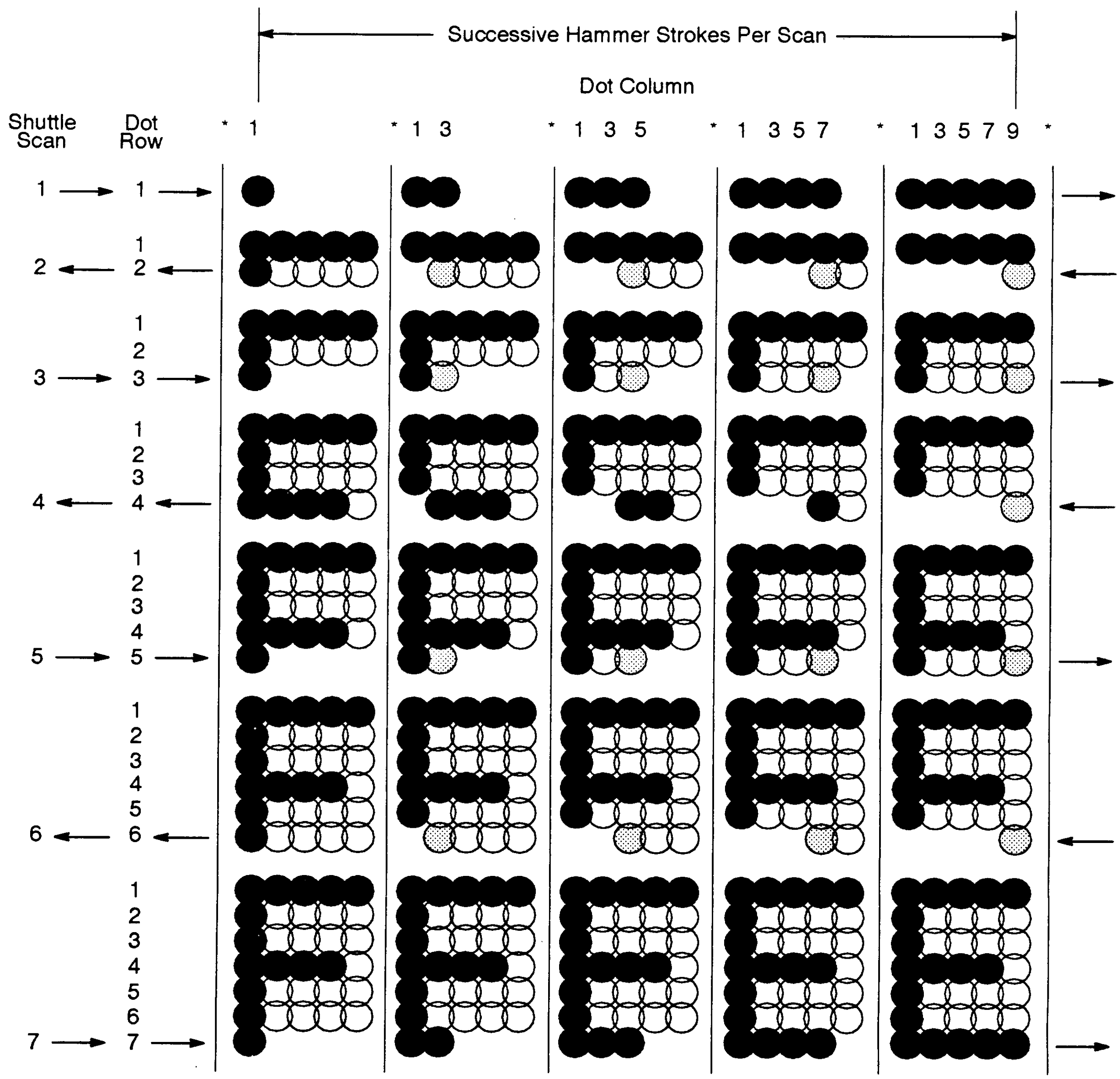


Figure 3–6. Standard Character Formation



* Even column dot centers within the printed character area and character space hammer positions are not illustrated in this diagram.

NOTE: ● = Dot

○ = No dot where hammer has already been

◌ = Hammer Position

Figure 3–7. Character Formation by One Hammer

Normal Operation

In normal operation, the user presses a switch on the operator panel to put the printer in READY mode (on–line). On IBM 6412–A00 models, ASCII data from the host computer are read directly into the input buffer. IBM 6412–CT0 models receive EBCDIC code and convert it internally to ASCII before processing the 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 3–8.)

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

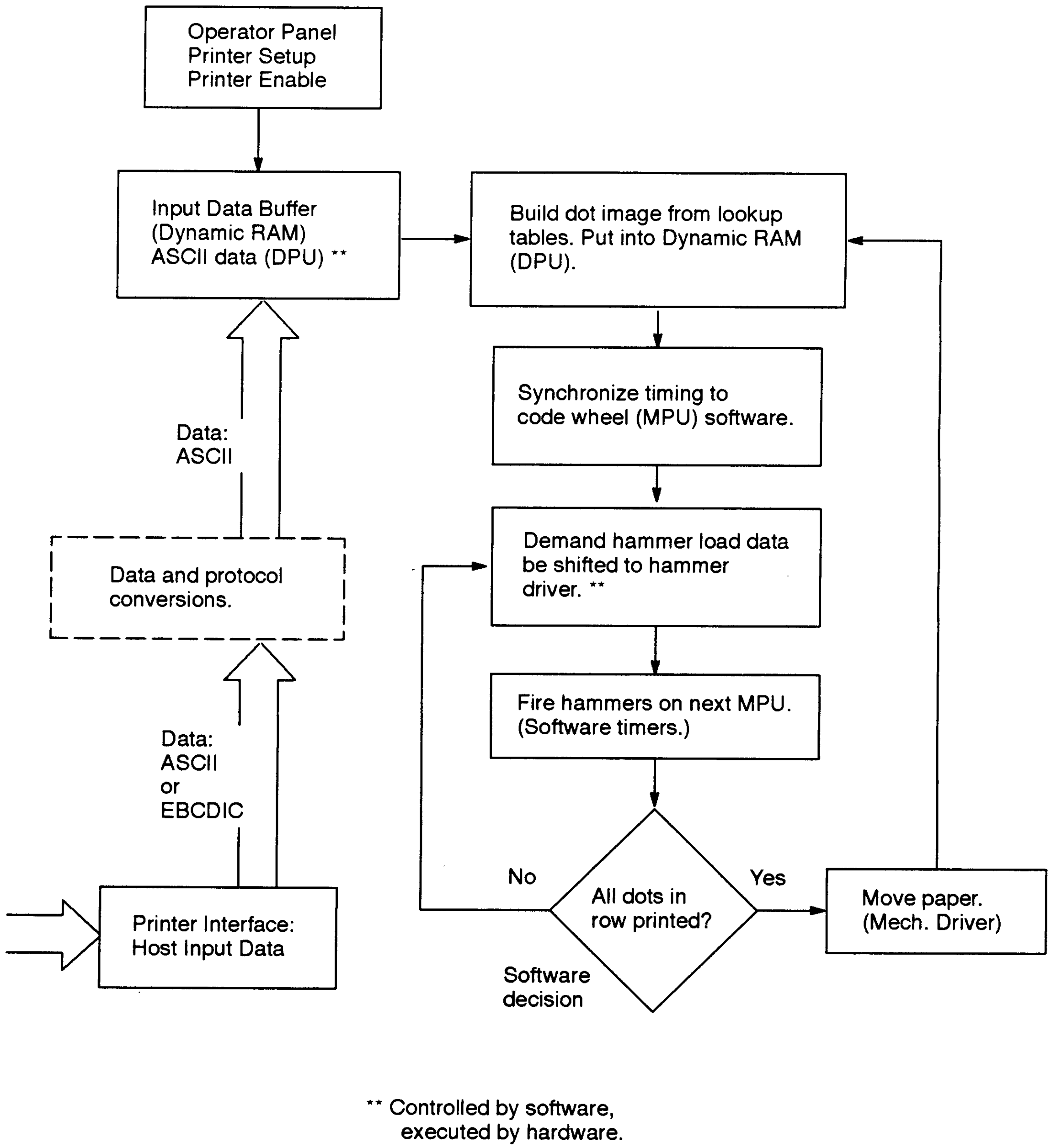


Figure 3–8. The Print Cycle

IBM 6412 Architectures

The IBM 6412 printer processes all data internally in extended ASCII format, but can receive data coded in ASCII or EBCDIC.

The model and configuration of the IBM 6412 is determined by the type of interface it uses. These configurations are summarized below:

IBM 6412 Model A00

- Uses the Common Controller Board (CCB) print engine.
- System, font, and emulation software are stored in PROMs on the CCB.
- Processes three kinds of computer input: PC parallel, DataProducts parallel, and RS–232 serial data. All three interfaces are mounted on a common circuit board assembly and all are processed directly by the CCB.

IBM 6412 Model CT0

- The Common Controller Board (CCB) is the print engine.
- System, font, and emulation software are stored in PROMs on the CCB.
- Is equipped with a coaxial/twinaxial integrated interface assembly, called the CT. The CT is a printed circuit board assembly that receives EBCDIC input data and converts it to an expanded ASCII character set. The CT then sends the converted data to the CCB for further processing.
- When configured for twinax operation, the IBM 6412–CT0 emulates IBM 5225 Models 1, 2, 3, and 4 printers, and IBM 4234 Model 2 printers.
- When configured for coax operation, the IBM 6412–CT0 emulates IBM 4234 Model 1 and IBM 3287 Models 1 and 2 printers.

Functional Elements of the Printer

The printer consists of six functional elements:

- Operator panel
- Common Controller Board (CCB)
- Mechanism driver board
- Hammer driver board
- Power supply
- Print mechanisms

Figure 3–9 is a block diagram of these elements.

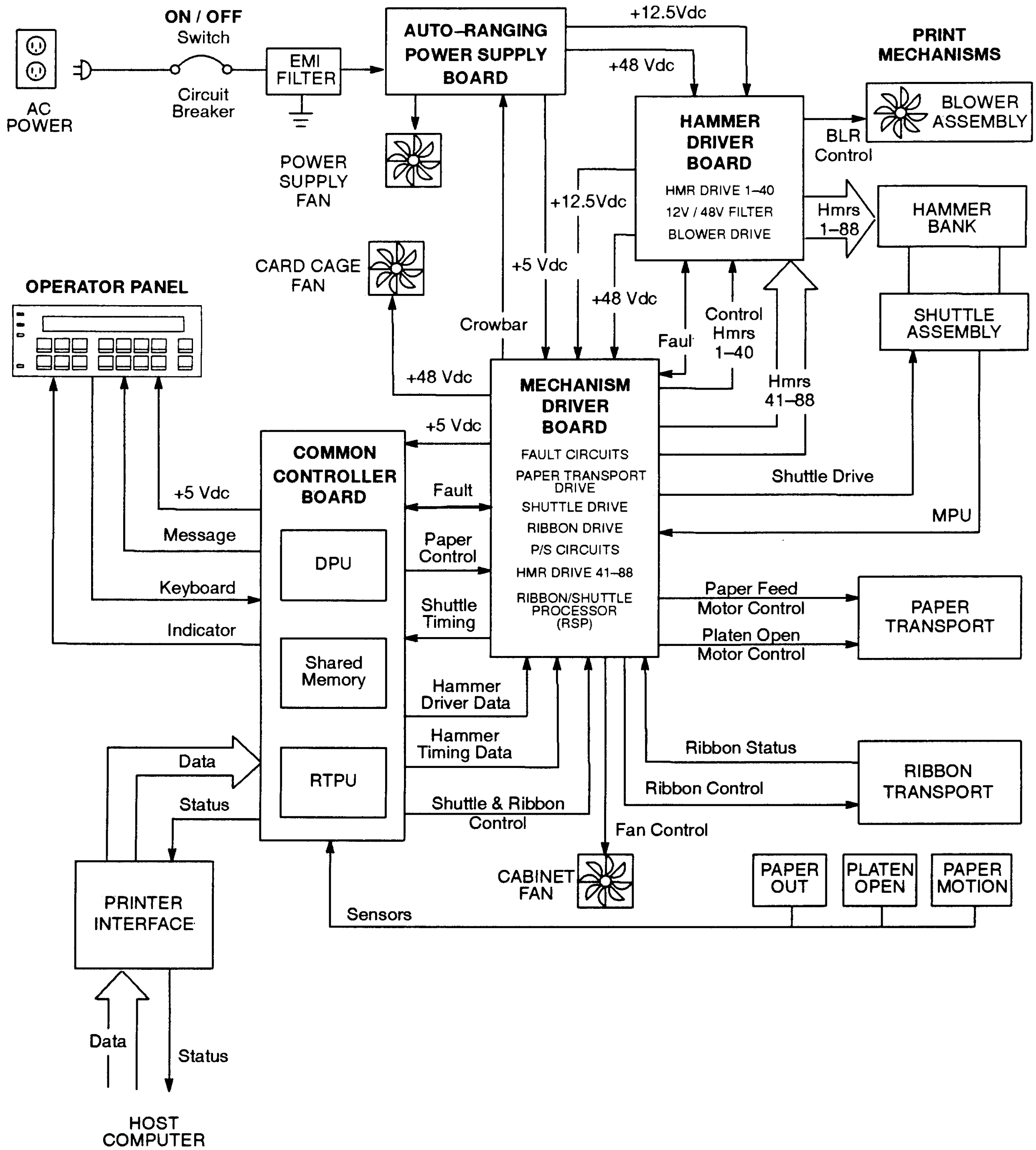


Figure 3–9. Functional Elements of the Printer

The Operator Panel

The operator panel is the user interface with the printer. The operator panel contains LEDs, contact switch keys, and a liquid crystal display (LCD) that communicate information to the user. The user communicates with the printer by pressing switch keys to select options displayed on the LCD.

The operator panel communicates directly with the Common Controller Board (CCB). The panel processes and sends switch closure information to the CCB and receives status information.

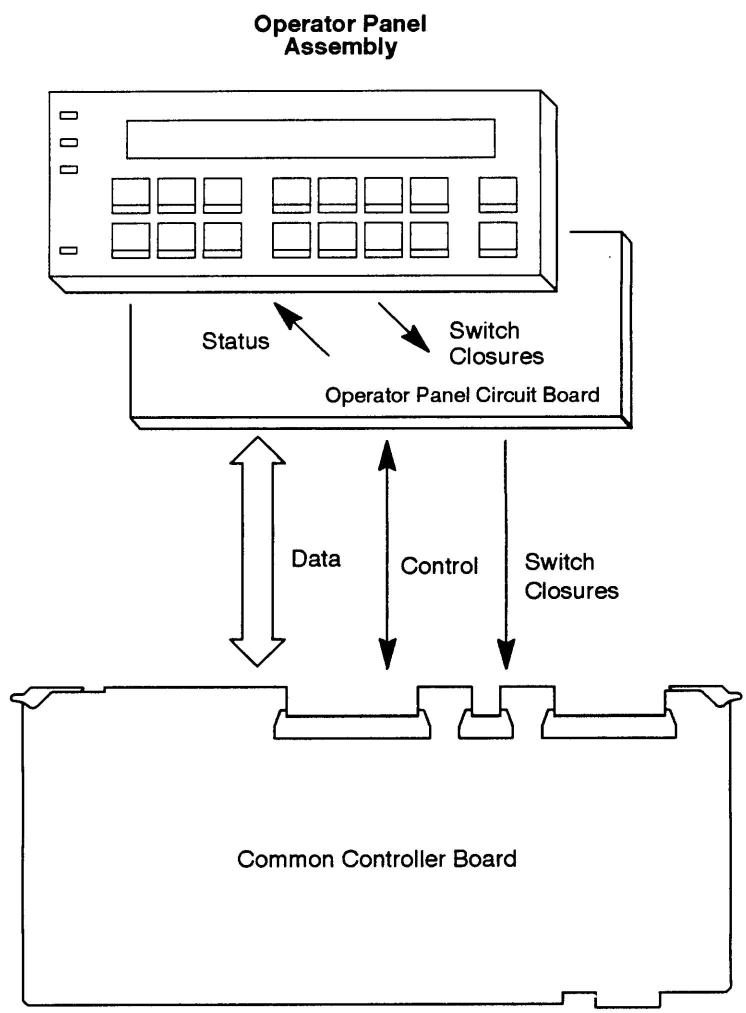


Figure 3–10. Operator Panel Functional Block Diagram

Common Controller Board

The heart of the printer is a printed circuit board assembly called the Common Controller Board or CCB. The CCB oversees and coordinates all printer functions.

The CCB 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 I/O (host) interface, the operator panel, and the print mechanism. The RTPU also monitors the fault circuitry in the mechanism.

The DPU and RTPU communicate with each other through shared memory. The DPU gets host and operator input from buffers in shared memory which the RTPU fills, and returns dot images and operator messages to buffers in shared memory which the RTPU empties. Figure 3–11 broadly summarizes the architecture of the CCB.

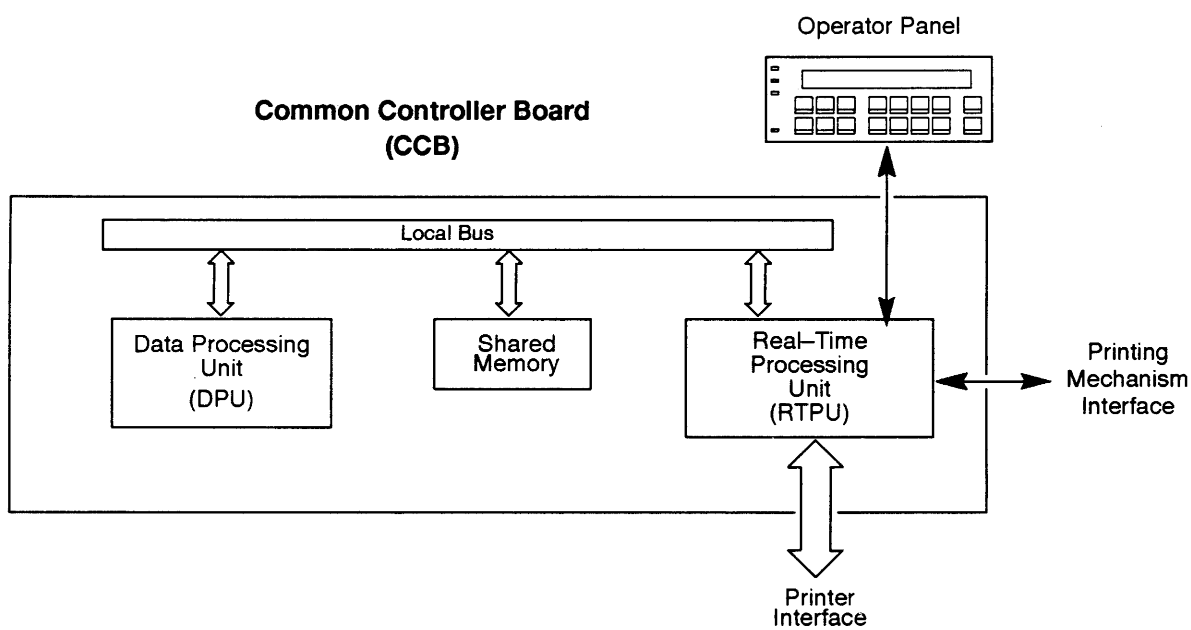


Figure 3–11. Architecture of the CCB

CCB Communication With the Host Computer and Operator

The CCB processes three kinds of computer input:

- PC parallel
- Dataproducts parallel
- RS–232 serial

The RTPU operates all interfaces. The PC and Dataproducts parallel interfaces are similar; the RTPU uses direct memory access (DMA) hardware to load 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 looks the same, regardless of which interface is used to receive the data.

Operator Panel

The printer communicates with the user by means of a Liquid Crystal Display (LCD) and Light Emitting Diode (LED) indicators on the operator panel. The user communicates with the printer by pressing keys on the operator panel.

There are three kinds of operator panel operation: keystroke input, display output, and indicator output. The RTPU handles the operator panel interface requirements of shifting and clocking operator panel data, but it is the DPU that 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 it can be 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 coordinates both of these functions, but each is actually performed by an application–specific integrated circuit (ASIC) containing hardware dedicated to the function: the Dot Plucker Memory Controller (DPMC) and the Fire Timer IC (FTIC). These functions are summarized in Figure 3–12.

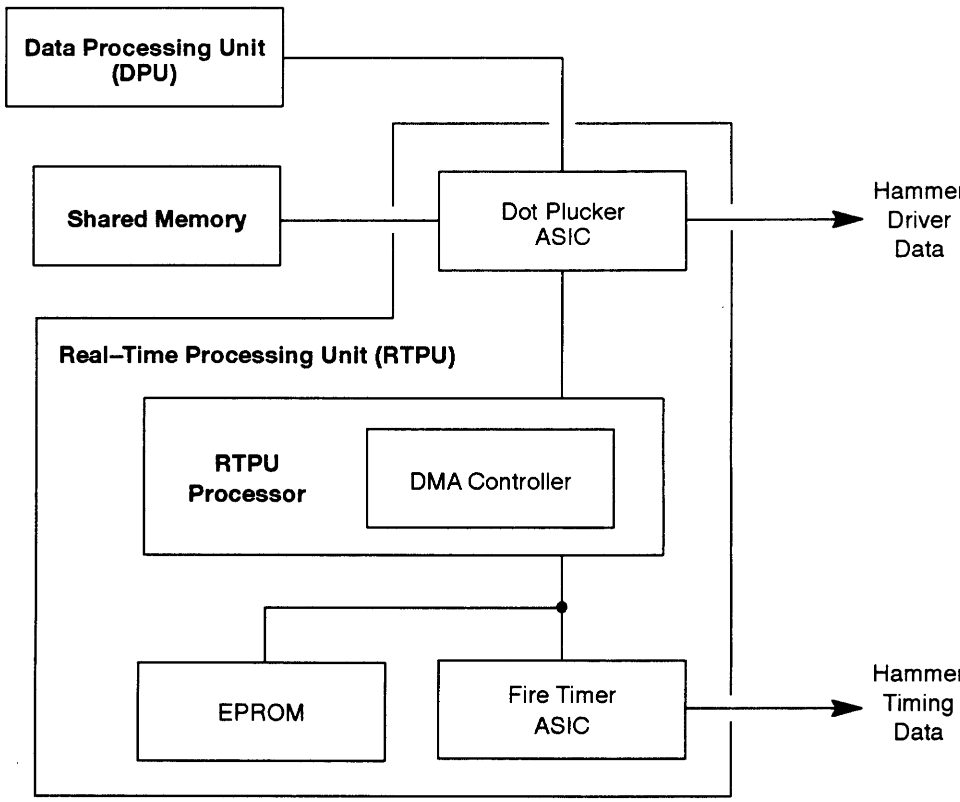


Figure 3–12. Hammer Driver Interface Functions of the RTPU

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 microprocessor as it programs the dot plucker and the FTIC for each dot row.

Hammer Fire Control Hammer fire control consists of synchronizing the firing of different sections of the hammer bank with the position of the shuttle. This synchronization varies with the dot density, the number of dots per hammer, the number of hammers on the hammer bank, the number of phases, and so on. The Fire Time IC (FTIC) performs this synchronization, but it is such a complex procedure that most synchronization factors are programmed into the fire timing tables which are transferred (by DMA) from EPROM to FTIC while printing. The FTIC's fire control responsibility is thus reduced to tracking the MPU pulses that tell shuttle position, timing hammer firing between MPU pulses, and sending a pattern to the hammer driver telling it which phases to fire.

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 must be 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 3–13 shows the mechanical interface section of the RTPU.

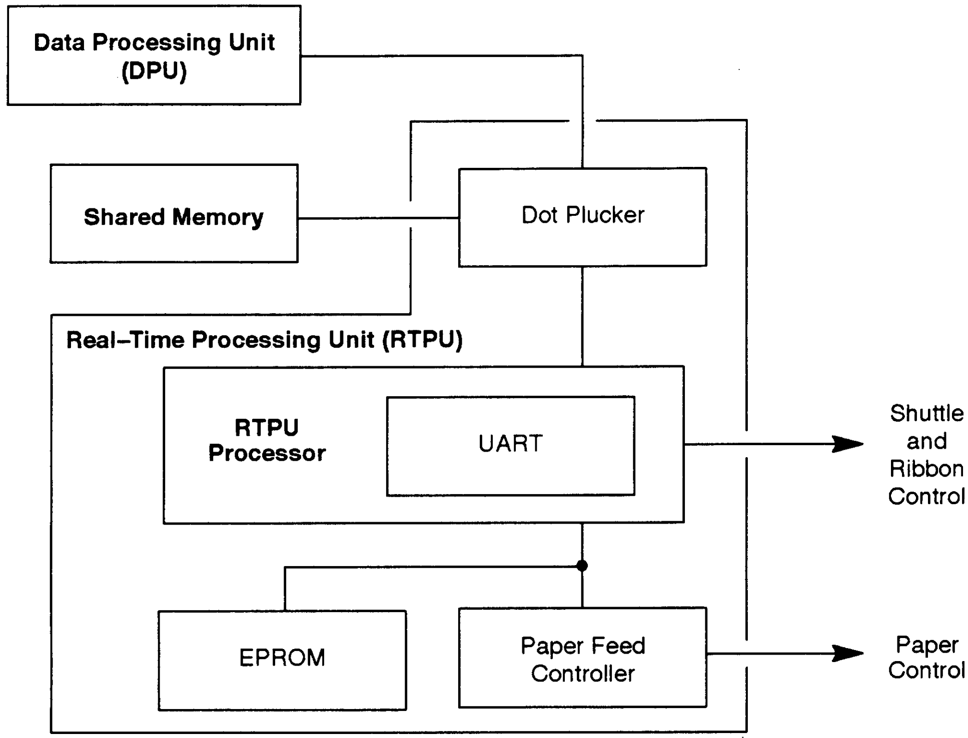


Figure 3–13. Mechanism Driver Interface Functions of the RTPU

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 (on the mechanism driver board) 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 by 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

This section summarizes CCB hardware functions.

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 processor has a local 16–bit bus.
- The 64180 processor uses a local 8–bit bus.
- The DPU and RTPU share a 16–bit bus arbitrated on a cycle–by–cycle basis.

- The 8032 chip has its own 8–bit local bus.

The manner in which the CCB implements this hardware is shown in Figure 3–14.

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.

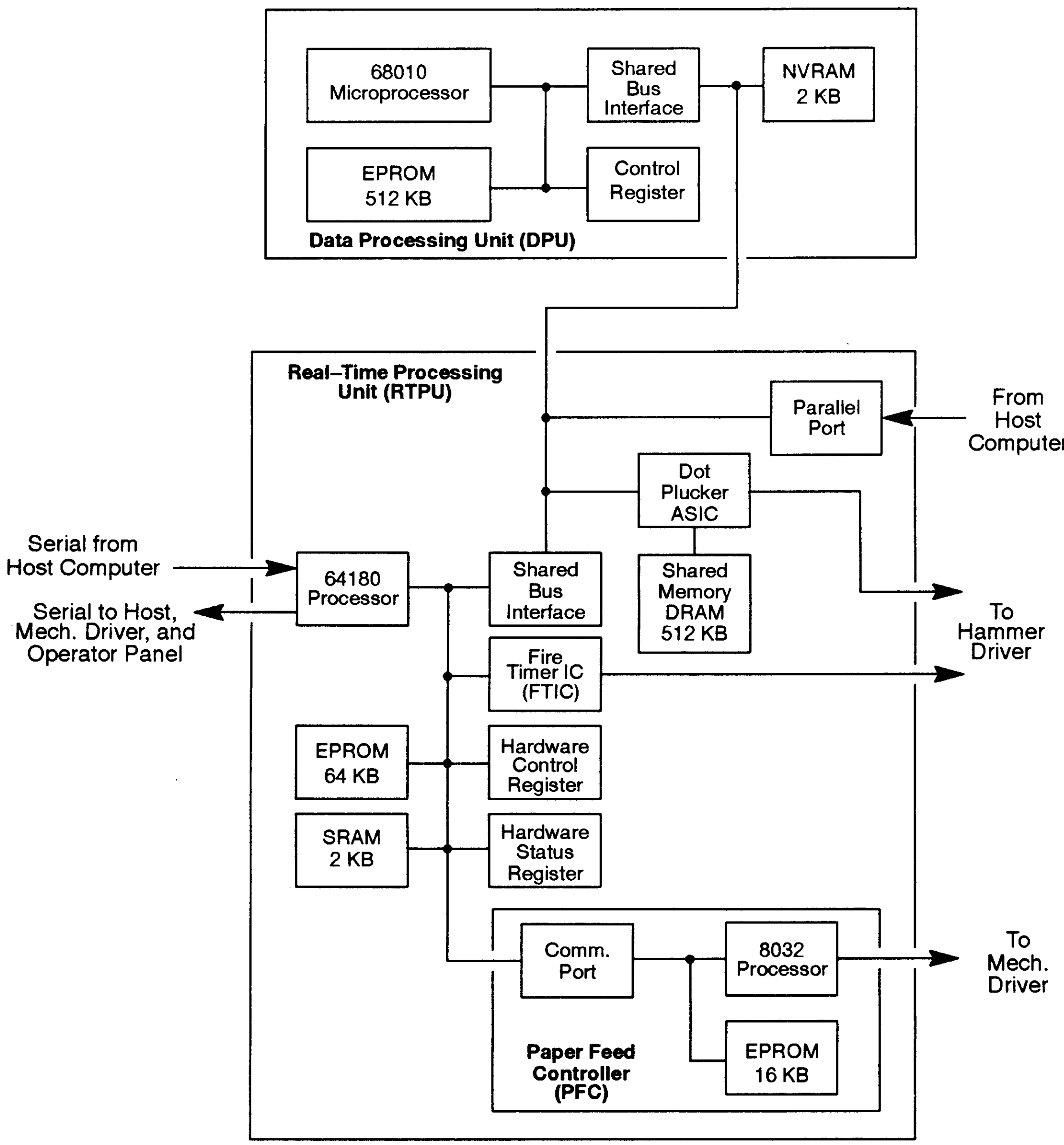


Figure 3–14. Hardware Implementation of the CCB

Communicating With the Host Computer

The 64180 (RTPU) 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 panel. The control register in the RTPU contains three other operator 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, which contains analog circuits to 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 (the RSP) controls shuttle, ribbon, and platen drives, and communication with the CCB.
- The interface to the power supply board.
- 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 CCB for each motor phase to vector–control the paper feed motor.
- The shuttle drive controller receives speed commands from the CCB 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 CCB 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.
- 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 CCB.
- Circuitry that registers magnetic pick–up unit (MPU) output, processes it for the logic interface, and sends it to the CCB for timing hammer fire.

Figure 3–15 summarizes mechanism driver board operation.

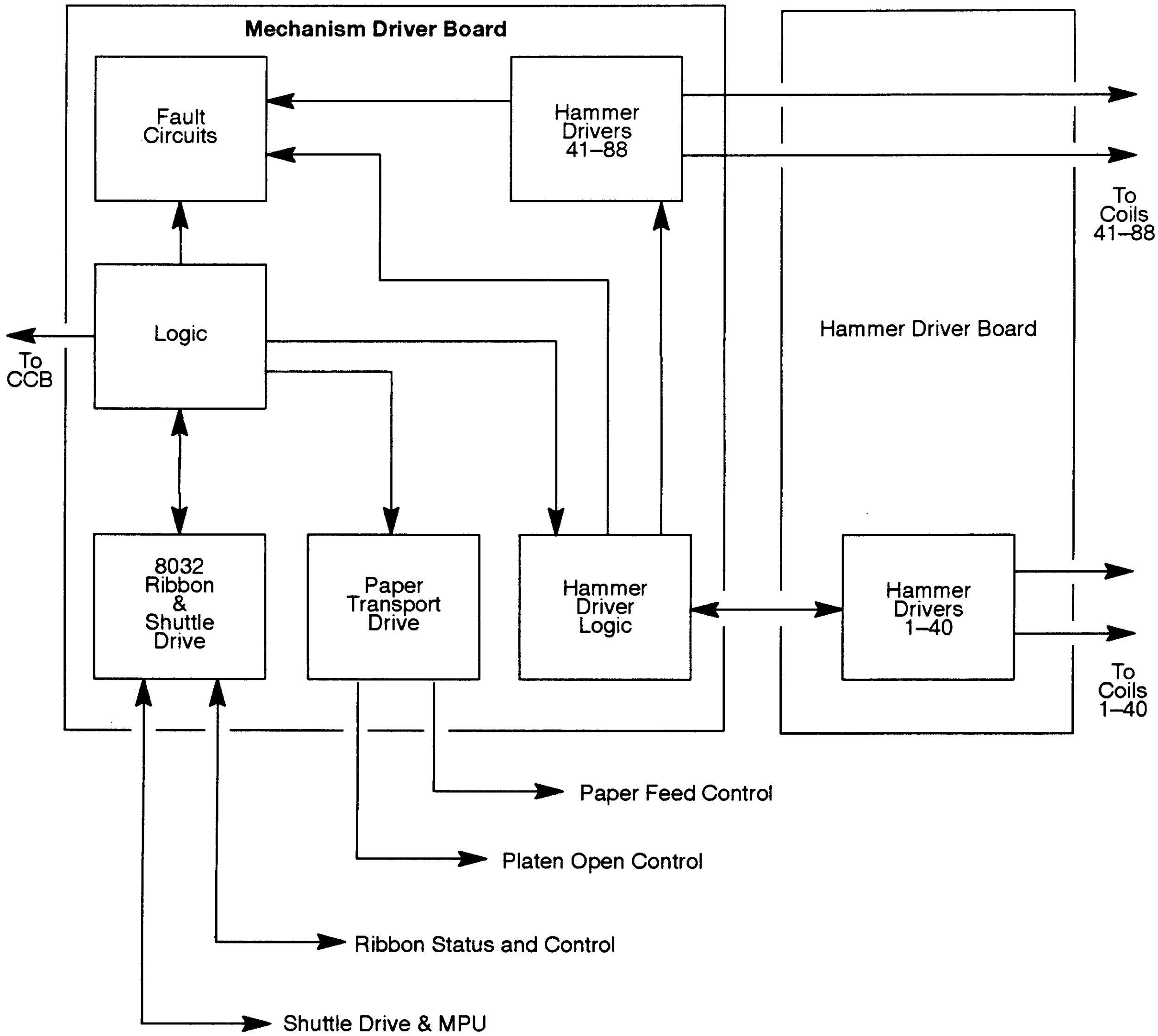


Figure 3–15. Operational Overview of the Mechanism Driver Board

Ribbon Drive System

The ribbon drive system is controlled by the 8032 microcontroller. The CCB 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 CCB.

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 CCB. After a stop signal is received, the ribbon is locked to maintain tension. If the CCB 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 CCB through the 8032 microcontroller and MDIC ASIC. The CCB 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.

Paper Feed System

Dot row advance and slew tables are stored in the CCB. The paper feed drive circuit takes commands directly from the CCB to control the two–phase dc paper feed stepper motor. A CCB 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.

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 CCB 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 (see Figure 3–16) perform the following functions:

- Convert serial data bits on the Com signal 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.

A signal line called Com carries dot information for the characters to be printed by each hammer. Another signal, called hammer shift clock (HSC), provides clocking for the hammer driver logic circuitry. The rising edges of these HSC clock pulses cause the data coming in on the Com signal line to be shifted into the hammer driver shift register. This process continues until all of the data bits on the Com line have been clocked into the shift register.

After the last data bit has been clocked into the shift register, a signal called Upper Driver (UD) goes high. This signal serves as a "hammer fire" signal. When the UD signal goes high, it causes the data in the shift register to be transferred into the hammer driver data latches. Each of these latches drives one of the gates of the lower drive MOSFETs (Metal Oxide Semiconductor Field Effect Transistors).

When the UD signal goes high, it also turns on the upper drive MOSFETs. When UD is high and a lower drive MOSFET is on, 48 volts are applied across the hammer coil connected to that lower drive MOSFET. This causes the current in that hammer coil to rise rapidly, cancelling the magnetic field that holds the hammer retracted. With the magnetic field cancelled, the hammer starts to fly forward. The UD signal then goes low, disabling the upper drive MOSFETs. The coil current is sustained by the upper drive diodes and the lower drive MOSFETs. This combination applies

12.5 volts (V_{sus}) across the coil, keeping the magnetic field cancelled until hammer impact.

After the dot is printed, the Lower Driver Reset (LD Rst.) signal resets the hammer driver data latches, turning off the lower drive MOSFETs. The remaining coil current returns to the 48 volt supply through flyback diodes. With the hammer coils de-energized, the magnetic field is restored, and the permanent magnet recaptures the hammer.

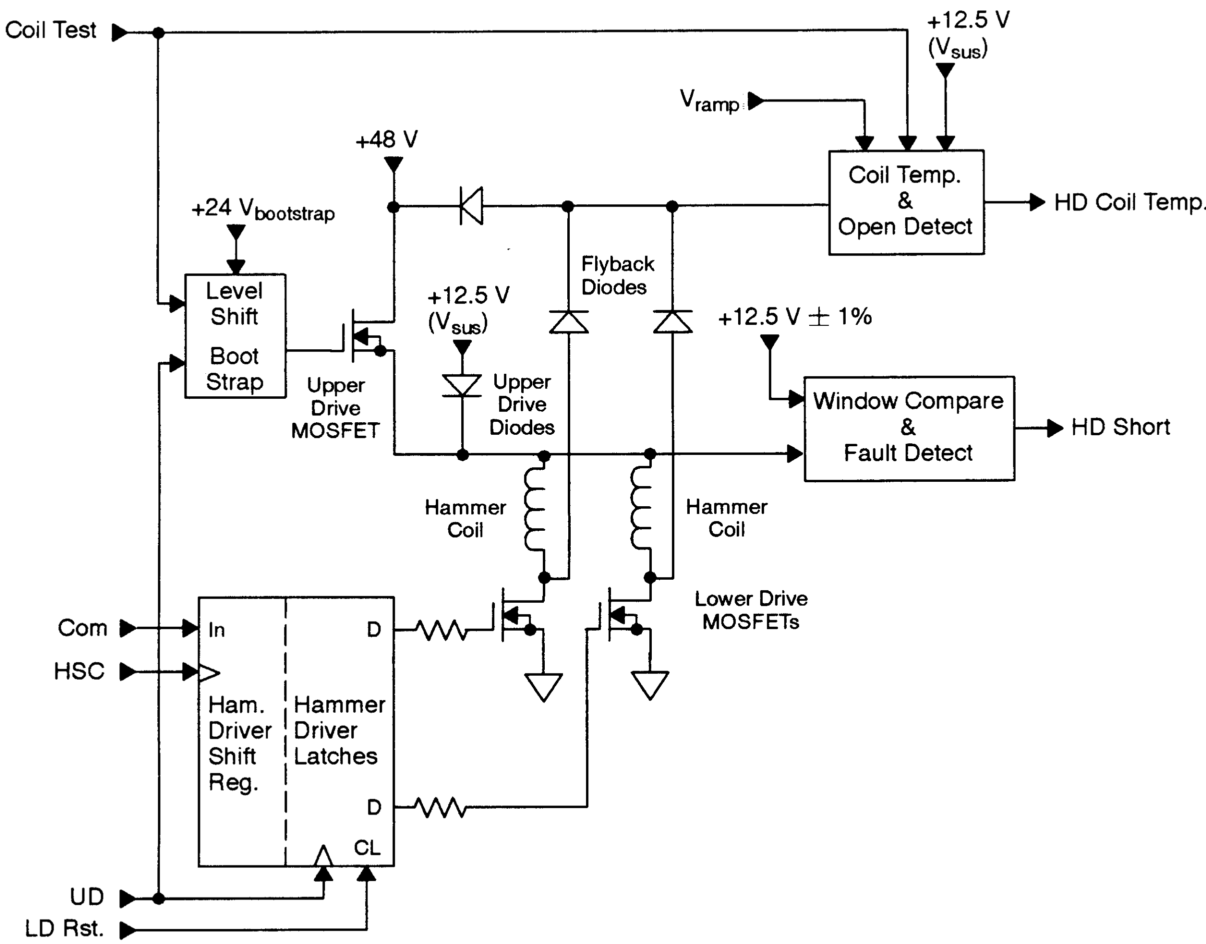


Figure 3–16. Hammer Driver Logic

Power Filtering

The power supply is housed in a protected and independently cooled steel module located behind the card cage containing the hammer driver and mechanism driver boards. The hammer driver board provides bulk filtering of the +48 and +12.5 (V_{SUS}) supplies. (See Figure 3–17.)

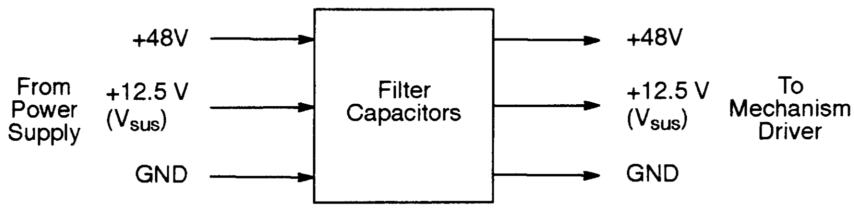


Figure 3–17. Hammer Driver Power Filtering

Hammer Bank Cooling

The hammer driver board also powers a blower that cools the hammer bank. A fixed 60/40 signal (PWM) is provided to the hammer driver board to run the blower. The hammer driver board demodulates this signal to a binary logic (on/off) 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 3–18.)

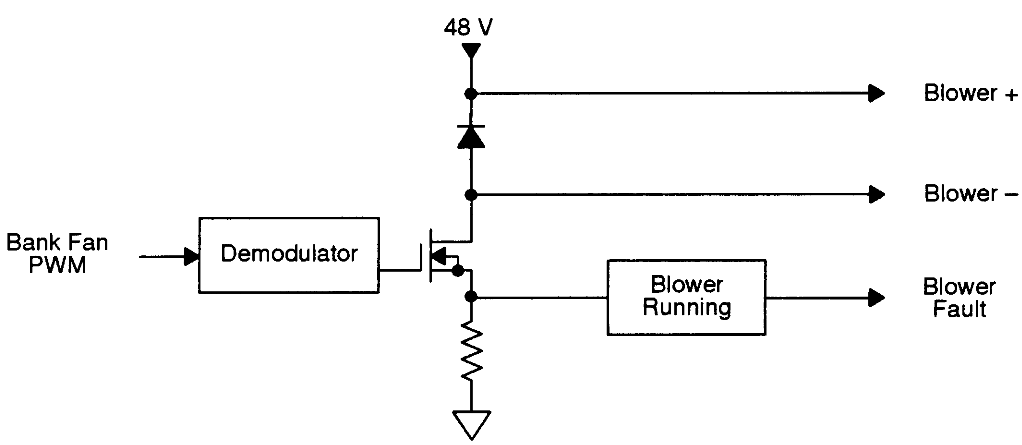


Figure 3–18. Hammer Bank Cooling

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 filtering. The hammer driver board passes the filtered +48 and +12.5 Vdc to the mechanism driver board for distribution to electromechanical circuits. The power supply board supplies +5 Vdc power directly to the mechanism driver board.

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 is located next to the flywheel timing disk, and is oriented so that timing signals relate precisely to the shuttle position. (See Figure 3–19.) 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 timing disk provides eight printing periods and four back and forth shuttle cycles. 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 described on page 3–5.

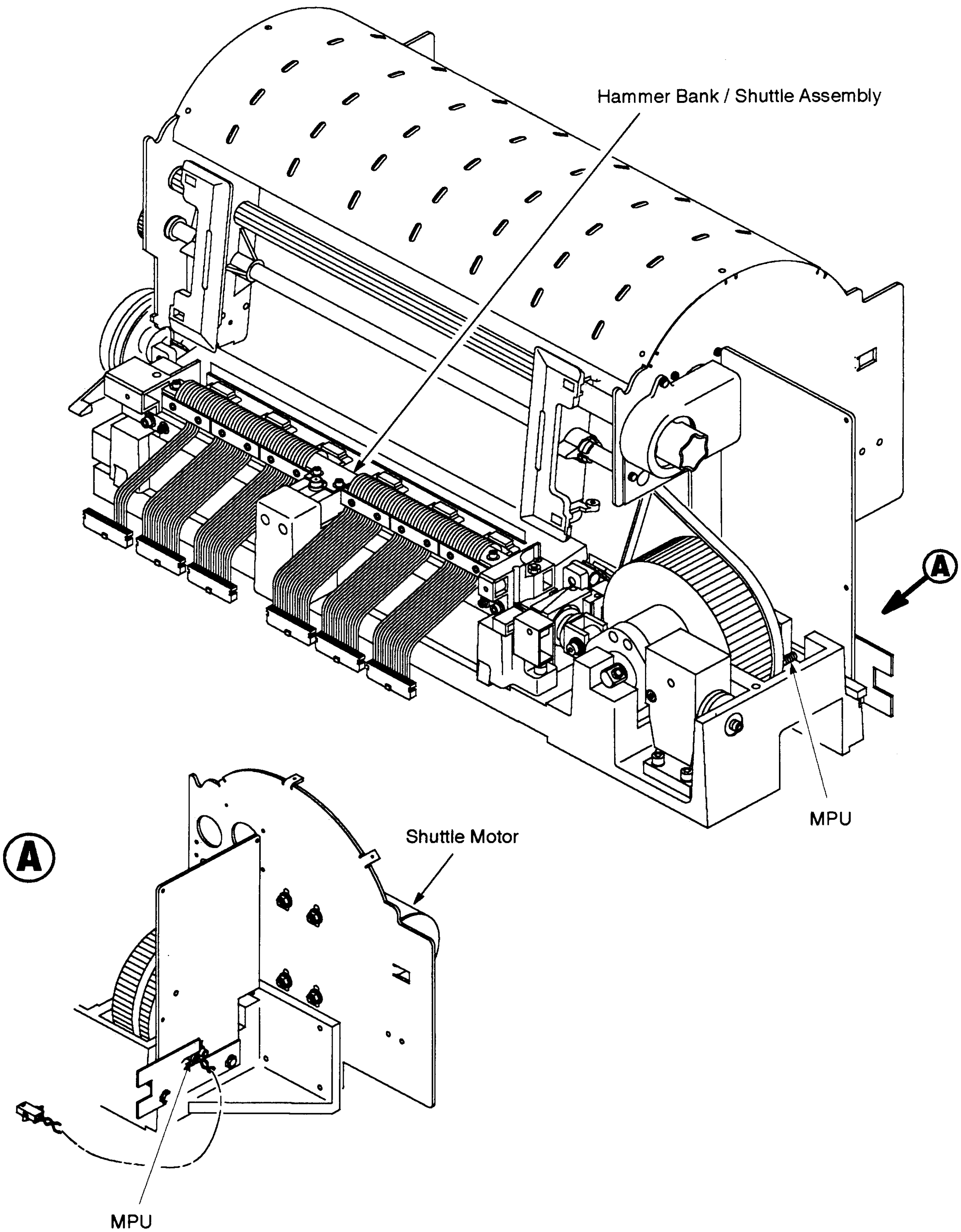


Figure 3–19. Hammer Bank and Shuttle Mechanical Elements

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 shuttle assembly is moving. 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.

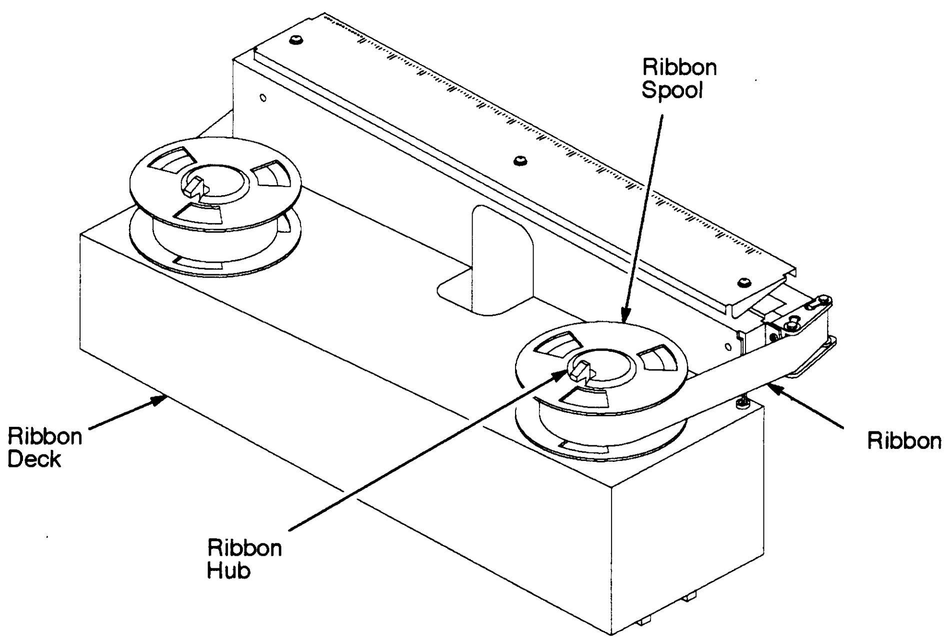


Figure 3–20. Ribbon Deck

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. 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 can be advanced by hand with the vertical adjustment knob.

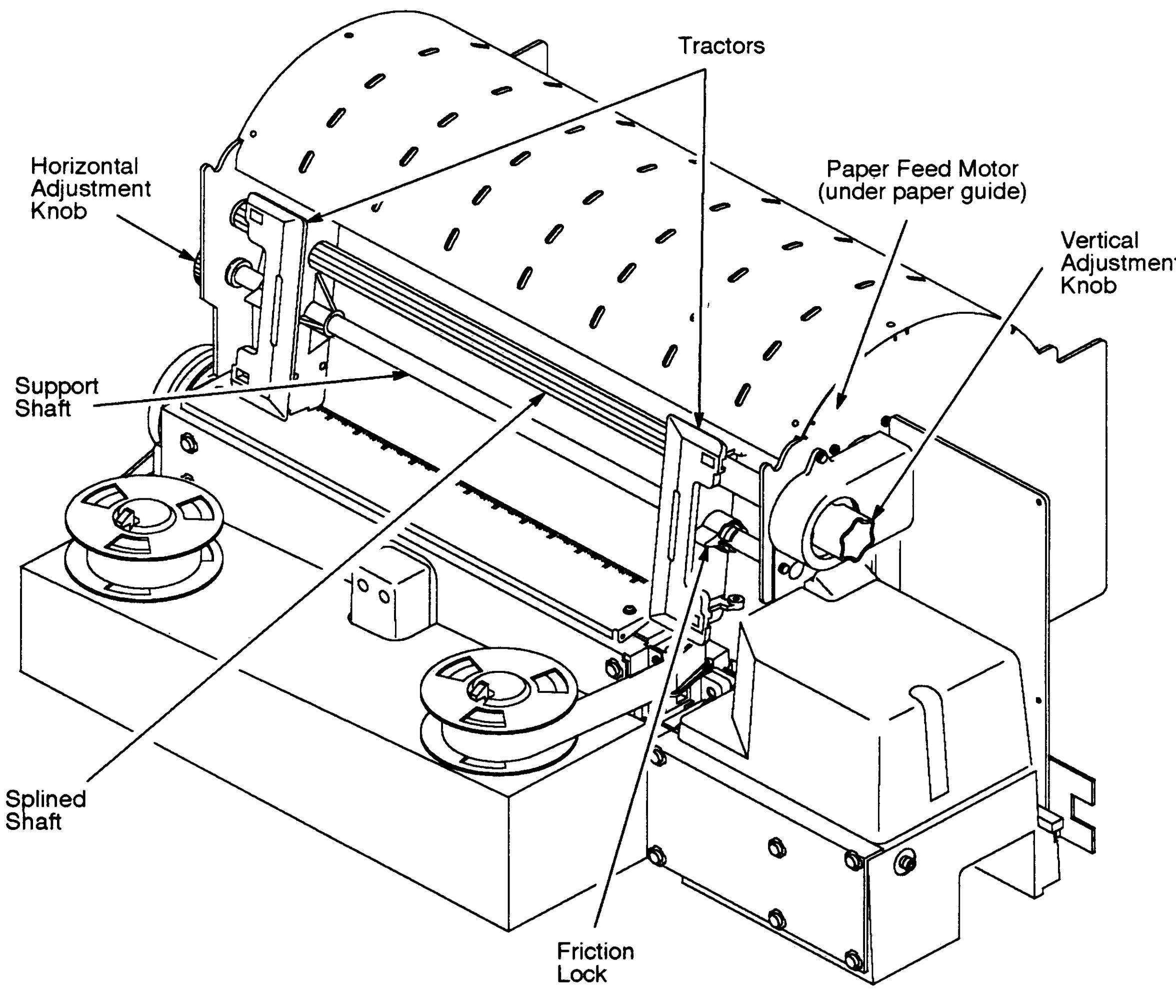


Figure 3–21. Paper Feed Components

4 Preventive Maintenance

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Cleaning the Printer 4–2

Preventive Maintenance

The IM 6412 printer is a rugged and reliable device. It requires no preventive maintenance beyond normal replenishment of paper and ribbons and periodic cleaning.

Operating conditions vary widely; therefore, the user must determine how often to clean the printer.

Since there is no guarantee that the user will clean the printer regularly, you should clean the printer whenever you are called to service it.

IMPORTANT

Proper cleaning will improve print quality and extend the life of the hammer bank and shuttle assembly. Thoroughly clean dirt, excessive ink buildup, paper and ribbon debris from the hammer bank cover/ribbon mask and hammer bank/shuttle assemblies.

Cleaning the Printer

WARNING

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. Power off the printer.
2. Unplug the power cord from the printer.
3. Wipe the cabinet exterior with a clean, lint–free cloth dampened (not wet) with water and mild detergent or window cleaning solution.
4. Dry the cabinet with a clean, lint–free cloth.
5. Open the printer cover.
6. Remove paper from the printer.
7. Raise the forms thickness lever all the way. (See Figure 4–1.)
8. Remove the ribbon.

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.

WARNING

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.

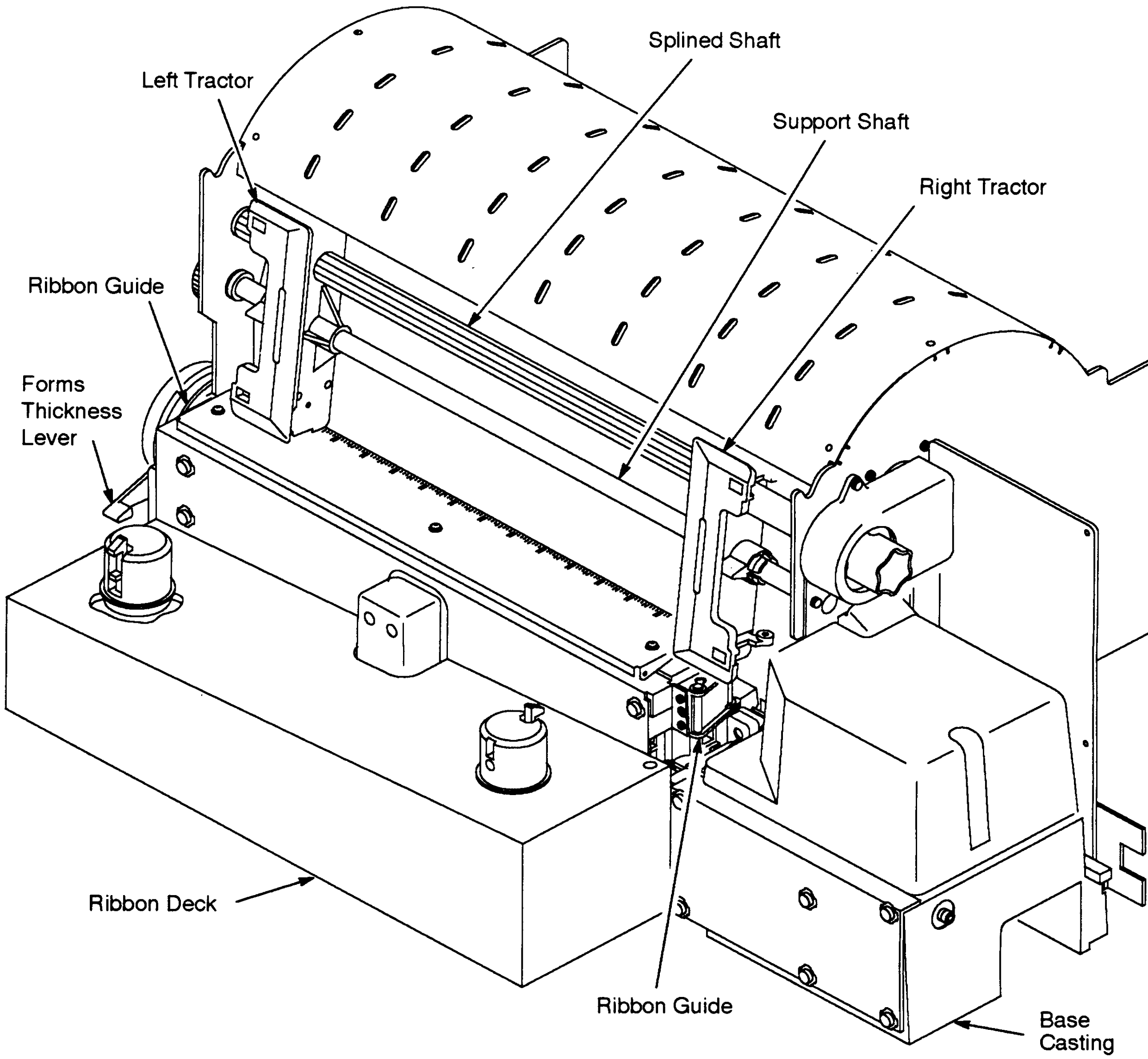

Figure 4–1. Cleaning Interior of Cabinet

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 4–2.)

14. Put the hammer bank in the service position. (See page 6–2.)

15. Remove the hammer bank cover/ribbon mask assembly.

NOTE: Handle the hammer bank cover/ribbon mask assembly carefully. A damaged hammer bank cover/ribbon mask assembly can degrade print quality.

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

17. Install the hammer bank cover/ribbon mask assembly.

18. Return the hammer bank to the operating position. (See page 6–6.)

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.

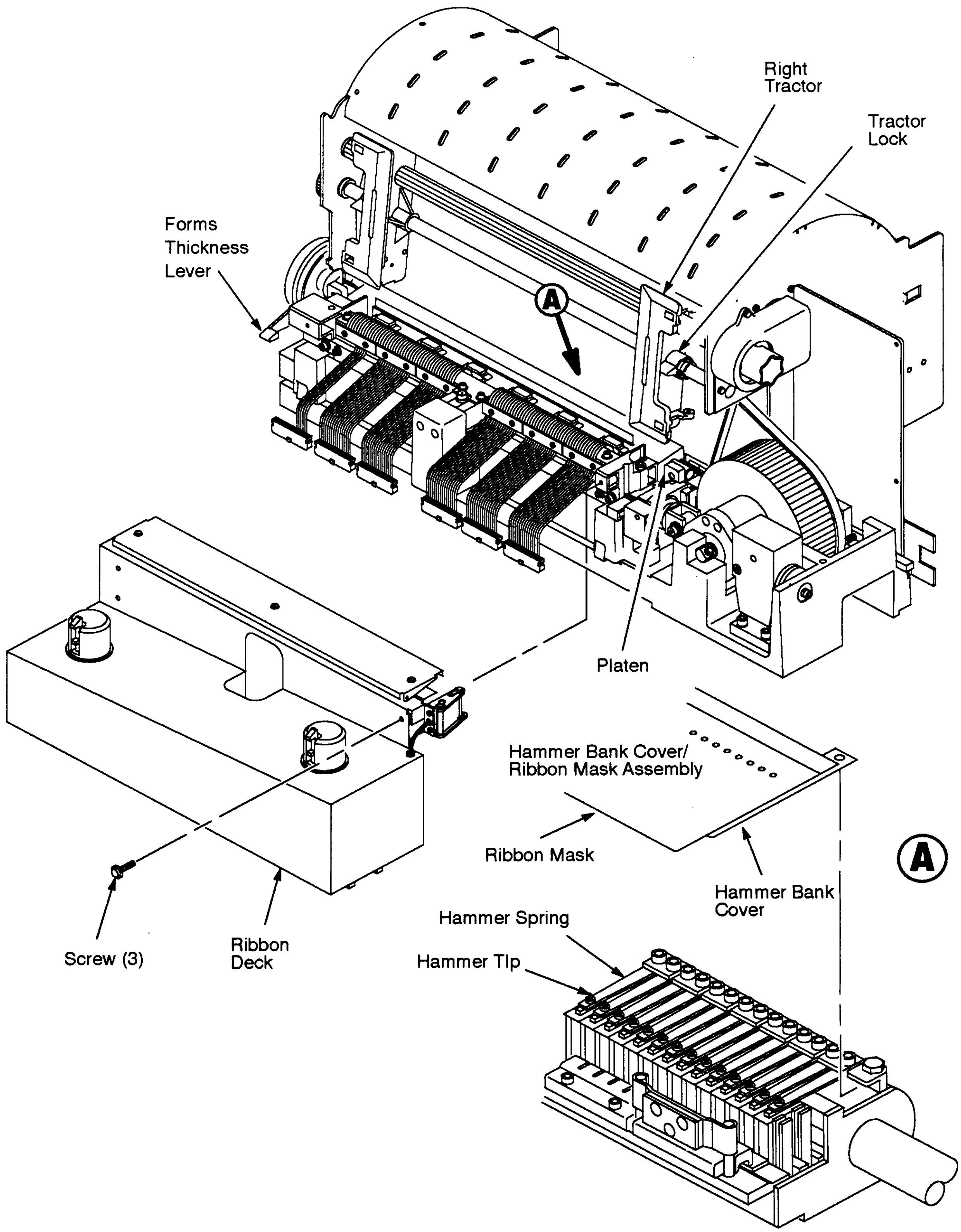

Figure 4–2. Cleaning Hammer Bank Assembly

5 Troubleshooting

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Introduction

This chapter contains procedures for troubleshooting printer malfunctions.

Operator panel keys, configuration menus, and diagnostic tests are different for IBM 6412 Model A00 and Model CT0 printers. For this reason, and because you must operate the printer to check its performance, have the *Operator's Guide* and the *Setup Guide* at the printer site.

The troubleshooting aids available to you are summarized below.

Troubleshooting Aids

- **Fault Messages: IBM 6412–A00 (ASCII) Printer** — page 5–4

  The LCD fault messages that can occur when using the Model A00 printer are listed, and a troubleshooting logic tree is included for each message.

- **Fault Messages: IBM 6412–CT0 (SCS) Printer** — page 5–6

  The LCD fault messages that can occur when using the Model CT0 printer are listed, and a troubleshooting logic tree is included for each message.

- **Symptoms Not Indicated by Fault Messages** — page 5–26

  Not all malfunctions are indicated on the LCD. Standard troubleshooting techniques for these kinds of malfunction are covered in this section. A logic tree of common problems is also included.

- **Printer Confidence Check** — page 5–30

  A systematic check of printer operation. Use it to establish basic printer status or for troubleshooting imprecise or intermittent symptoms.

- **CCB Diagnostic Check** — page 5–31

  Checks the operation of the microprocessors and IC chips on the CCB and Mechanism Driver boards.

- **CT Board Diagnostic Check** — page 5–37

  Checks initialization of the coax/twinax integrated interface board in the IBM 6412–CT0 printer.

- **IBM 6412–A00 Self–Tests** — Page 5–39

  A suite of printer tests stored in ROM. Use the tests to check the print quality and operation of the model A00 (ASCII) printer.

- **IBM 6412–CT0 Self–Tests** — Page 5–45

  A suite of printer tests stored in ROM. Use the tests to check the print quality and operation of the model CT0 (SCS) printer. Error log explained.

- **Making a Hex Code Printout** — Page 5–50

  You can print data streams in hexadecimal format, and use the printout to troubleshoot printer data reception problems.

- **Wire Data — Appendix A**

  Interconnect diagrams, pin–outs, and diagrams of the cable assemblies. Use as source material for tracing electrical problems.

- **Hammer and Coil Wire Data — Appendix H**

  Hammer driver coil and cabling charts for determining hammer or coil failures.

Fault Messages: IBM 6412–A00 (ASCII) Printer

DANGER

Always disconnect the AC power cord from the power source before performing any maintenance procedure. Failure to remove power could result in injury to persons or damage to equipment. If you must apply power during maintenance, you will be instructed to so in the maintenance procedure.

If a fault condition occurs in an IBM 6412–A00 printer, the following occur:

- The **Attention** indicator on the operator panel lights.
- If enabled, an alarm sounds. (Press **Stop** to silence the alarm.)
- The message display indicates "ATTENTION" on the first line and the specific fault message on the second line.

Displayed faults fall into one of two categories:

- Operator correctable.
- IBM service representative required—indicated by an asterisk [*] after the fault message.

Clearing Errors

Refer to Table 5–1 and follow the instructions. After correcting an error, press **Start** to clear the message and place the printer in READY mode. Press **Clear** to clear the message and place the printer in NOT READY mode.

If an error is not cleared, the printer will try to print again but will display another error message until the error is finally cleared.

Table 5–1. IBM 6412–A00 Fault Messages

Fault Message	Explanation	Solution
DCU RAM	RAM on CCB failed initialization test.	Replace the CCB.
Font PROM	Font PROM failure on CCB.	Replace font PROMs on CCB. If message recurs, replace CCB.
001 Out of Forms	Printer out of paper.	Page 5–22.
002 Forms Jammed	No paper motion.	Page 5–20
051 Hammer Driver Short*	Electrical malfunction of hammer driver system.	Page 5–16
052 Mechanism Driver Hot*	Mechanism driver board is overheating.	Page 5–17
053 48 Volt Failed*	Internal power failure.	Page 5–10
055 Mechanism Driver Link Down*	Electronic fault between the CCB and mechanism driver board.	Page 5–18
057 Platen Open	Forms thicknes lever is raised to open position.	Page 5–22
058 Shuttle Jammed	No shuttle movement or shuttle moving at wrong speed.	Page 5–25
059 Hammer Bank Hot*	One or more hammer coils are overheating.	Page 5–15
060 Shuttle Fan Failure*	Shuttle is overheating.	Page 5–13
076 Printer Board Failure*	Failure in printer's operational software.	Replace the CT board. Write down the logged error code(s) and send them back with the old board.
089 Ribbon Jammed	No ribbon movement.	Page 5–23

Fault Messages: IBM 6412–CT0 (SCS) Printer

DANGER

Always disconnect the AC power cord from the power source before performing any maintenance procedure. Failure to remove power could result in injury to persons or damage to equipment. If you must apply power during maintenance, you will be instructed to so in the maintenance procedure.

If a fault condition occurs in an IBM 6412–CT0 printer, the following occurs:

- The **Attention** indicator on the operator panel lights.
- If enabled, an alarm sounds. (Press **Stop** to silence the alarm.)
- The error log buffer automatically logs the error.
- The operator panel message display indicates "ATTENTION" on the first line and the specific fault message on the second line.

The message display shows only one error at a time. If multiple errors occur simultaneously, the errors are prioritized to determine which error is displayed on the operator panel.

The IBM 6412–CT0 printer has four categories of errors:

- **Fatal Errors:** electromechanical problems detected by built–in test equipment. Printing stops and the printer requires repair.
- **Correctable Errors:** errors requiring the user to perform some action to clear the error.
- **Overrideable Errors:** errors informing the user that printer performance has decreased for some reason. The user can override the error and continue printing.
- **Non–Intervention Errors:** host system errors cleared by the host. These are logged in the error log. In some cases, but not all, the user is informed that they have occurred.

Clearing Errors

Refer to Table 5–2 and follow the instructions. After correcting an error, press **Stop** to clear the error. Press **Start** to resume printing.

If an error is not cleared, the printer will try to print again but will display another error message until the error is finally cleared.

Table 5–2. IBM 6412–CT0 Fault Messages

Error Log Code	Fault Message	Explanation	Solution
	DCU RAM	RAM on CCB failed initialization test.	Replace the CCB.
	FONT PROM	Font PROM failure on CCB.	Replace font PROMs on CCB. If message recurs, replace CCB.
	INVALID KEYPRESS	Appears briefly if an inactive key is pressed.	Re–enter the value, or press the correct key.
01–04	076 PRINTER BOARD FAILURE	01—System comm. error 02—Illegal protocol communication 03—Illegal function request 04—Initialization error	Replace the CT board. Write down the logged error code(s) and send them back with the old board.
05	999 NVRAM ERROR	Non–volatile memory fault.	Replace the CCB.
06–15	076 PRINTER BOARD FAILURE	Internal error message.	Replace the CT board. Write down the logged error code(s) and send them back with the old board.
16	HAMMER DRIVER ERROR	Electronic fault in mechanism driver system.	Page 5–16.
17		Not Used	
18	COOLING ERROR	Circuit boards are overheating.	Page 5–13.
19	001 END OF FORMS	Twinax printer out of paper.	Load paper. See also page 5–22.
20	PLATEN OPEN	Forms thickness lever is raised to open position. (Twinax)	Page 5–22.
21		Not Used	
22	089 RIBBON JAM	No ribbon movement or ribbon moving at wrong speed.	Page 5–23.
23	SHUTTLE STALL	No shuttle movement or shuttle moving at wrong speed.	Page 5–25.
24	002 FORMS JAMMED	No paper motion. (Twinax)	Page 5–20.

Continued on next page.

Table 5–2. IBM 6412–CT0 Fault Messages (Continued)

Error Log Code	Fault Message	Explanation	Solution
25	002 FORMS JAMMED	No paper motion. (Coax)	Page 5–20.
26	PLATEN OPEN	Forms thickness lever is raised to open position. (Coax)	Page 5–22.
27	001 END OF FORMS	Coax printer out of paper.	Load paper. See also page 5–22.
28	RIBBON OUT	RibbonMinder** message indicating it is time to change the ribbon.	Replace old ribbon with new one and configure the ribbon life to 100%. See the *Setup Guide*.
29		Not Used	
30		Not Used	
31–33	076 PRINTER BOARD FAILURE	Internal error message.	Replace the CT board. Write down the logged error code(s) and send them with the old board.
34	024 PARITY ERROR	Parity error on the twinax line.	The printer reports the error; host clears the error. See also page 5–11.
35	076 PRINTER BOARD FAILURE	Internal error message.	Replace the CT board. Write down the logged error code(s) and send them with the old board.
36	02X ACTIVATE LOST	Twinax protocol communication errors.	The printer reports the error. See also page 5–11.
37	02X INVALID ACTIVATE	Twinax protocol communication errors.	The printer reports the error. See also page 5–11.
38	02X INVALID COMMAND	Twinax protocol communication errors.	The printer reports the error. See also page 5–11.
39	02X INPUT QUERY OVERRUN	Data byte limit exceeded on twinax printer.	Have the system operator rerun the print job. See also page 5–11.
40	A97 UNDEFINED CHARACTER	Twinax printer has received a non–printable character.	Press **Start**.
41	02X SCS CODE ERROR	Printer received undefined control character (hex 40).	The printer clears the error. See also page 5–24.
			Continued on next page.

Table 5–2. IBM 6412–CT0 Fault Messages (Continued)

Error Log Code	Fault Message	Explanation	Solution
42	02X SCS PARAMETER ERROR	Illegal parameter value received in command code.	Press Stop to clear fault. Press **Start** to go on–line. See also page 5–24.
43	BELL CHARACTER	See the *Operator's Guide*.	Press **Start**.
44–47	076 PRINTER BOARD FAILURE	Internal error message.	Replace the CT board. Write down the logged error code(s) and send them with the old board.
48	CU NOT ENABLE	Host has not communicated with the coax printer for approximately one minute.	Correct host communication problem. See the *Programmer's Reference Manual*.
49–51	076 PRINTER BOARD FAILURE	Internal error message.	Replace the CT board. Write down the logged error code(s) and send them with the old board.
52		Not Used	
53	MECH DRV LINK	Electronic fault between the CCB and mechanism driver board.	Page 5–18.
54	MECH DRV HOT	Mechanism driver board is overheating.	Page 5–17.
55	48 VOLT FAILED	Internal power failure.	Page 5–10.
56		Not Used	
57		Not Used	
58	051 HAMMER DRV SHORT	Electrical malfunction of hammer driver system.	Page 5–16.
59	059 HAMMER BANK HOT	One or more hammer coils are overheating.	Page 5–15.
60	SHUTTL FAN FAULT	Shuttle assembly is overheating.	Page 5–13.

053 48 Volt Failed *
48 VOLT FAILED

Instruction	Indication	Yes	No
1. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"48 Volt Failed * " message.	Go to step 2.	Return printer to normal operation.
2. Press the operator panel key that clears fault indications.	"48 Volt Failed * " message.	Go to step 3.	Return printer to normal operation.
3. Power off the printer. Disconnect CCB/Mech Driver cable from connector J2 on the CCB and connector J6 on the mech driver board. (See Appendix A.)	—	Go to step 4.	—
4. Power on the printer and observe card cage fan: feel for air flow beneath the card cage.	Card cage fan comes on.	Replace the CCB.	Reattach CCB/Mech Driver cable to connector J2 on the CCB and connector J6 on the mech driver board, and go to step 5.
5. Cycle power and check operation of the power supply fan above the on/off switch.	Power supply fan runs, then stops.	Replace the mech. driver board. Gto to step 6.	Go to step 7.
6. Cycle power and check operation of the power supply fan.	Power supply fan runs, then stops, with new mech. driver board installed.	Install the original mech. driver board and replace the hammer driver board.	Go to step 7.
7. Cycle power and observe the power supply fan.	Power supply fan does not run at all.	Install the original hammer driver board and replace the power supply. Go to step 8.	Return printer to normal operation.
8. Cycle power and check for the fault message.	"48 Volt Failed * " message.	Install the original power supply. Replace one at a time until the problem goes away: a) +5V cable assy b) Hi Voltage Cable Assy c) Main Wire Harness d) Hammer Bank Cables (See Appendix A.)	Return printer to normal operation.

02X ACTIVATE LOST
02X INPUT QUERY OVERRUN
02X INVALID ACTIVATE
INVALID COMMAND
024 PARITY ERROR

DANGER

To prevent serious personal injury from electrical shock when connecting or disconnecting the signal cable, power the printer off and unplug the power cable.

Instruction	Indication	Yes	No
1. Print the Error Log, which is under the CT Internal Test menu. (Ref: *Setup Guide.*) A few parity errors are acceptable.	Host communication error message display logged.	Go to step 2.	Return printer to normal operation.
2. Power off the printer and disconnect the power cord. Check coax/twinax cable termination.	Coax/twinax cable is properly attached.	Go to step 3.	Attach cable correctly.
3. Check coax/twinax I/O cable grounding and connection to the PCBA. (See Appendix A.)	Cable is grounded and attached to CT board correctly.	Go to step 4.	Attach cable correctly.
4. Check that coax/twinax data cable is undamaged and is not longer than 4921.5 feet (1500 meters).	Cable is OK.	Go to step 5.	Replace cable.
5. Power on the printer and send data from host.	Error message displays.	Power printer off. Replace one at a time until message is gone: a) CT board b) CCB board c) coax or twinax cable.	Return printer to normal operation.

CCB to Mech Err.

Instruction	Indication	Yes	No
1. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"CCB TO MECH ERR." message.	Go to step 2.	Return printer to normal operation.
2. Press the operator panel key that clears fault indications.	"CCB TO MECH ERR." message.	Go to step 3.	Return printer to normal operation.
3. Run a diagnostic print test.	"CCB TO MECH ERR." message.	Go to step 4.	Return printer to normal operation.
4. Power off the printer. Remove the card cage cover. Check ribbon cable connectors between the CCB and mechanism driver boards.	Connectors are attached properly.	Go to step 5.	Connect and latch ribbon connectors. Go to step 5.
5. Check installation of the CCB and mechanism driver boards.	Boards are installed correctly.	Go to step 6.	Reseat CCB and mechanism driver boards in their edge connectors at back of card cage. Go to step 7.
6. Check for correct installation of EPROMs for the RTPU on the CCB and RSP on the mechanism driver board.	RTPU and RSP EPROMs and microprocessors are installed correctly.	Go to step 7.	Install correct RTPU and RSP EPROMs and microprocessors. Go to step 7.
7. Power on the printer and check for fault message.	"CCB TO MECH ERR." message.	Replace one at a time until the message is gone: a) CCB b) Mech. driver board c) CCB/Mech. Dr. cable. (See Appendix A.)	Return printer to normal operation.

060 Shuttle Fan Failure
SHUTTL FAN FAULT
COOLING ERROR

Instruction	Indication	Yes	No
1. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"Shuttle Fan" error message.	Go to step 2.	Return printer to normal operation.
2. Run a shuttle/ribbon diagnostic test. Check for air exiting between the hammer bank antirotation block and the ribbon deck assembly.	Blower starts and runs, but "Shuttle Fan" error message displays.	Go to step 3.	Go to step 4.
3. Power off the printer. Check all cable connections between hammer drivers, power supply wire harness, and the sensor harness assembly. (See Appendix A.)	Cables are connected and undamaged.	Replace one at a time until the message is gone: a) CCB b) hammer driver board c) Blower assembly d) High voltage cable assembly	Return printer to normal operation.
4. Power on the printer and run a diagnostic print test.	"Shuttle Fan" error message displays and blower does not run.	Replace one at a time until the message is gone: a) Blower b) Hammer driver board c) Mech. driver board d) Power supply high voltage cable assembly (See Appendix A.)	Return printer to normal operation.

Dynamic RAM Fault *

DANGER

To prevent serious injury from electrical shock when connecting or disconnecting the signal cable, power the printer off and unplug the power cable.

Instruction	Indication	Yes	No
1. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"Dynamic RAM Fault * " message.	Go to step 2.	Return printer to normal operation.
2. Take the printer off–line. Power off the printer. Disconnect the power cord. Disconnect the signal cable from the host computer. Wait 15 seconds. Power on the printer.	"Dynamic RAM Fault * " message.	Make a CCB Diagnostic Check (page 5–31). If any problems are found on the CCB, replace the board.	Return printer to normal operation.

Graphic Check

DANGER

To prevent serious injury from electrical shock when connecting or disconnecting the signal cable, power the printer off and unplug the power cable.

Instruction	Indication	Yes	No
1. Run a buffer print. (Ref: *Setup Guide.*) Run the same job that generated the error message.	GRAPHIC CHECK message.	Go to step 2.	Return printer to normal operation.
2. Have the system operator verify: a) host data are correct, b) there are no invalid characters, and c) the printer's World Trade Language is correct.	Host data contain no invalid characters and World Trade Language correct.	Go to step 3.	Have the system operator make the necessary corrections to data or configuration.
3. Run the Translation Table in CT internal test menu and check characters.	GRAPHIC CHECK message.	Replace one at a time until message is gone: a) CT board b) CCB board c) coax or twinax cable.	Return printer to normal operation.

059 Hammer Bank Hot *
Hmr Coil Too Hot

NOTE: The printer has protective circuits designed to sense conditions that 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 operator panel key that clears fault indications.	The printer continues the print job.	No further attention required.	The printer continues original print job, then the fault message reappears.
2. Check the ambient temperature where the printer is operated.	Printer area at or above 100° F (37° C).	Allow hammer bank to cool for 10 minutes. Cool the printer area or reduce the size and duration of print jobs.	Go to step 3.
3. Run a diagnostic print test. While test is running, check operation of the blower fan and air flow through blower duct.	Unobstructed air flow through blower duct.	Go to step 4.	If the blower duct was blocked, remove all obstructions. If the blower fan did not operate, check electrical connections. If connections are okay, replace the blower assembly.
4. Cool the hammer bank for 2 hours. (It must be at room temperature.) Run a diagnostic print test.	"Ham. Bank Hot" or "HMR COIL TOO HOT" message.	Replace the hammer bank.	Return the printer to normal operation.

HAMMER DRIVER ERROR

Instruction	Indication	Yes	No
1. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	HAMMER DRV ERROR message.	Go to step 2.	Return printer to normal operation.
2. Press the operator panel key that clears fault indications.	HAMMER DRV ERROR message.	Go to step 3.	Return printer to normal operation.
3. Run a diagnostic print test.	HAMMER DRV ERROR message.	Replace one at a time until message is gone: a) Mech. driver board b) Hammer driver board c) Power supply board d) Hammer bank	Return printer to normal operation.

051 Hammer Driver Short

Instruction	Indication	Yes	No
1. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"Ham. Drv. Short * " message.	Go to step 2.	Return printer to normal operation.
2. Press the operator panel key that clears fault indications.	"Ham. Drv. Short * " message.	Go to step 3.	Return printer to normal operation.
3. Disconnect connectors P4, P5, and P6 from hammer driver board. Cycle power.	"Ham. Drv. Short * " message.	Replace the mechanism driver board.	Go to step 4.
4. Disconnect connectors P1, P2, P3, and P4 from the hammer driver board. Connect P5 and P6. Cycle power.	"Ham. Drv. Short * " message.	Install the original mechanism driver board and 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 less than or equal to 100 KΩ to ground, replace the cable and the coil.	"Ham. Drv. Short * " message.		Return printer to normal operation.

Internal Error

Instruction	Indication	Yes	No
1. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"Internal Error" message.	Go to step 2.	Return printer to normal operation.
2. Press the operator panel key that clears fault messages.	"Internal Error" message.	Go to step 3.	Return printer to normal operation.
3. This message indicates a software bug. Use your local support procedure to request assistance.	—	—	—

052 Mechanism Driver Hot *
MECH DRV HOT

Instruction	Indication	Yes	No
1. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"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 operator panel key that clears fault indications.	"Mech Driver Hot * " message.	Go to step 6.	Return printer to normal operation.
6. Run a diagnostic print test.	"Mech Driver Hot * " message.	Replace mechanism driver board.	Return printer to normal operation.

055 Mechanism Driver Link Down *
MECH DRV LINK

Instruction	Indication	Yes	No
1. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"Mech Driver Link * " message.	Go to step 2.	Return printer to normal operation.
2. Press the operator panel key that clears fault indications.	"Mech Driver Link * " message.	Go to step 3.	Return printer to normal operation.
3. Run a diagnostic print test.	"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 the CCB and mechanism driver boards.	Connectors are attached properly.	Go to step 6.	Connect and latch ribbon connectors. Go to step 6.
6. Check installation of CCB and mechanism driver boards.	Boards are installed correctly.	Go to step 7.	Reseat CCB and mechanism driver boards in their edge connectors at back of card cage. Go to step 7.
7. Power on the printer and check for fault message.	"Mech Driver Link * " message.	Replace one at a time until the message is gone: a) CCB b) Mech driver board c) CCB/Mech. Dr. cable (See Appendix A.)	Return printer to normal operation.

Off Line
Line Check Par.

DANGER

To prevent serious personal injury from electrical shock when connecting or disconnecting the signal cable, power the printer off and unplug the power cable.

Instruction	Indication	Yes	No
1. Wait a few seconds.	"OFF LINE LINE CHECK PAR." message.	Go to step 2.	Return printer to normal operation.
2. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"OFF LINE LINE CHECK PAR." message.	Communications problem. Check lines, interface configuration, controller, etc.	Return printer to normal operation.

On Line
Line Check Par.

DANGER

To prevent serious personal injury from electrical shock when connecting or disconnecting the signal cable, power the printer off and unplug the power cable.

Instruction	Indication	Yes	No
1. Wait a few seconds.	"ON LINE LINE CHECK PAR." message.	Go to step 2.	Return printer to normal operation.
2. Cycle power: Power off the printer. Wait 15 seconds. Power on the printer.	"ON LINE LINE CHECK PAR." message.	Communications problem. Check lines, interface configuration, controller, etc.	Return printer to normal operation.

Paper Jam
002 FORMS JAMMED

Instruction	Indication	Yes	No
1. Check for a failure to sense End of Forms.	End of Forms (last form) is past the hammer area.	Do one at a time until the problem is gone: a) Clean the paper motion/out detector with a cotton swab and alcohol. b) Replace paper motion/out detector assembly c) Replace CCB d) Replace Sensor Harness assembly (See Appendix A.)	Go to step 2.
2. Inspect paper path for bunched, torn, folded paper or labels.	Paper path is clear.	Go to step 3.	Remove paper and go to step 3.
3. 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. WARNING: Do not pry on or apply force to the hammer tips. Go to step 4.	Go to step 4.
4. Load paper. Press the Form Feed key several times.	Forms feed without erratic motion, noise, or pin–hole damage.	Go to step 5.	If pin holes are damaged, go to step 7. For erratic motion or noise, go to step 9.
5. Press the View key twice.	Forms move correctly in both directions, without jamming, tearing, or folding.	Suspect a false indication. Go to step 13.	Go to step 6.
6. Check the platen motor belt.	Platen motor belt OK.	Replace one at a time until message goes away: a) mech driver board b) platen motor c) main wire harness cable assembly	Replace platen motor belt.

Instruction	Indication	Yes	No
7. Check that the hammer bank cover/ribbon mask assembly has not been deformed in such a way as to block the paper path.	Hammer bank/ribbon mask assembly damaged or bent.	Replace the hammer bank cover/ribbon mask assembly.	Go to step 8.
8. Check to platen gap adjustment.	Platen gap incorrect.	Adjust platen gap. Go to step 9.	Go to step 9.
9. Check for damage to the paper feed belt.	Paper feed or belt damaged.	Replace the paper feed belt. Go to step 10.	Go to step 10.
10. Check the tractors and tractor door springs for damage or excessive wear.	Tractors are OK.	Go to step 11.	Replace defective tractor.
11. Run a diagnostic print test.	"Paper Jam" message.	Replace one at a time until the message is gone: a) Mech. driver board b) Paper feed motor c) Main Wire Harness Assy (See Appendix A.)	Return printer to normal operation.
12. Clean the paper motion detector with cotton swab and alcohol. Run a diagnostic print test.	"Paper Jam" message.	Go to step 13.	Return printer to normal operation.
13. Set the paper motion/out detector fault setting to DISABLE (Ref: *Setup Guide*). Run a print test and check paper feeding as the printer prints.	"Paper Jam" message.	Set the paper motion/out detector fault setting to ENABLE. Go to step 14.	Set the paper motion/out detector fault setting to ENABLE. Return printer to normal operation.
14. Run a diagnostic print test.	"Paper Jam" message.	Replace one at a time until the message is gone: a) Paper Motion/Out Detector b) CCB c) Intermediate Cable Assy W5 (See Appendix A.)	Return printer to normal operation.

001 END OF FORMS
001 OUT OF FORMS
Paper Out

1. Load paper.	—	Go to step 2.	—
2. Run a diagnostic print test.	"Paper Out" message.	Replace one at a time until the message is gone: a) Paper Motion/Out Detector b) CCB c) Sensor Harness Assy (See Appendix A.)	Return printer to normal operation.

057 Platen Open
PLATEN OPEN

Instruction	Indication	Yes	No
1. Load paper and close the forms thickness lever.	—	Go to step 2.	—
2. Run a diagnostic print test.	"Platen Open" message.	Replace one at a time until the message is gone: a) Platen Open Switch Assembly b) Sensor Harness Assy (See Appendix A.) c) CCB	Return printer to normal operation.

089 Ribbon Jammed
089 RIBBON JAM

Instruction	Indication	Yes	No
1. Using a screwdriver, short across the ribbon guide screws to reverse ribbon hub motion. Check for ribbon failing to reverse motion.	Ribbon fails to reverse.	Go to step 2.	Go to step 3.
2. Check for missing foil strip at end of ribbon.	Foil strip missing.	Replace the ribbon.	Go to step 8.
3. Check that the forms thickness lever is not closed too tightly; this can jam the ribbon and shuttle.	Forms thickness lever is set correctly.	Go to step 4.	Readjust the setting of the forms thickness lever. Go to step 4.
4. Run a ribbon and shuttle test and check for shuttle obstruction.	Ribbon fault message.	Go to step 5.	Return printer to normal operation.
5. Check ribbon path for blockage or obstruction.	Ribbon path is clear	Go to step 6.	Remove obstructions from ribbon path and go to step 6.
6. Wind ribbon by hand and inspect for folds, tears, holes, fraying.	Ribbon is OK.	Rewind and reinstall ribbon. Go to step 7.	Replace ribbon, if damaged. Unfold and rewind ribbon if it was folded. Go to step 7.
7. Run the "Ribbon and Shuttle" self–test and check the alignment of the ribbon guides and hubs if the ribbon was folded.	Ribbon tracks OK.	Go to step 8.	Align ribbon guides. Go to step 8.
8. 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.	Both motors wind the ribbon.	Replace the mechanism driver board.	Replace one at a time until message is gone: a) defective ribbon drive motor b) mechanism driver board c) main wire harness (See Appendix A.)

SCS CODE ERROR
SCS PARAMETER ERROR

DANGER

To prevent serious personal injury from electrical shock when connecting or disconnecting the signal cable, power the printer off and unplug the power cable.

Instruction	Indication	Yes	No
1. Run a buffer print. Run the same job that generated the error message.	SCS CODE or SCS PARAMETER ERROR message.	Verify host data are correct and there are no invalid characters.	Return printer to normal operation.
2. Ask the system operator to verify that the printer's Device ID is set to the correct emulation with respect to the host configuration.	SCS CODE or SCS PARAMETER ERROR message.	Replace one at a time until message is gone: a) CT board b) CCB c) Coax or Twinax cable.	Return printer to normal operation.

058 Shuttle Jammed
SHUTTLE STALL

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 the forms thickness lever for thicker paper. Go to step 2.
2. Run a diagnostic print test and check for shuttle obstruction.	"Shuttle Jam" or "Shuttle Stall" message.	Go to step 3.	Return printer to normal operation.
3. Remove the ribbon deck and flywheel/cam cover. Inspect shuttle area and mechanism for obstruction.	Shuttle movement blocked.	Remove obstruction. Go to step 4.	Go to step 4.
4. Run shuttle/ribbon diagnostic print.	Nothing obstructing shuttle, but "Shuttle Jam" or "Shuttle Stall" message appears.	Go to step 5.	Return printer to normal operation.
5. Run shuttle/ribbon diagnostic print.	Shuttle moves.	Go to step 6.	Go to step 8.
6. Check MPU adjustment.	MPU adjustment within specifications.	Go to step 7.	Adjust MPU and return printer to normal operation.
7. Run shuttle/ribbon diagnostic test and check MPU voltage at connector P35.	MPU voltage is 2.5–6 VAC.	Replace mechanism driver board. Go to step 8.	Replace the MPU. Adjust the MPU gap and hammer phasing. Go to step 8.
8. Check the shuttle motor belt.	Shuttle motor belt OK.	Replace one at a time until the message is gone: a) Mech Driver board b) Shuttle motor c) Main wire harness cable assembly (See Appendix A.) d) hammer bank assembly	Replace shuttle motor belt.

Symptoms Not Indicated by Fault Messages

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

1. Ask the operator to describe the problem.
2. Verify the fault by running diagnostic self–tests or replicating conditions reported by the user.
3. Look for a match in the "Symptoms Not Indicated by Fault Messages Troubleshooting Table" (page 5–27), and follow the instructions given.
4. Locate the malfunction using the half–split method:
    a. Start at a general level and work down to details.
    b. Isolate faults to half the remaining system at a time, until the final half is a field–replaceable part or assembly. (Troubleshooting aids are listed on page 5–2.)
5. Replace the defective part or assembly.

IMPORTANT

Do NOT attempt field repairs of electronic components or assemblies. Replace a malfunctioning electronic assembly with an operational spare. Most electronic problems are corrected by replacing the printed circuit board assembly (PCBA), sensor, or cable that causes the fault indication. The same is true of failures traced to the hammer bank: replace the entire shuttle frame assembly. It is not field repairable.

6. Test printer operation after every corrective action.
7. Stop troubleshooting and return the printer to normal operation when the reported symptoms disappear.

Symptoms Not Indicated by Fault Messages Troubleshooting Table

Symptom	Instruction
Power on hang condition.	1. Perform a diagnostic check of the microprocessors: a) CCB Diagnostic Check (page 5–31) b) CT Board Diagnostic Check (CT0 model only) (page 5–37) c) Replace the power supply
Blank or single line of black squares across top row of operator panel LCD.	1. Perform the CCB Diagnostic Check (page 5–31).
Operator Panel key failure.	1. Replace one at a time until the problem is fixed: a) Operator Panel Assembly b) CCB c) Operator Panel Cable Assembly (See Appendix A.)
Ribbon folding or feed problems.	1. Clean the ribbon guides, ribbon mask, hammer spring (page 4–4, steps 14, 15, and 16). 2. Check the left and right ribbon guide alignment.
Printer appears normal, but does not print data sent from the host.	1. Perform the CCB Diagnostic Check (page 5–31).
Printer prints data sent from the host, but occasionally prints double characters or loses blocks of data.	1. Perform the CCB Diagnostic Check (page 5–31).
	(continued on next page)

Print Quality Problems	
Missing, light, or smeared characters or dots: NOTE: For the following steps, use Appendix H to determine positions of failing hammer springs, coils, coil connectors, and pins. If you follow all the steps in this procedure and still have print quality problems, the hammer bank may be worn or defective, requiring replacement. (This condition is very rare.)	1. Check the forms thickness lever setting. 2. Check the ribbon for folds or tears. 3. If the left–most, right–most, or all print positions are too light or missing, check the platen gap adjustment (page 6–24). 4. Run a diagnostic print test and determine the failing positions. 5. Clean the hammer bank cover/ribbon mask assembly and hammer springs (page 4–4, steps 14, 15, and 16). 6. Check for a bent or damaged hammer bank cover/ribbon mask assembly, and for hammer springs that do not retract. 7. If the symptom is light or smeared characters or dots, replace the failing position hammer spring. 8. Disconnect the failing position's coil connector from the hammer bank. 9. Measure for a hammer coil resistance of 4–8 Ω at the disconnected coil connector. If the resistance is correct, go to the next step. If the resistance is not correct, replace defective *and* two adjacent coils. (A defective coil can burn the coils on either side of it.) 10. Reconnect the coil connector to the hammer bank assembly. 11. Disconnect the failing hammer driver connector from the hammer driver PCBA. 12. Measure for a hammer coil resistance of 4–8 Ω through the hammer bank cable assembly. If the resistance is correct, go to the next step. If the resistance is not correct, replace the hammer bank cable assembly. 13. If the failing print position is between 1 and 40, replace the Hammer Driver Board. If the failing print position is between 41 and 88, replace the following one at a time until the problem is gone: a) Mechanism Driver board b) Mech Driver/Hammer Driver cable assembly c) Hammer Driver board
	(continued on next page)

Print Quality Problems	
All characters or dots are too light or too dark.	1. Check the forms thickness lever setting. 2. Clean the hammer bank cover/ribbon mask assembly and hammer springs (page 4–4, steps 14, 15, and 16). 3. Check the platen gap adjustment. 4. Install a new ribbon. 5. Replace mechanism driver board.
Horizontal misalignment. (Dots or characters move left or right from dot row to dot row or line to line.)	1. If all dots between alternate rows are misaligned, check hammer phasing (page 6–12). 2. Clean the ribbon mask and hammer springs (page 4–4, steps 14, 15, and 16). 3. Check the MPU gap adjustment (page 6–18). 4. Replace mechanism driver board.
Vertical misalignment: 1. Dots or characters move up or down from dot row to dot row or line to line. 2. Incorrect spacing from dot row to dot row or line to line.	1. Check paper feed belt tension (page 6–20). 2. Check platen gap adjustment (page 6–18). 3. Replace one at a time until problem is fixed: a) tractors b) mechanism driver board c) paper feed motor d) CCB e) power supply
Randomly misplaced dots.	1. Check platen gap adjustment (page 6–18). 2. Check printer grounding (Appendix G). 3. Replace one at a time until problem is fixed: a) CCB b) power supply
Garbled print.	1. Perform the CCB Diagnostic Check (page 5–31).

Printer Confidence Check

DANGER

To prevent serious personal injury from electrical shock when connecting or disconnecting the signal cable, switch off the printer power and unplug the power cable.

Instruction	Indication	Yes	No
1. Check that printer is plugged into correct power source.	Power cable installed correctly to proper source.	Power off the printer. Go to step 2.	Power off the printer. Connect printer to correct power source.
2. Take printer off–line. Power off the printer. Disconnect printer power cord. Disconnect the interface (data) cable from the host computer to isolate the printer. Power on the printer and run a diagnostic print test.	Printer operates correctly.	Fault is not in the printer. Check host computer, applications software, cabling, etc.	Go to step 3.
3. Power off the printer. Connect the interface (data) cable to host and printer. Power on the printer. Make a configuration printout. (Refer to the *Setup Guide*.)	a) Configuration is correct for the user's application. b) Host computer and printer use the same protocol (emulation). c) Configuration has not been inadvertently changed by the user.	Go to step 4.	Reconfigure the printer. (Ref: *Setup Guide*.)
4. Power off the printer. Check alignments and adjustments. (Chapter 6.)	Assemblies and components adjusted in accordance with Chapter 6.	Go to step 5.	Adjust all assemblies that are out of spec.
5. Power off the printer. Remove paper guide assembly. Check all electrical connectors.	Connections are clean and tight. Wires are not stripped, frayed, or out of connectors.	Go to step 6.	Replace stripped, frayed, or broken wires.
6. Check that all printed circuit boards are seated correctly and cable connections are correct.	Printed circuit boards are firmly seated and all cables are correctly attached.	Go to step 7.	Unseat and reseat each board, one board at a time. Check and correct the cable attachments.
7. Inspect for debris that could cause short circuits (loose fasteners, foil, etc.).	Metallic debris.	Remove debris. Clean the printer.	Go to step 8.
8. Install paper guide assembly. Power on the printer.	Printer powers up and initializes properly.	Return printer to normal operation.	Troubleshoot the fault message.

CCB Diagnostic Check

This procedure checks the operation of the microprocessors and IC chips on the Common Controller (CCB) and Mechanism Driver boards. The locations of chips and processors are shown in Appendix C. Do the steps in the order presented.

1. Power off the printer.
2. Open the front door and remove the card cage cover. (See Figure 7–17, page 7–65.)
3. Reseat the CCB and Mech Driver boards in the card cage.
4. Power on the printer. Wait at least 15 seconds; while you are waiting watch the 68010 DPU LED at location A2 on the CCB (some boards may be silk–screened as "68000") and watch the display on the operator panel. (NOTE: IC locations are shown in Appendix C.)

   a. When the CCB is operating correctly, the operator panel displays "Diagnostic Tests in Progress," and the 68010 DPU LED turns on for 1 to 15 seconds, then turns off. The 68010 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. Return the printer to normal operation.

      If the 68010 DPU LED turns on and off as described above, but the printer does not work properly, or fails later, go to step 5.

      ("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 68010 DPU LED to fault isolate this message.)

   b. **If the 68010 DPU LED never turns on**, it means the 68010 did not execute the first software instruction in its ROM. Go to step 6.

   c. **If the 68010 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 7.

d. **If the 68010 DPU LED blinks steadily at 1 blink per second**, it means the 68010 ROM chips are bad. Power 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 seems to operate properly, a high current flowed through the backwards–biased transistors and its service life is probably shortened due to thermal damage.

   ROMs that appear to be correctly inserted can still be defective. Sometimes zero bits "fade" to ones when internal floating gates discharge. This can occur from over–voltage programming, radiation damage, too many EPROM erasures, and so on. Install new program PROMs.

e. **If the 68010 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. Power off the printer, wait at least 15 seconds, then power on the printer again before accepting an indication of CCB RAM failure.

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

   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.

5. The 68010 DPU LED turns on, then off, but the printer doesn't work. Look at the operator panel display:

a. **If the display is blank, or has a single line of black squares across the top**, the connector to the operator panel probably needs to be plugged in or reseated. Power 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 68010 DPU LED lights and turns off, the operator panel, operator panel cable, or CCB 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 connector 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 (E2), 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 *reversed* in relation to the rest of the board. On these boards, the silk–screen shows the correct orientation.) Always replace PROMs and parts that were oriented incorrectly.

   If the problem persists, replace the 8032 PROMs on the CCB and Mech Driver boards. If the problem persists, replace the interconnect cable assembly W1. (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 at location A12. Then make sure the correct interface is selected and configured from the operator panel. (Printer configuration is covered in the *Setup Guide*.) Save the configuration and reset the printer. If the printer interface is 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, number of data bits, number of stop bits, and parity. When using RS–232, configure the host for XON/XOFF, if possible, because 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 PC Parallel interface, this means the host is ignoring BUSY; in RS–232, the host is ignoring the XOFF character or "Data Terminal Ready" signal (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 breakout box works, but will not debug XON/XOFF or other RS–232 data protocols. If the printer is sending XOFF with one stop bit, the host may not be receiving it if the host 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 PC Parallel or Dataproducts interfaces, never on RS–232. What happens is that 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 strobe polarity. (Refer to the *Setup Guide*.)

   Also check that the terminating resistors are present at locations C12 and D12 on the CCB. You can correct some noise problems by using a shielded data cable or by changing the terminating resistors. The standard terminating resistors are optimized for high speed data transfer for cables between 1 and 5 meters long; you can change them for slower operation, which will provide slightly more noise immunity.

   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 other signals on the cable (especially PC Parallel "ACK" or Dataproducts "DEMAND") 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. Also, make sure that both the printer and the host computer are properly grounded.

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 not transmitting all 8 data bits. When this occurs, the PC Parallel or Dataproducts interface receives a 1 on every unconnected data line. Uncontrolled slewing is often caused by enabling PI (Paper Instruction) in the printer when the host lacks a PI signal. (PI shows as "p" on the hex dump.) Some RS–232 and Dataproducts interfaces only send 7 data bits. In this case, the eighth bit will be received as a one.

   In RS–232, a common cause of garble is the interface set to 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 indicates a problem with PC Parallel or Dataproducts terminating resistors on the CCB at C12 and D12, especially if they are absent. Garble also can result from failed termination resistors or parallel logic, but this is rare.

6. The 68010 DPU LED never lights. The 68010 has not run its first instruction. Remove the CCB and make sure jumper E2 is inserted correctly.

   a. The first two programs PROMs may be malfunctioning or inserted wrong. Do the corrective actions listed in step 4.d.

   b. Look at the operator panel display. If it is not blank, the logic power supply is okay. If the display is blank, power off the printer. Reseat the power supply cable on the Mech Driver board and the CCB/Mech Driver cable assembly W1. power on the printer. If that does not correct the problem, check for logic supply voltage on the CCB board: DC voltage between the positive end of capacitor C4 (location A5) and TP1 (GND, location A1) should be +4.8 or higher. If the voltage is less than +4.8 VDC, suspect a failed power supply, interconnect cabling, and the CCB, in that order.

   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. Replace the common controller board (CCB).

7. The 68010 DPU LED lights, but never turns off. Look at the operator panel display:

   a. **If the top line of the display is blank**, the operator panel is probably unplugged or defective. Do the corrective actions listed in step 5.a.

   b. **If the display has a single line of black squares on the top line,** the 64180 has failed. Power 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 have been 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 68010 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. Power off the printer, reseat the cable in connectors J2 on the CCB and J6 on the Mech Driver board. Check the 8032 on the Mech Driver, its PROM, and its clock jumper (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.

CT Board Diagnostic Check

This procedure is a quick check of the Coaxial/Twinaxial Integrated Interface (CT) board on the IBM 6412 Model CT0 printer. You check CT operation by monitoring three diagnostic LEDs as the printer powers up. LED locations are shown in Figure 5–1.

What the LEDs Do

LEDs on the CT board indicate successful communication among devices:

- LED 1 lights to indicate successful communication between CT processor 8344 and CT processor 80186.
- LED 2 lights to indicate successful communication between the CT and the DCU on the common controller board.
- LED 3 lights to indicate a successful boot–up and initialization.

How to Test the CT Board

1. Power off the printer.
2. Open the front door and remove the card cage cover. (See Figure 7–17, page 7–65.)
3. Make sure all cable connections to the CT board are correct.
4. Power on the printer and watch the three LEDs as the printer initializes:
    a. If all three LEDs come on sequentially, the CT board is operational. Go to step 5.
    b. If any LED does *not* come on, or comes on then goes out, power off the printer, remove the CT board, and install new PROMs on the CT board. Run the power–up check again. If all LEDs come on, go to step 5. If any LED does not come on, replace the CT board.
5. Power off the printer.
6. Install the card cage cover and close the front door. (See Figure 7–17, page 7–65.)
7. Return the printer to normal operation.

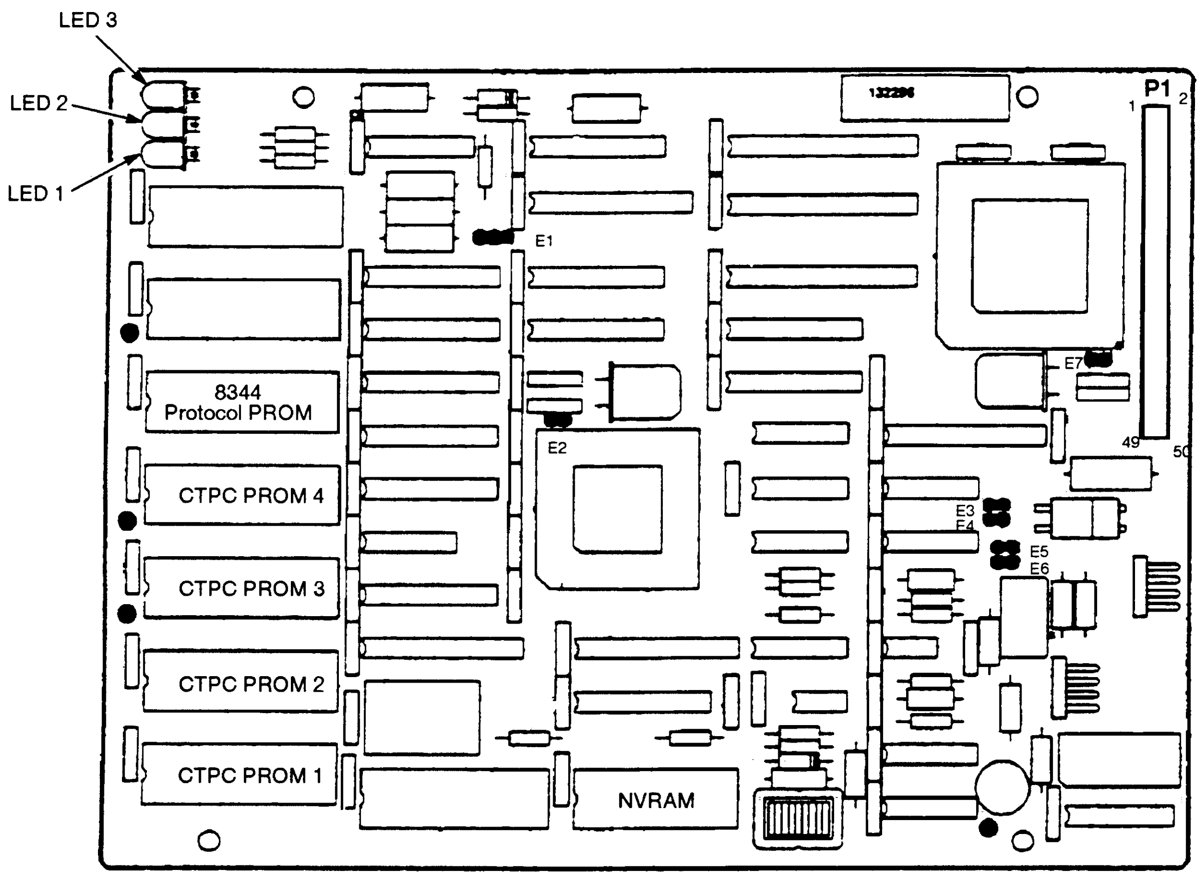

Figure 5–1. Diagnostic LED Locations

A suite of print tests is stored in ROM for use as diagnostic tools. Use these tests to check the print quality and operation of the model A00 (ASCII) printer.

The print tests are summarized below.

NOTE: Items listed under the description of a test may require replacement or adjustment if the test produces a bad print pattern. Items are listed in the order you should check them: simplest items first, complex items last.

- **Ripple Print** A "sliding" alphanumeric pattern useful for identifying missing or malformed characters, improper vertical alignment, or vertical compression.

  Hammer bank cover/ribbon mask assembly
  Hammer spring
  Shuttle frame assembly

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

  Ribbon
  Splined shaft skew adjustment
  Hammer bank cover/ribbon mask assembly
  MPU sensor
  Hammer spring
  Hammer coil (shuttle frame assembly)

- **E's + TOF** A pattern of all E's repeated for ten lines and followed by a form feed to the next page top of form, useful for identifying paper motion or feeding problems.

  Hammer bank cover/ribbon mask assembly
  Power supply PCBA
  Mechanism Driver PCBA
  Paper motion sensor or cable
  Paper feed belt or motor
  Splined shaft bearings
  Tractors or tractor belts

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

  Ribbon
  Hammer bank cover/ribbon mask assembly
  MPU sensor
  Hammer spring
  Hammer coil

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

  Mechanism Driver PCBA
  Hammer bank cover/ribbon mask assembly
  Hammer tips
  Paper feed belt or motor
  Splined shaft bearings
  Tractor bearings or belts

- **Slow Shuttle Test** Verifies proper operation by exercising shuttle motion at low speed. You can also use this test to check ribbon tracking and reversing.
- **Fast Shuttle Test** Verifies proper operation by exercising shuttle motion at high speed. You can also use this test to check ribbon tracking and reversing.
- **Shuttle Only Test** Verifies proper operation by exercising the hammer bank/shuttle assembly at high speed with the ribbon motors deactivated.
- **Phasing** A hammer timing parameter that permits you to adjust the vertical alignment of dots in character printing.
- **End of Forms** A vertical comb pattern used to determine the number of dot rows from the completion of a paper out fault to the end of the paper.
- **Burn In** Used *only* at the factory to burn in the printer. Do *not* use this test in the field.
- **Test Width** Selects either 8.0 or 13.2 inches as the width to print the self–test.

Running IBM 6412–A00 Print Tests

To run a print test, you must do three things:

- Select the Printer Tests emulation
- Select and run the test(s).
- Return the printer to normal operation.

This section shows you how do each procedure.

Select the Printer Tests Emulation:

Step	Key	Displayed Result	Notes
1.	Make sure the printer is powered on, a ribbon is installed, and paper is loaded.		
2.	Press: Stop	Not Ready	Take the printer off-line before running printer tests.
3.	Press: Scroll ↑ + Scroll ↓	Unlocked	Press both keys at the same time. Allows you to test the printer.
4.	Press: Menu	Printer Configuration Emulation	
5.	Press: Enter	Emulation Proprinter III XL *	Moves down to the currently selected emulation. (Proprinter III XL, the factory default is shown in this example.)
6.	Press: Scroll ↑ UNTIL	Emulation Printer Tests	
7.	Press: Enter	Emulation Printer Tests *	Selects the Printer Tests emulation.
8.	Press: Clear	Not Ready	

Run the Printer Test:

Step	Key		Displayed Result	Notes
1. Press:	Menu		Printer Configuration Emulation	First of the series of configuration menus.
2. Press:	↑ Scroll		Printer Configuration Emulation Parameters	
3. Press:	Enter		Emulation Parameters Proprinter III XL	
4. Press:	↑ Scroll		Emulation Parameters Printer Tests	
5. Press:	Enter	UNTIL	Printer Tests [Printer Test Name]	
6. Press:	↑ Scroll	UNTIL	Printer Tests Test Width: n	Advances to the Test Width option, which is either 8.0 or 13.2.
7. Press:	Enter		Printer Tests Test Width: n *	Enters the Test Width options submenu.
8. Press:	↑ Scroll	UNTIL	Printer Tests Test Width: 13.2	Advances to a test width of 13.2 inches wide (132 columns) for testing.
9. If you loaded 132–column paper in the printer, go to the next step. If you loaded paper narrower than 132 columns, skip to step 12.				
10. Press:	Enter		Printer Tests Test Width: 13.2 *	Selects the Printer Tests and sets full width (132 columns) for testing.
11. Skip to step 14.				

Step	Key		Displayed Result	Notes
12. Press:	↑ Scroll	UNTIL	Printer Tests Test Width: 8.0	Advances to a test width of 8 inches wide (80 columns) for testing.
13. Press:	Enter		Printer Tests Test Width: 8.0 *	Selects a test width of 8 inches wide (80 columns) for testing.
14. Press:	Return	UNTIL	Printer Tests Test Width: n	
15. Press:	↑ Scroll	UNTIL	Printer Tests [Test Name]	Cycles through the list of Printer Tests. Stop when the name of the test you wish to run is displayed (will print at either 80 or 132 columns, as specified).
16. Press:	Enter		Running [Test Name]	The printer starts printing.
17. Press:	Stop		Printer Tests [Test Name]	The printer stops printing.
18. Examine the print quality of the characters. They should be fully formed and of uniform density.				
19. Press:	Clear		Not Ready	

Return the Printer to Normal Operation:

Step		Key	Displayed Result	Notes
1.	Press:	Menu	Printer Configuration Emulation	
2.	Press:	Enter	Emulation Printer Tests *	Moves down to the Printer Tests menu, the currently selected emulation.
3.	Press:	↑ Scroll UNTIL	Emulation Proprinter III XL	
4.	Press:	Enter	Emulation Proprinter III XL	Selects the desired emulation. (Proprinter III XL shown in example.)
5.	Press:	Clear	Not Ready	Returns the printer to NOT READY mode.
6.	Press:	Scroll↑ + Scroll↓	Locked	Locks the **Enter** key.
7.	Press:	Start	Ready	Printer is ready for normal operation.

IBM 6412–CTO Diagnostic Print Tests

The IBM 6412–CTO printer emulates IBM model 5225, 3287, and 4234 printers by using a coaxial/twinaxial integrated interface, designated the "CT." The printer has a suite of print tests stored in ROM and accessed in the Program mode. Use these print tests to check the print quality and operation of the CTO model (SCS) printer.

The print tests for this model are summarized below. (See also Figure 5–2.)

DCU Tests

Test	Function
DCU Hex Print	Prints out all of the hex codes that the CT sends to the DCU. This test must be terminated before running any other tests.
Printer Demonstration	Demonstrates all the functions and features available on the printer.
All E's All H's All E's + FF Underlines Ripple Print	Produces tests designed to run the printer benchmark, which tests the phasing, form feeding, and hammer banks.
Plot Test	All dot positions are printed, creating a solid black band. Exercises the shuttle and hammer bank at maximum capacity.
Ribbon Shuttle	Test operation of the ribbon and shuttle mechanisms.
Hammer Phasing	Verifies the adjustment of the hammer phasing. This test provides the following LCD message: PHASE ADJUSTMENT XX NOTE: In this test, the **Scroll↑** and **Scroll↓** keys are used to raise and lower the phasing values. This test prints 132 columns of H's. You adjust the phasing value until the print quality of the H's is acceptable.
End of Forms Adjust	Prints a vertical comb pattern used to determine the number of dot rows from the completion of a paper out fault to the end of the paper.

CTPC Tests

Test	Function
Printer Configuration	Prints out the host and the CT internal parameter settings.
Print Custom Sets	Prints out the parameters set in all four NVRAM blocks.
Translation Table	Prints out an EBCDIC hex character map of the currently selected IBM character set.
Print Error Log	Prints a log of errors that have occurred in the printer.
Clear Error Log	Clears the error log, except for power on HOURS and LINES PRINTED.

Running IBM 6412–CT0 Print Tests

To run print tests on the IBM 6412–CT0, perform the following steps. (DCU Tests is used as an example.)

The Printer Tests menu is the same for coax and twinax emulations. (See Figure 5–2.)

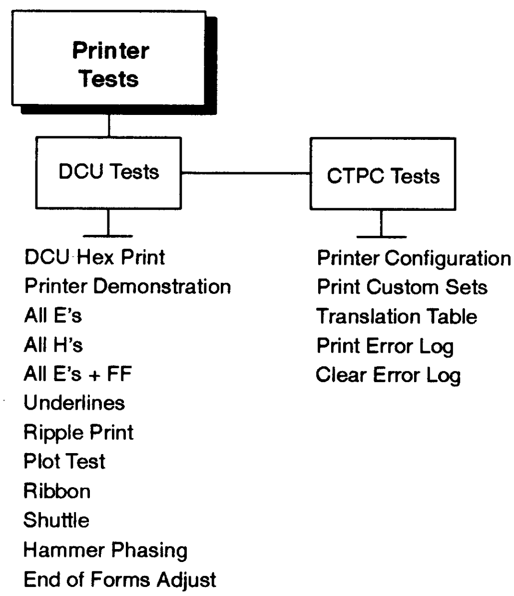

Figure 5–2. IBM 6412–CT0 Printer Tests

NOTE: After unlocking the operator panel, you can press the **Test** key to go directly to the PROGRAM mode and jump to the Printer Tests menu.

Step	Key	LCD Message	Notes
1. If you are in the top level of the configuration menu, scroll through the menu options until you reach Printer Tests, and press **Enter**. Go to Step 5. If you have been using the printer for normal printing operations and you now want to run one or more tests, follow the next steps.			
2. Press:	Stop	NOT READY	
3.	Micro ↑ Scroll ↑ + Micro ↓ Scroll ↓	NOT READY Configuration Menu Unlocked	"Unlocked" permits configuration changes.
4.	Test	Printer Tests DCU Tests	
5.	Enter	DCU Tests DCU Hex Print	
6.	Micro ↑ Scroll ↑	DCU Tests Printer Demonstration	Cycle through the tests. (See Figure 5–2.)
7. To start the test, press	Enter	Printer Demonstration Running	
8. To stop the test, press	Stop	Printer Demonstration Stopped	

Step	Key	LCD Message	Notes
9.	You may continue running this test (using **Enter** to start and and **Stop** to stop), or you may select another test to run. If you are running tests that check print quality, characters should be horizontally and vertically aligned and correctly formed.		
10. To exit tests, press	Start	NOT READY	
11.	Micro ↑ Scroll ↑ + Micro ↓ Scroll ↓	NOT READY Configuration Menu Locked	Prevents settings from being changed by locking the configuration menu.
12.	Start	READY	Printer is ready for normal operation.

The Error Log

The "Print Error Log" option on the CTPC Tests menu prints a record of the number of times a coded error occurred in the printer since the last time the error log was cleared. (See Figure 5–3 and Figure 5–4.)

Errors are stored in the error log as two–digit codes. For each error that has occurred, the error log lists the two–digit code, the error message, and the number of occurrences of the error.

The error log codes are listed in Table 5–2 on page 5–7.

The "Clear Error Log" option on the CTPC Tests menu clears the error log.

NOTE: If you clear the Error Log, the values of the power on HOURS and LINES PRINTED will not be cleared.

ERROR LOG

POWER ON HOURS	2251
LINES PRINTED	181

ERROR CODE	NAME	COUNT
25	002 FORMS JAMMED	3
26	PLATEN OPEN	6
27	001 END OF FORMS	1
48	CU NOT ENABLE	1

Figure 5–3. Coax Error Log

ERROR LOG

POWER ON HOURS	2251
LINES PRINTED	19212

ERROR CODE	NAME	COUNT
19	001 END OF FORMS	5
20	PLATEN OPEN	8
24	002 FORMS JAMMED	1

Figure 5–4. Twinax Error Log

Making a Hex Code Printout

A hex code printout (or "hex dump") lists all the ASCII character data received from the host computer in two–digit hexadecimal codes. (The ASCII character set is shown on page 5–51.)

Hex dumps are used to troubleshoot some types of 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.

NOTE: Operator panel keys and menu arrangements vary according to printer model. For the menu structure and keys used to make a hex code printout, refer to the *Operator's* and *Setup Guides* for the model you are servicing. The general procedure is summarized below.

1. Take the printer off–line.
2. On the operator panel, unlock the **Enter** key:
   on the IBM 6412–A00, press **Scroll↑** + **Scroll↓**
   on the IBM 6412–CT0, press **Micro↑Scroll↑** + **Micro↓Scroll↓**
3. Using the directional keys, access the hex printout menu:
   on the IBM 6412–A00, select "Hex Dump" emulation
   on the IBM 6412–CT0, select "DCU Hex Print" from the DCU Tests submenu running under Printer Tests
4. Place the printer on–line. The display will indicate the printer is on–line in hex dump mode: "On–Line Hex Dump"
5. 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.)
6. To stop a hex dump, take the printer off–line.
7. Press the key that exits configuration and hex dump mode.

ASCII Character Set

Data Bits

B7 B6 B5 B4 B3 B2 B1

Most Significant — Least Significant

KEY:

B7 B6 B5 BITS B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 27 1B

33 — OCTAL equivalent
27 — DECIMAL equivalent
1B — HEXADECIMAL equivalent
ESC — ASCII Character

B7 B6 B5 BITS B4 B3 B2 B1	ROW	0 0 0 COLUMN 0		0 0 1 1		0 1 0 2		0 1 1 3		1 0 0 4		1 0 1 5		1 1 0 6		1 1 1 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 0A	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 0B	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 0C	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 0D	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 0E	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 0F	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

6 Adjustments

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Putting the Hammer Bank in the Service Position

1. Power off the printer.
2. Unplug the printer power cord from the AC receptacle.
3. Open the printer top cover and the front door of the floor cabinet.
4. Remove the ribbon.
5. Disconnect four connectors (1) from the bottom of the ribbon deck assembly (2). (See Figure 6–1.)
6. Remove three hex head screws (3) securing the ribbon deck assembly (2).
7. Lift the ribbon deck assembly off the retaining clips (4).

(Procedure continued on page 6–4.)

1. Connector (4)
2. Ribbon Deck Assembly
3. Screw (3)
4. Retaining Clip (2)

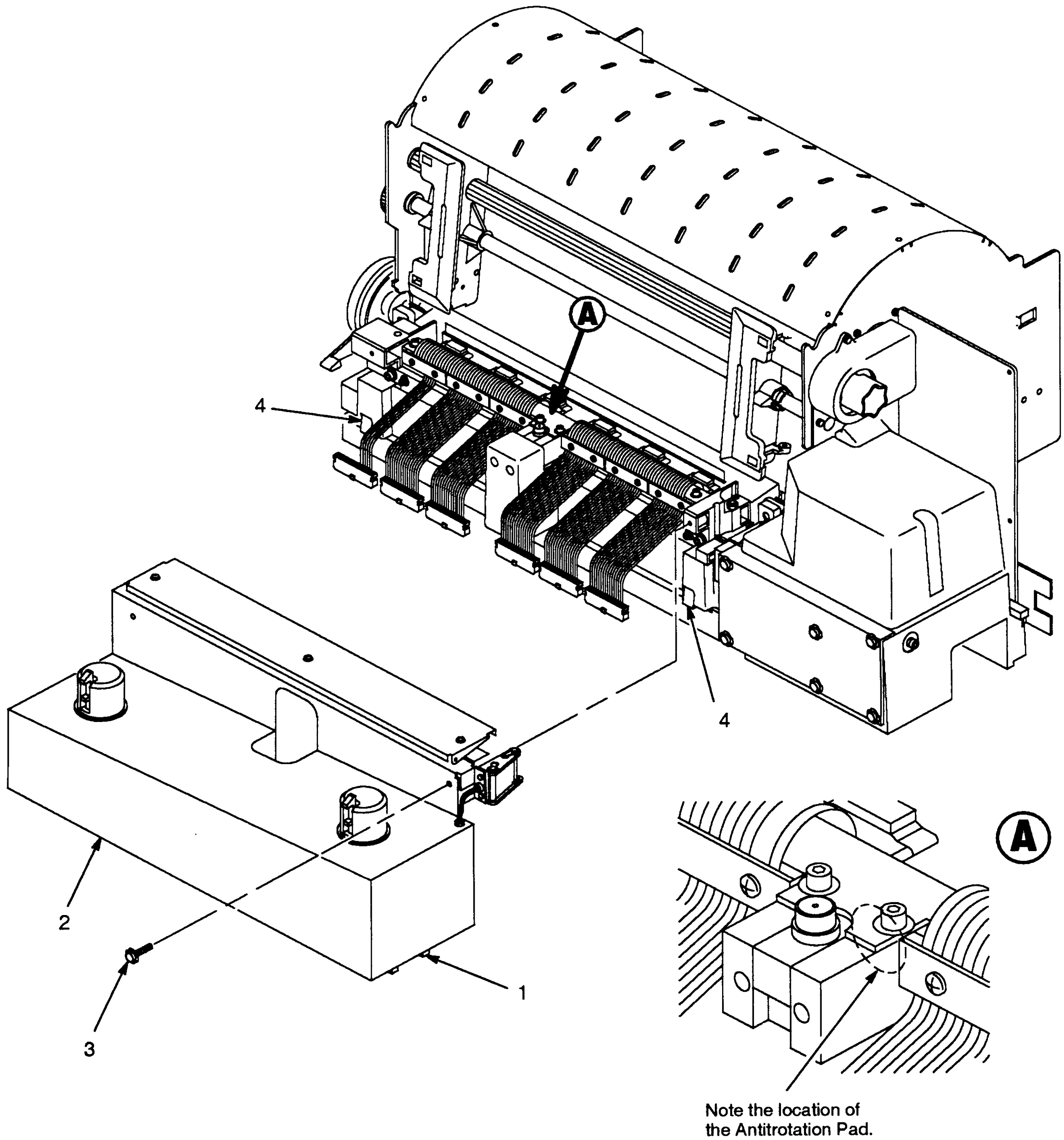


Figure 6–1. Ribbon Deck Removal

8. Put the hammer bank assembly in the service position, as follows:

    a. Raise the forms thickness lever (1) all the way. (See Figure 6–2.)

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

    c. Disconnect the coil cable connectors (3).

    d. Remove four screws (4), eight washers (23, 24), and two coil lead brackets (5) from the shroud assembly (11).

    e. Remove two screws (6), lockwashers (7), and washers (8) securing the shroud assembly (11).

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

    g. Remove the shroud assembly (11) from the shuttle assembly (12).

WARNING

In the next three steps, do not let the shims and antirotation block pad fall into the printer. (The location of the antirotation block pad is shown in Figure 6–1.)

    h. Remove two screws (13) securing the antirotation block (14).

    i. Separate the antirotation block (14) and shims (15) from the shuttle assembly by compressing the spring on the front side and lifting the block up.

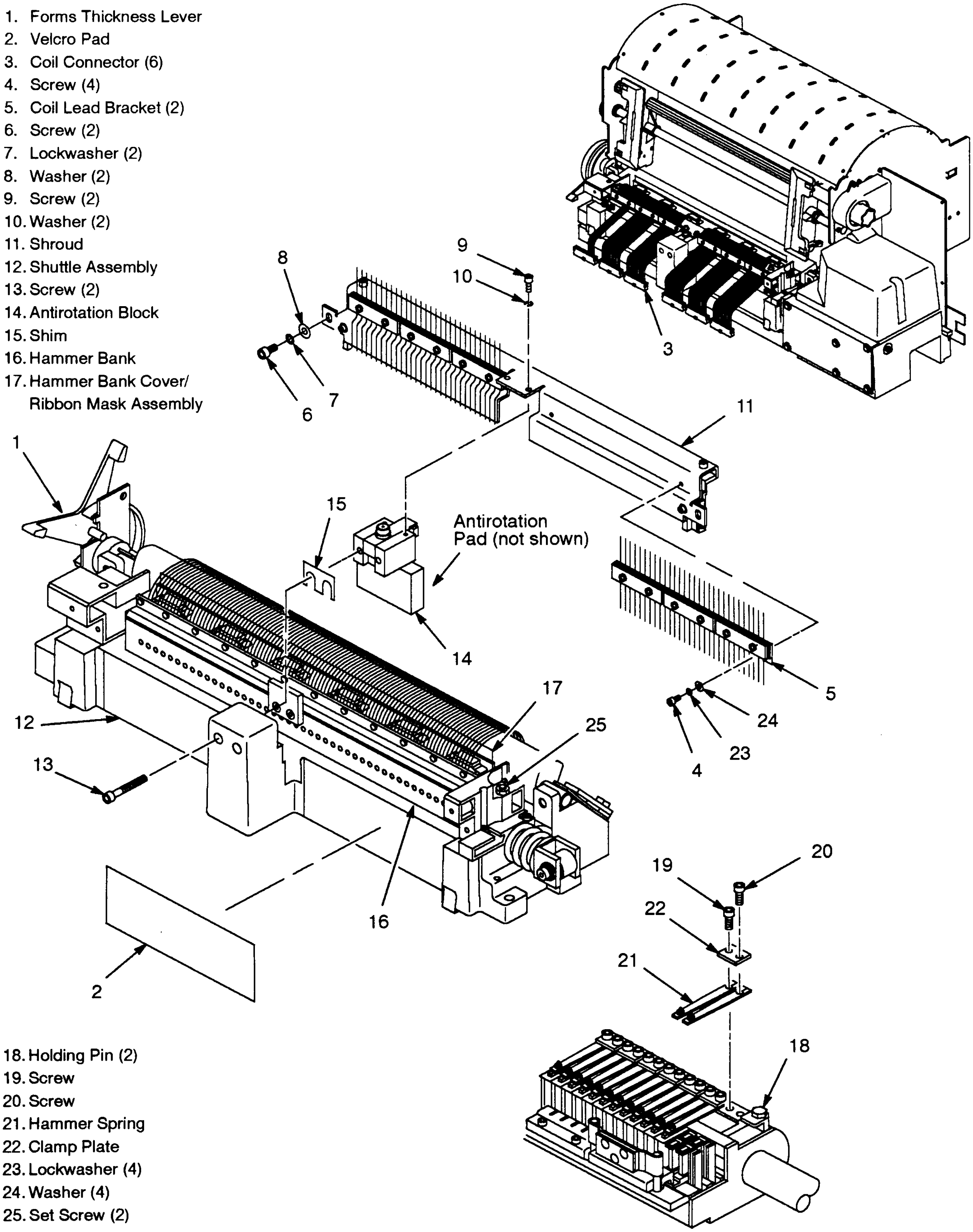
    j. Rotate the hammer bank (16) toward the front of the printer as far as it will go.

WARNING

DO NOT loosen the bearing block set screws (25).

    k. Rotate the hammer bank cover/ribbon mask assembly (17) off the magnet and holding pins (18) on the hammer bank.

1. Forms Thickness Lever
2. Velcro Pad
3. Coil Connector (6)
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/ Ribbon Mask Assembly



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

Figure 6–2. Hammer Bank Service Position

Returning the Hammer Bank to the Operating Position

1. Install the hammer bank cover/ribbon mask assembly on the holding pins. Do not let it snap into position as the magnet pulls it.

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

WARNING

In the next step, do not lubricate the bearing block assemblies or the hammer bank shaft.

3. Apply a 1/4 inch dab of grease 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 on the shuttle assembly by pushing the slide toward the rear of printer. Install two screws (13).

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

6. Loosely install two front 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).

WARNING

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

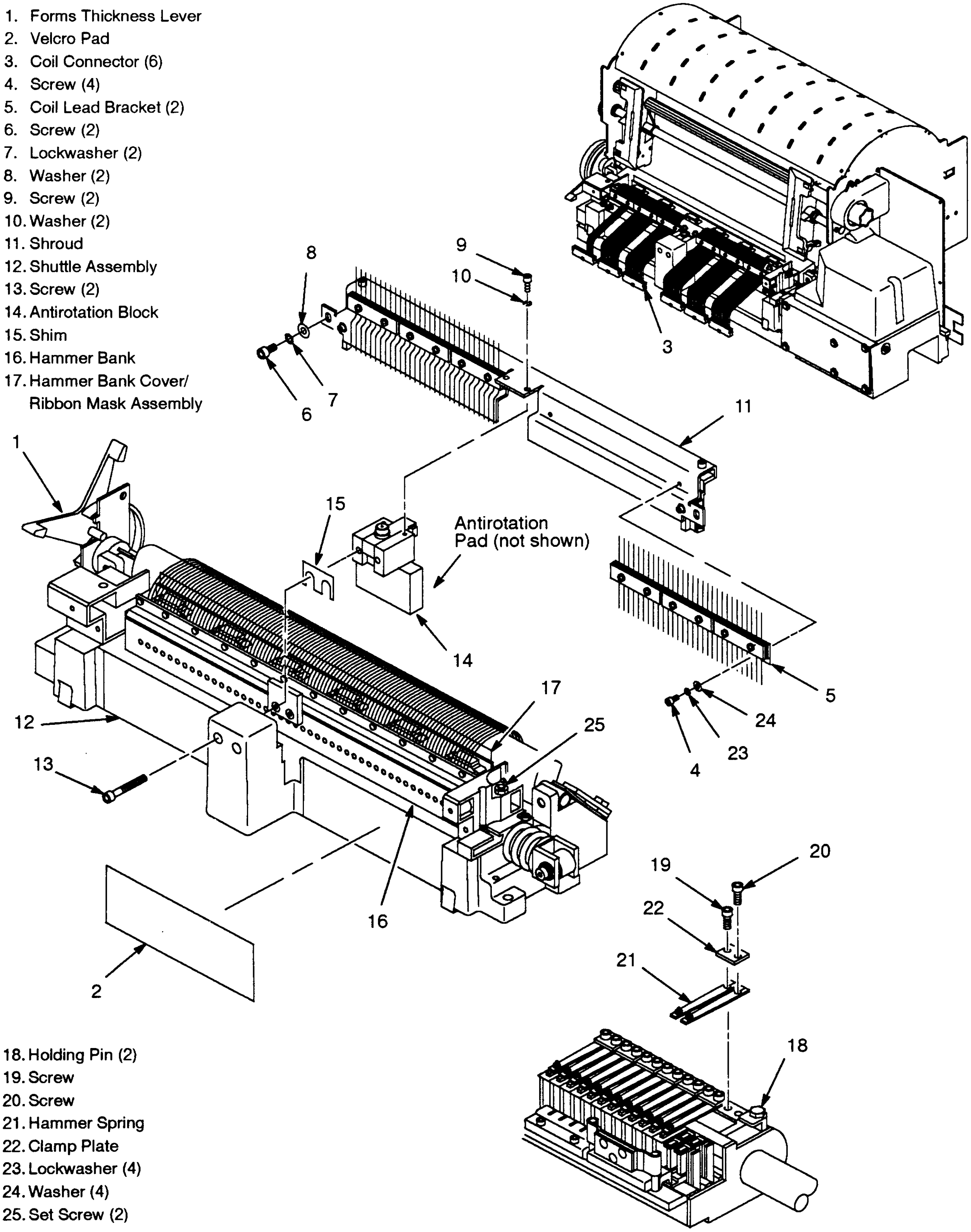
7. Position the coil lead brackets (5) down against the ledge on the shuttle shroud (11). Install four screws (4) and eight washers (23, 24) securing the coil lead brackets (11).

8. Working from left to right, connect the coil cable connectors (3).

9. Install the velcro pads (2) that protect the coil lead wires.

10. Install the ribbon deck assembly by reversing the steps on page 6–2.

1. Forms Thickness Lever
2. Velcro Pad
3. Coil Connector (6)
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/ Ribbon Mask Assembly



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

Figure 6–2. Hammer Bank Service Position

Adjusting the End of Forms Distance

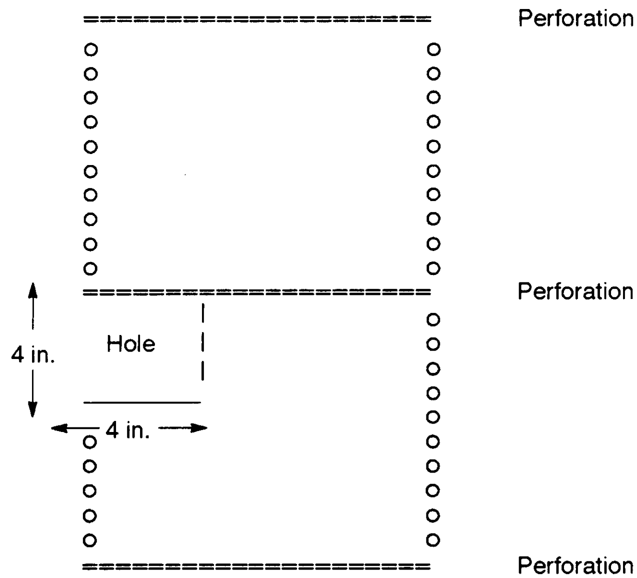
This procedure tests and sets the distance from the page perforation at which an End of Forms fault message is triggered. This adjustment prevents printing on the platen when the printer runs out of paper. The measurement units are dot rows.

You will use the dot row patterns printed by the End of Forms Adjust self–test to verify that this parameter is set correctly.

NOTE: Do this procedure only if a new paper detector switch assembly has been installed, or if you are sure that the end of forms adjustment is incorrect. An End of Forms triggering distance of 1 or 2 dot rows from the perforation is acceptable; 5 to 7 dot rows off indicates adjustment is required.

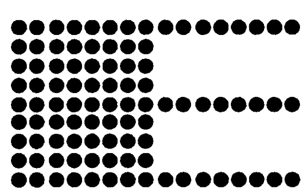
The following procedure describes how to run the End of Forms Adjust printer test and modify the End of Forms adjustment value.

1. Power on the printer.
2. Load paper and make sure the forms thickness lever is closed. Open the cabinet front door.
3. On the paper just below the paper entrance slot, tear a four–inch square on the left side, immediately below the perforation. (See below.) This creates a hole that will trigger an End of Forms condition, but allows printing to the right of the hole (which would normally be on the platen).



4. Tear 8 to 10 holes in the manner described above, on every third sheet.
5. Unlock the **Enter** key:
   on the IBM 6412–A00 printer, press **Scroll↑** + **Scroll↓**
   on the IBM 6412–CT0 printer, press **Micro↑Scroll↑** + **Micro↓Scroll↓**
6. Select the End of Forms printer test:
   for the IBM 6412–A00, see page 5–41
   for the IBM 6412–CT0, see page 5–46

   This test prints a vertical "comb" pattern at column 70, each long bar separated by 4 dot rows. (See the enlarged example below.)



7. Press **Enter** to start the test. When the End of Forms condition occurs, remove the paper from the tractors and examine the area of the page perforation.

   If the comb pattern just meets the perforation, the end of forms adjustment distance is correct. (1 or 2 dot rows off is OK; 5 to 7 dot rows off is too much.) You may stop the test here, unless you wish to restart the procedure with 6–part paper. (See step 15.)

   If the comb pattern stops short of the perforation or prints beyond the perforation, go to step 8.

8. Open the forms thickness lever. Open the tractor doors and remove the paper from the tractors.

9. Measure how short or long the comb pattern has printed by counting the number of dot rows needed to reach the perforation, or the number of dot rows that have printed beyond the perforation.

NOTE: Use the long bars for counting the dot rows quickly. There are three dot rows between each long bar, so each long bar increases the number of dot rows by four.

You can also tear off a small piece of the comb pattern from the beginning of the pattern and use it as a ruler to help you measure the dot rows required either to reach the perforation or back up to it.

10. On the IBM 6412–A00, press these keys at the same time:
    Scroll↑ + Scroll↓ + Enter + Return.

    On the IBM 6412–CT0, press these keys at the same time:
    Micro↑Scroll↑ + Micro↓Scroll↓ + Enter + Return.

    The LCD will show "Maintenance / End of Forms Adjust."

    a. Press **Enter**. The LCD shows "End of Forms Adjust / *nn* dots".

    b. Press **Enter** again.
       The LCD shows "End of Forms Adjust / *nn* dots* ".

    c. Use the **Scroll↑** and **Scroll↓** keys to increase or decrease *nn* by the number of dot–rows you counted in Step 9.

    d. Press **Enter** to select the new value as the active value.

e. Exit the test and maintenance menus:
on the IBM 6412–A00 printer, press **Clear**
on the IBM 6412–CT0 printer, press **Start**

11. Lock the **Enter** key:
on the IBM 6412–A00 printer, press **Scroll↑** + **Scroll↓**
on the IBM 6412–CT0 printer, press **Micro↑Scroll↑** + **Micro↓Scroll↓**

12. Load the paper on the tractors and close the forms thickness lever.

13. Reset the printer:
on the IBM 6412–A00 printer, press **Stop** + **Enter**
on the IBM 6412–CT0 printer, press **Stop** + **Cancel**

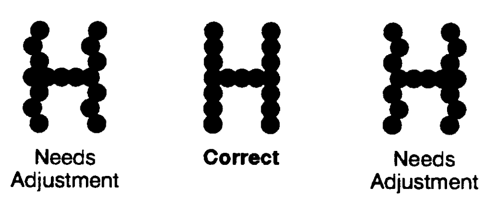
14. Verify that the End of Forms adjustment is correct by repeating the End of Forms Adjust test, starting at Step 6.

15. Although not required, it is advisable to test the End of Forms distance with 6–part paper, in order to verify correct printing with multi–part forms.

Hammer Phasing Adjustment (Figure 6–3)

Unless otherwise directed, adjust the MPU gap (page 6–18) before doing this procedure.

1. Open the printer cover and make sure the cam cover is installed.
2. Loosen the clamp screw (1) enough to pivot the MPU arm (2) with some effort. Push the MPU arm (2) all the way down.
3. Power on the printer, load full width (132 column) paper, and install the ribbon.
4. Press the **Stop** key to put the printer in the NOT READY mode (off–line).
5. Unlock the **Enter** key:
   on the IBM 6412–A00, press **Scroll↑** + **Scroll↓**
   on the IBM 6412–CT0, press **Micro↑Scroll↑** + **Micro↓Scroll↓**
6. Using the directional switches on the operator panel, access the "Hammer Phasing" menu: for the IBM 6412–A00, see page 5–41
   for the IBM 6412–CT0, see page 5–46
7. Press the **Enter** key. "Phase Adjustment" and the current phasing index number display. The printer begins printing all Hs, each line preceded by the phasing index number.
8. Press the directional keys to increase or decrease the phasing index until the pattern of Hs prints correctly. (See below.)



9. When the print pattern is acceptable, press **Enter**. Printing stops, and the current phase index value is entered into nonvolatile memory.
10. Exit the configuration menus:
    on the IBM 6412–A00 printer, press **Clear**
    on the IBM 6412–CT0 printer, press **Start**, then press **Stop.**
11. Lock the **Enter** key:
    on the IBM 6412–A00 printer, press **Scroll↑** + **Scroll↓**
    on the IBM 6412–CT0 printer, press **Micro↑Scroll↑** + **Micro↓Scroll↓**

12. Close the printer cover and place the printer in the READY mode (on–line).

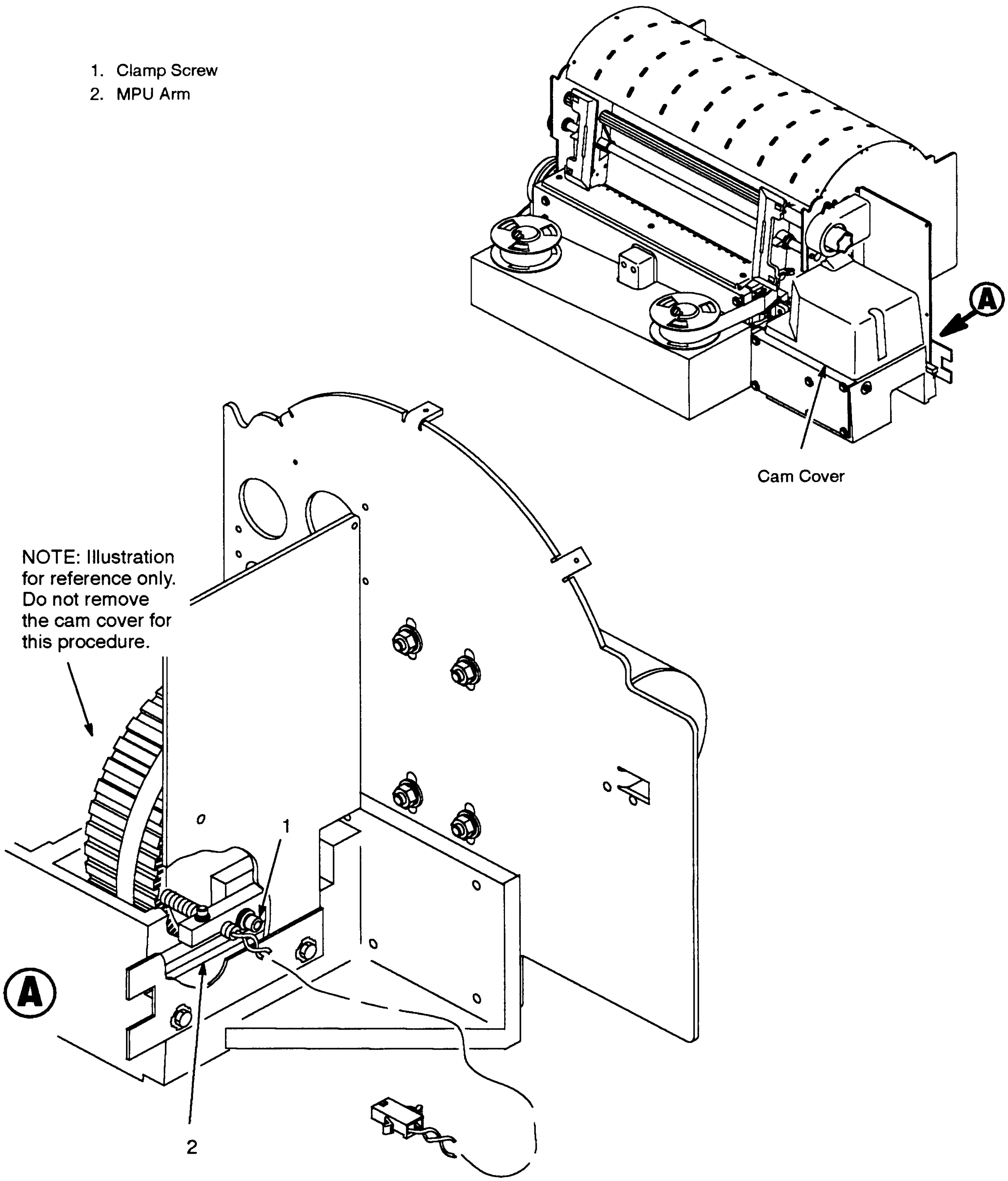


Figure 6–3. Magnetic Pickup Phasing Adjustment

Hammer Spring Retensioning (Figure 6–4)

NOTE: Tensioning hammer springs is a trial–and–error process. Adjust and test until print quality is satisfactory. If a replacement (new) hammer spring does not print or retract properly, retension the spring as if it were printing too dark. (See below.)

If Print is Too Light:

1. Put the hammer bank in the service position. (See page 6–2.)

WARNING

The hammer tip is fragile. Be careful 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. Return the hammer bank to the operating position. (See page 6–6.)

If Print is Too Dark:

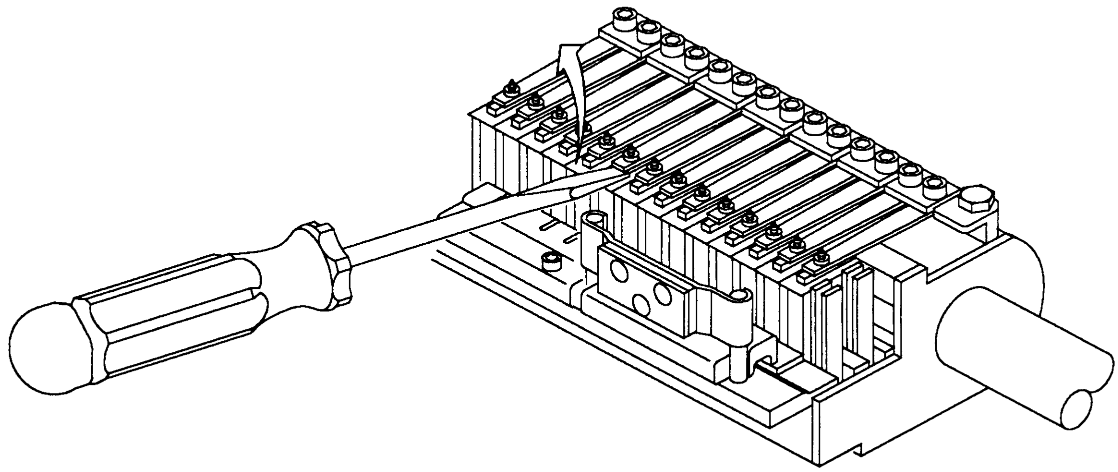
1. Put the hammer bank in the service position and remove the hammer spring. (See page 6–2.)

WARNING

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 chain nose pliers so the screw hole is just covered. Using the tip of the screwdriver, *carefully* flex the spring in the direction away from the hammer tip.
3. Install the hammer spring. (See page 6–2.)
4. Align the hammer tip. (See page 6–16.)
5. Return the hammer bank to the operating position. (See page 6–6.)

If print is TOO LIGHT, adjust this way:



If print is TOO DARK, adjust this way:

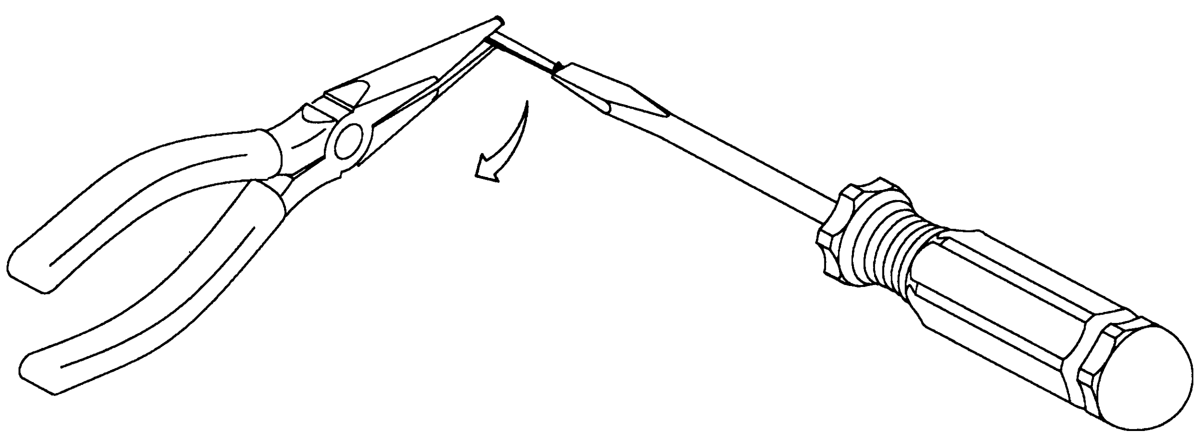


Figure 6–4. Hammer Spring Retensioning

Hammer Tip Alignment (Figure 6–5)

IMPORTANT

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

1. Put the hammer bank in the service position. (See page 6–2.)
2. Loosen the screw (1) of the hammer spring (2) to be aligned.
3. Place the alignment tool (3) (Part Number 57G7257) over the hammer tips. Move the hammer spring until its tip is in an appropriate hole in the alignment tool.
4. Torque the hold–down screw (1) 6 to 9 in–lbs.
5. Remove the alignment tool.
6. Return the hammer bank to the operating position. (See page 6–6.)

1. Screw
2. Hammer Spring
3. Alignment Tool (P/N 57G7257)

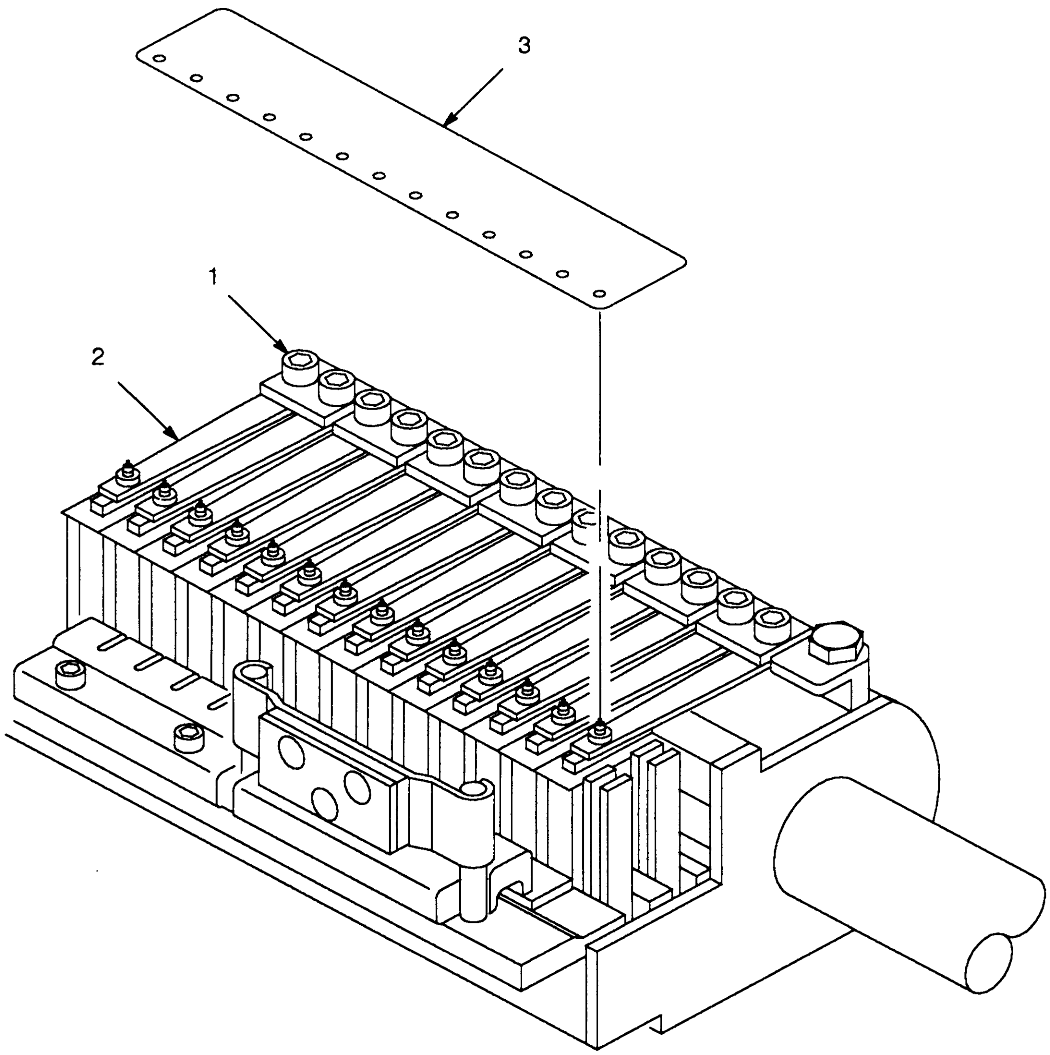


Figure 6–5. Hammer Tip Alignment

Magnetic Pickup Gap (Figure 6–6)

NOTE: Unless otherwise directed, do the hammer phasing adjustment (page 6–12) immediately after this procedure.

1. Power off the printer.
2. Make sure the flywheel axle is against the rear roll pin.
3. Loosen two captive screws and remove the cam cover (1).
4. Loosen the clamping screw (2) enough to allow the MPU (3) to be rotated.
5. Set the gap between the MPU and the flywheel (4) using a flat feeler gauge (5):

CAUTION

The gear teeth on the flywheel are sharp and the flywheel can "jump" off the cam when it is rotated. To avoid hand injuries when rotating the flywheel, hold the flywheel with a cloth.

   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 to set the gap.

6. Tighten the clamping screw (2). Verify that the MPU does not rotate.
7. Install the cam cover (1) and tighten the two captive screws.
8. Adjust the hammer phasing (page 6–12).

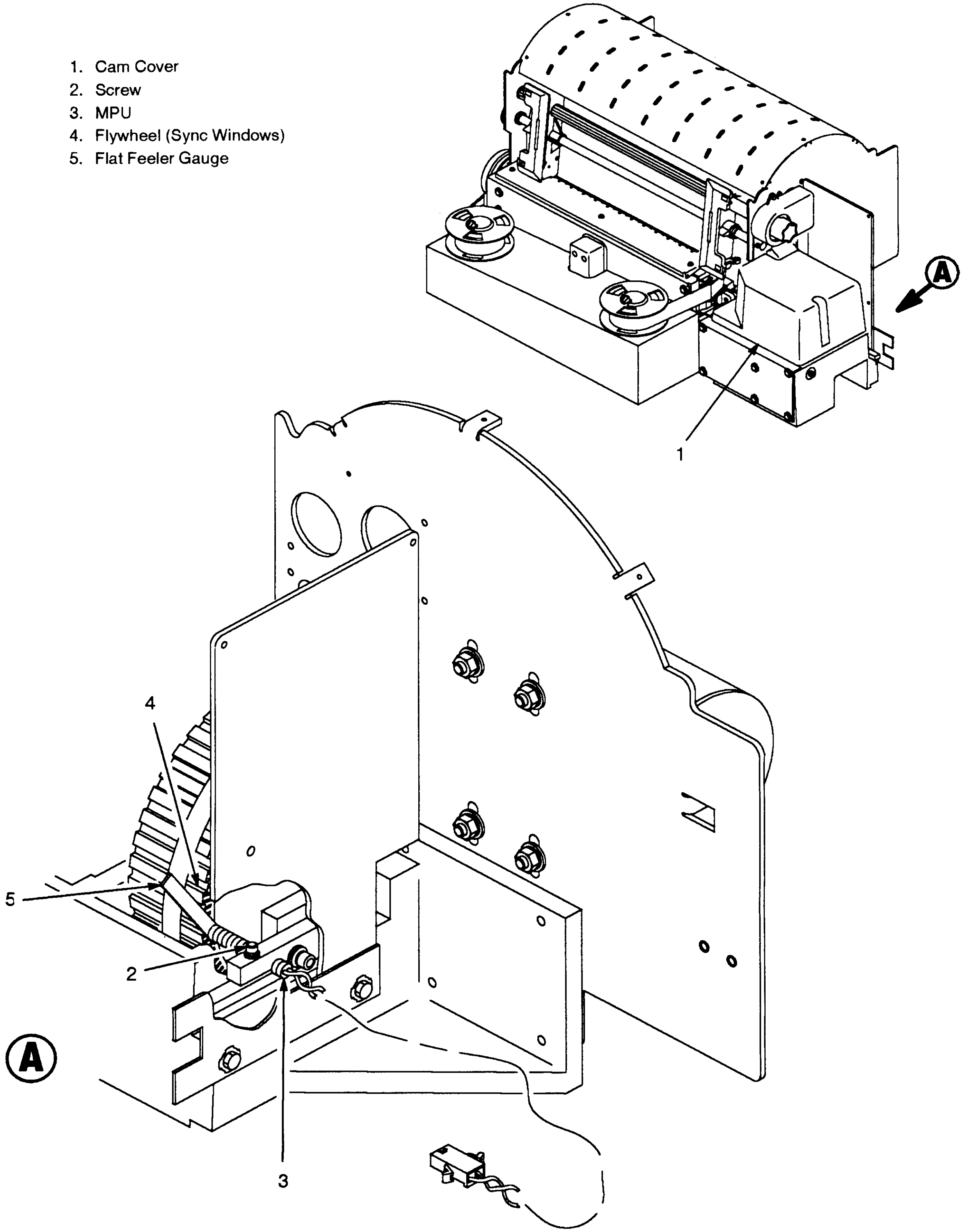


Figure 6–6. Magnetic Pickup Gap Adjustment

Paper Feed Belt Tension (Figure 6–7)

Tension Check

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

Adjustment

1. Remove the paper path assembly. (See page 7–32.)
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 a force gauge.
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 paper path assembly. (See page 7–32.)

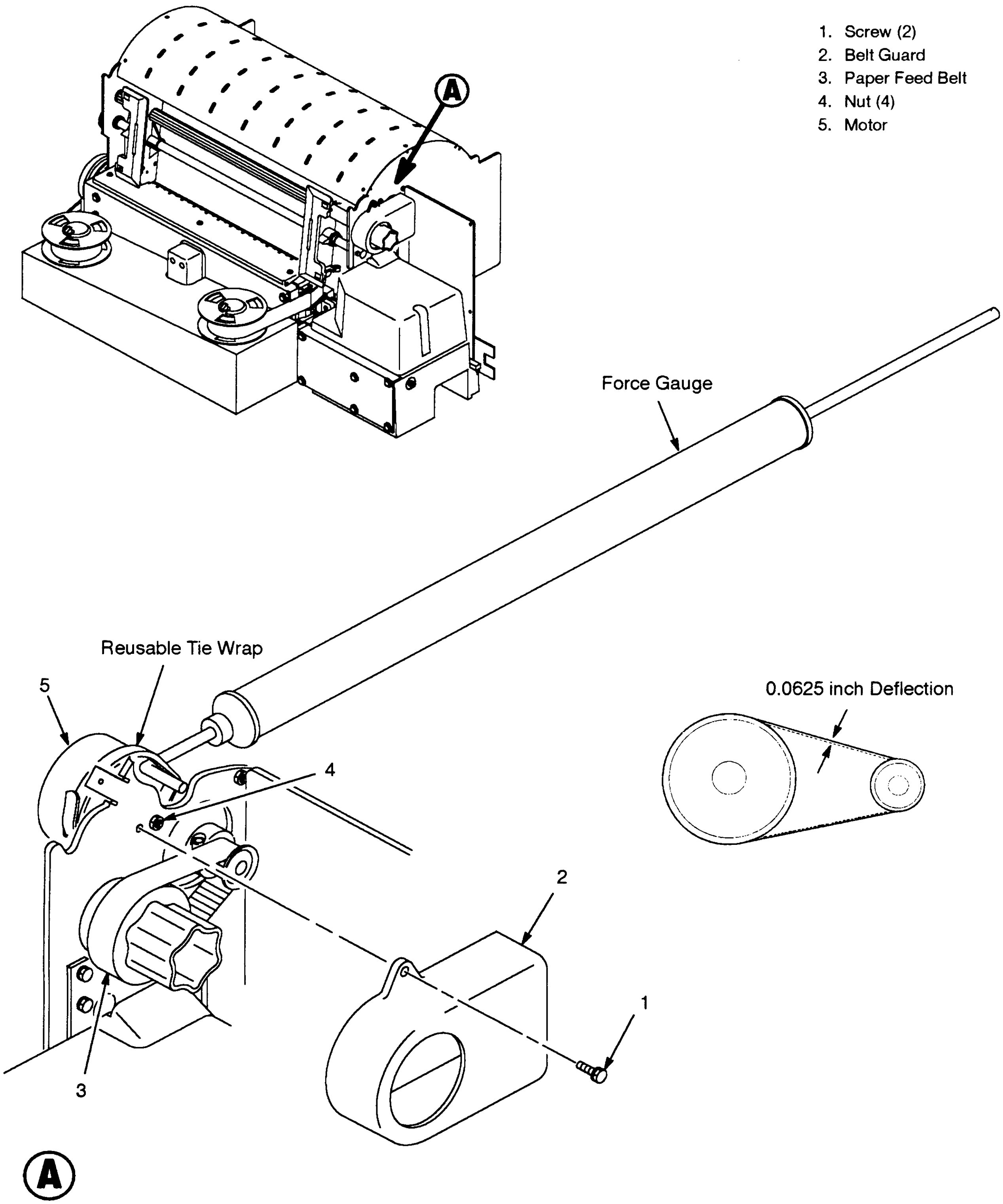


Figure 6–7. Paper Feed Belt Tension Check and Adjustment

Paper Scale Adjustment (Figure 6–8)

1. Load paper and ribbon.
2. Connect the power cord to the AC power source.
3. Power on the printer.
4. Open the printer cover.
5. Print a full 132 column line by selecting and running one of the diagnostic self–tests. (See Chapter 5.)
6. Check the alignment of the paper scale to the print at column positions 1 and 132.
7. If adjustment is necessary, loosen the three button–head 5/64 inch hex screws (1).
8. Position the paper scale (2) so that column positions 1 and 132 line up with the first and last characters on the 132 character printout.
9. Tighten the button–head screws (1).
10. Close the printer cover.

1. Screw, Buttonhead (3)
2. Paper Scale

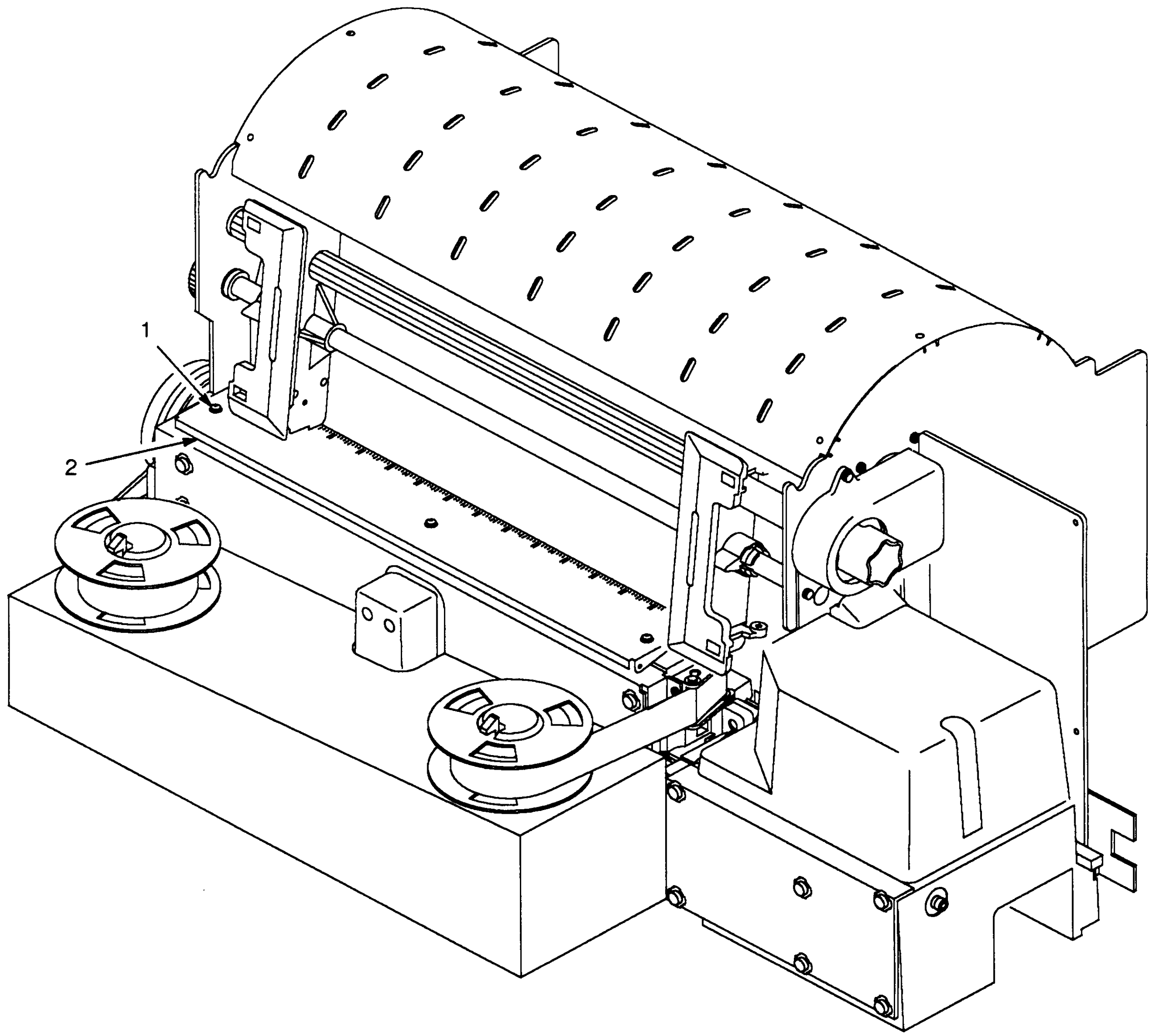


Figure 6–8. Paper Scale Adjustment

Platen Gap (Figure 6–9)

1. Power off the printer. Unplug the power cord from the rear of the printer. Open the printer cover. Unload paper.
2. Remove the ribbon deck assembly. (See page 6–2.)
3. Remove the belt cover. Loosen the platen open motor screws to loosen the platen open belt. (See page 7–53.)
4. Raise the forms thickness lever (1) to the open position.
5. Measure the platen gap, as follows:

WARNING

Be careful 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 feeler 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. (See page 6–26.)
9. Install the ribbon deck assembly. Install paper. Close the printer cover and connect the power cord.

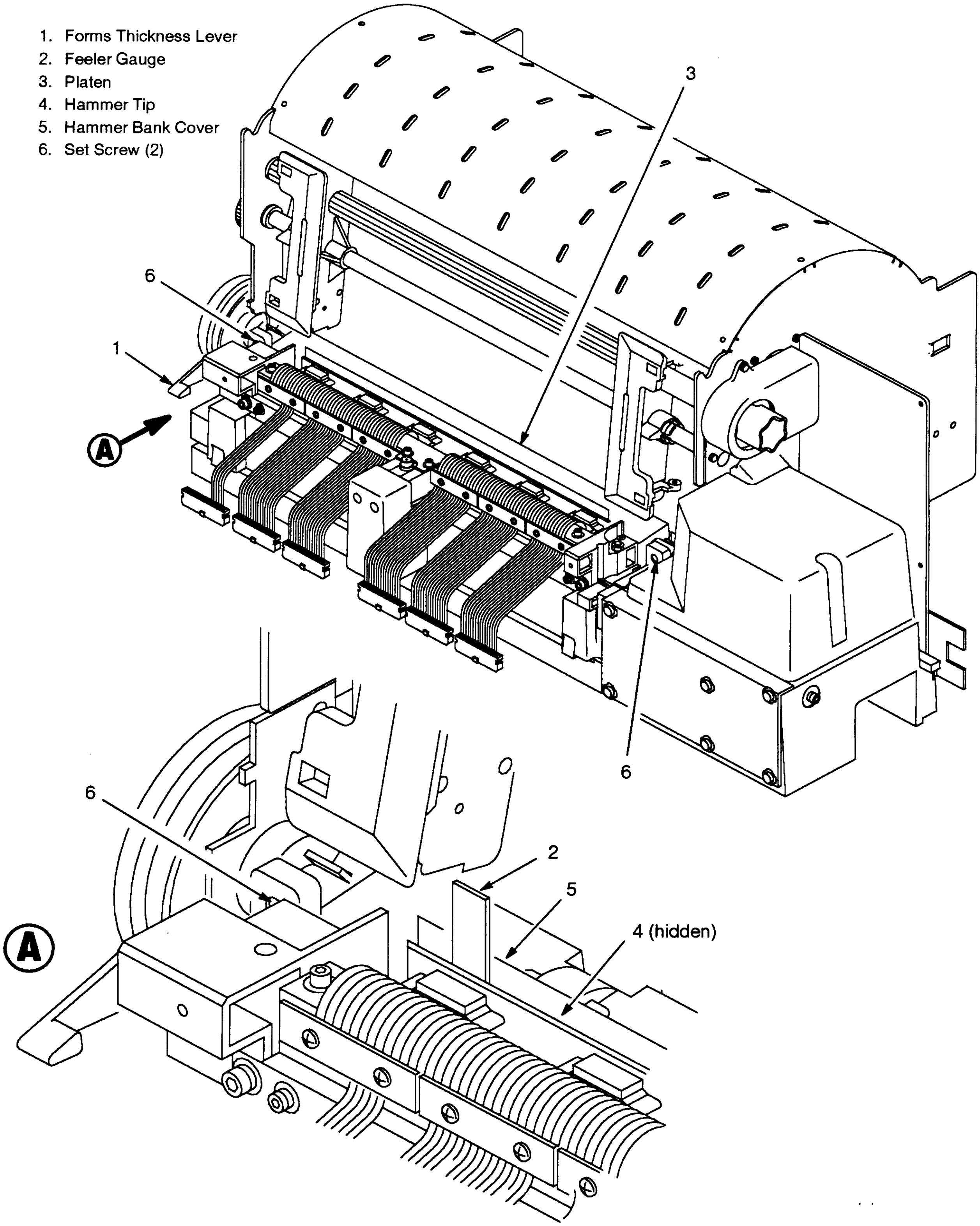


Figure 6–9. Platen Gap Adjustment

Platen Open Belt Adjustment (Figure 6–10)

1. Power off the printer.

2. Open the printer top cover and the rear door.

3. Remove the platen open belt cover (1):

    a. Press down on the cover to release the top tab.

    b. Lift the cover to release the bottom tab, then slide the cover towards the rear of the printer.

4. Loosen the platen open motor mount screws (2).

5. Place a reusable tie–wrap (3) around the platen open motor (4). Leave just enough slack to insert the force gauge.

6. Close the forms thickness lever all the way.

WARNING

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

7. 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.

8. Hold 5–6 pounds tension on the force gauge and torque the motor mount screws to 20 inch–pounds.

9. Remove the reusable tie–wrap from the platen open motor.

10. Snap the belt cover into the slots in the side plate.

11. Close the printer cover and the rear door.

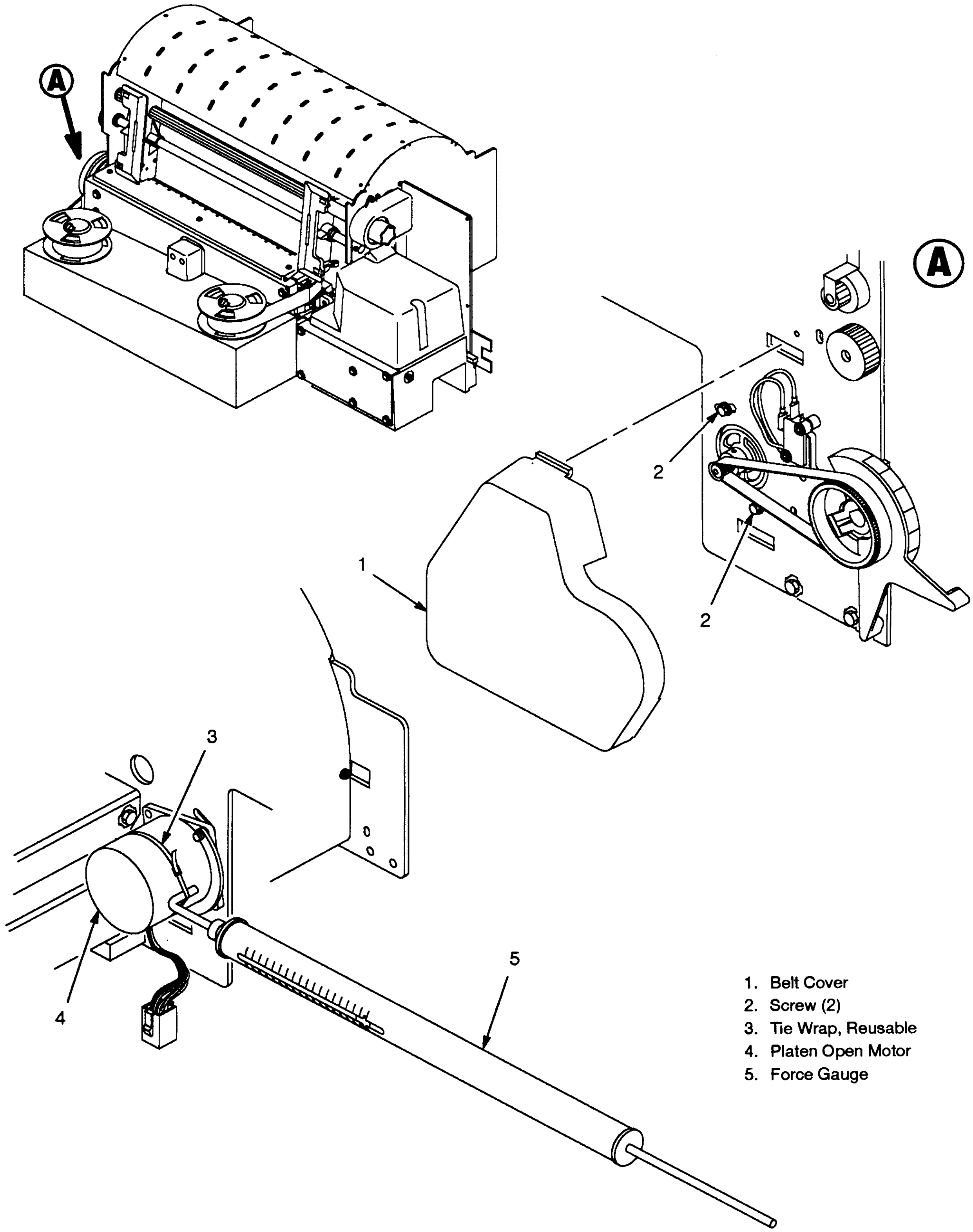


Figure 6–10. Platen Open Belt Adjustment

Ribbon Tracking Check and Adjustment (Figure 6–11)

1. Make sure paper is loaded and that the ribbon is fully wound on one of the spools.

2. Power on the printer.

3. Open the printer cover.

4. Set the forms thickness lever (1) to any position between "A" and "B." Make sure no error indications appear.

5. Run a shuttle/ribbon self–test. (Refer to Chapter 4.) Shuttle action and ribbon motion should begin.

6. On either the left or right ribbon guide (2), momentarily short across the skids (3).

7. Let the ribbon run completely out of one spool. Verify the ribbon is centered in the guide. If it is not, follow these Steps:

    a. Loosen two screws (4) with washers (5) 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. If the ribbon does not wind smoothly on the spool, make sure the ribbon hub and spool are mounted correctly.

8. The spool should automatically reverse. If it does not:

    a. Replace the ribbon and rerun the test.

    b. If there is still an error, check the cabling.

    c. If ribbon tracking is still unsuccessful, make sure the ribbon deck is installed properly and replace it if necessary.

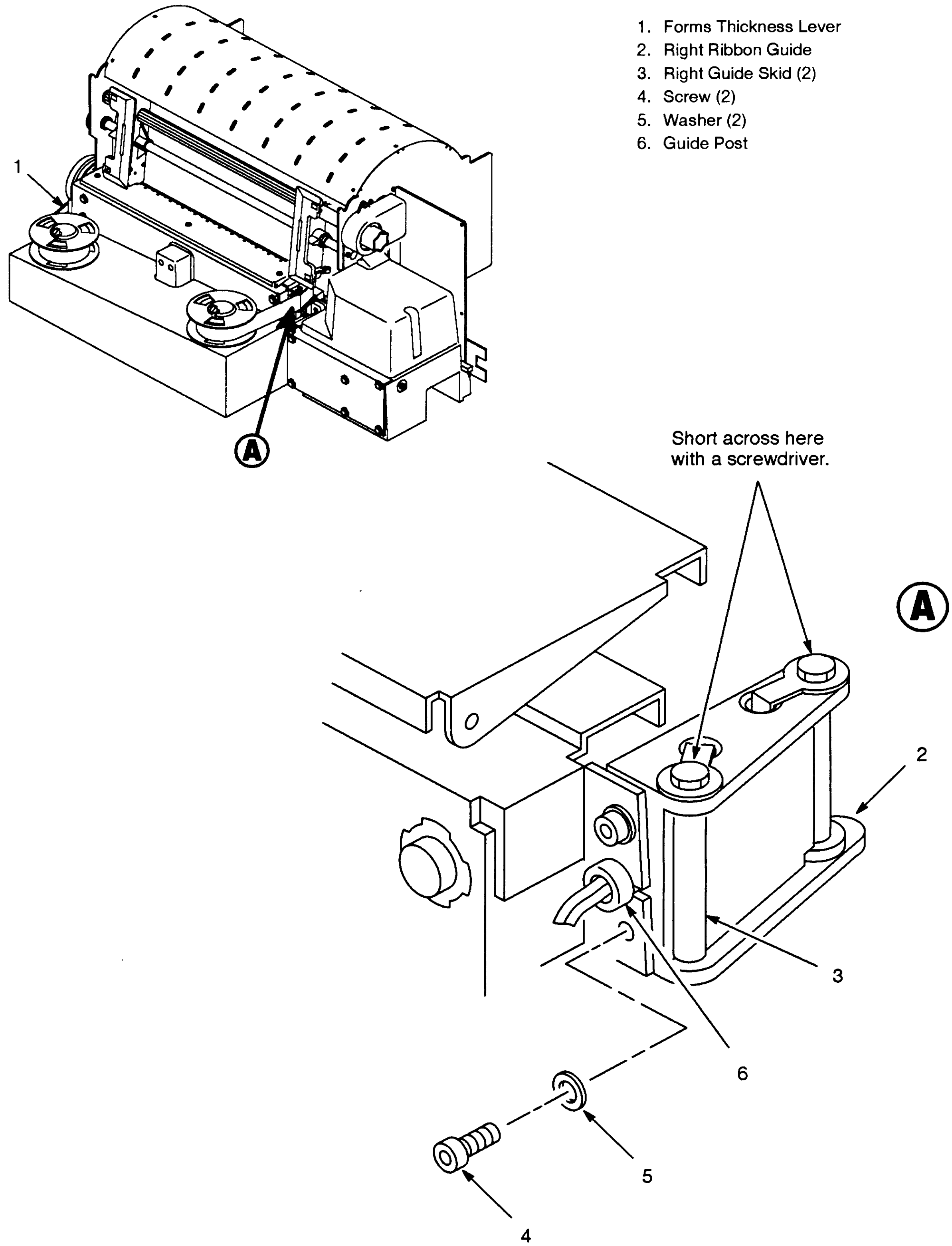
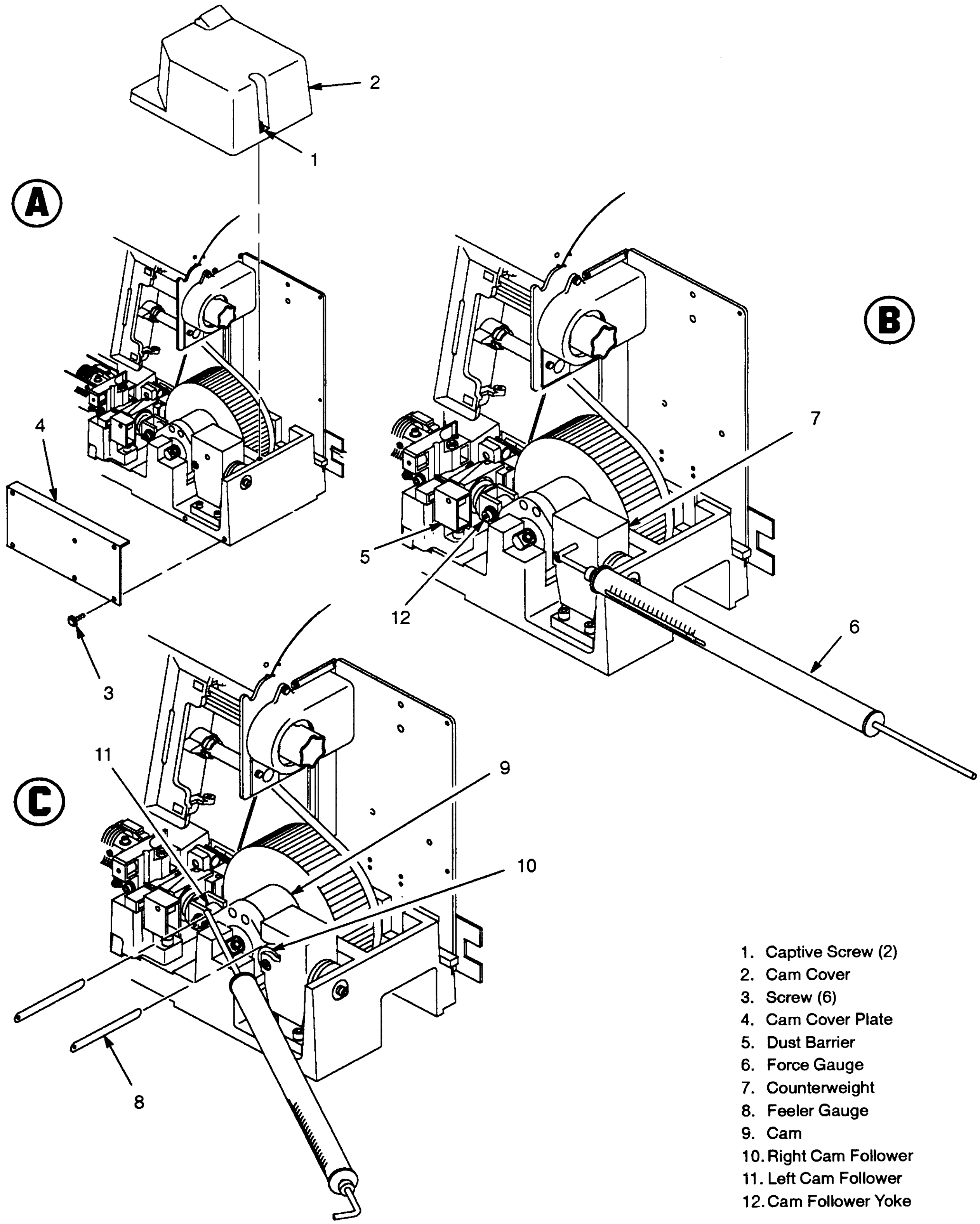


Figure 6–11. Ribbon Tracking Check and Adjustment

Shuttle and Counterweight Preload (Figure 6–12)

NOTE: Set shuttle and counterweight preload if you detect improper shuttling action, excessive rattle under the cam cover, or if you have replaced shuttle drive components. (Only use the procedure on page 6–34 if you do not have a force gauge.)

1. Power off the printer. Unplug the power cord from the rear of the printer. Open the printer cover.
2. Remove the ribbon deck assembly. (See page 6–2.)
3. Loosen two captive screws (1) and remove the cam cover (2). (Figure 6–12, detail A.)
4. Remove six screws (3) and the cam front cover plate (4).
5. Remove the dust barrier (5).
6. Insert the force gauge (6) in the hole in the counterweight (7). (Figure 6–12, 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 force gauge indication when the feeler gauge comes loose.
   a. If the indication is 12–17 pounds, go to Step 9.
   b. If the indication is less than 12 pounds, install a shuttle counterweight shim as described on page 6–34 and repeat Steps 6. through 8.
   c. If the indication is greater than 19 pounds, remove a counterweight spring shim and repeat Steps 6. through 8.
9. Insert a 0.003 inch flat feeler gauge between the cam 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 6–12, detail C.)



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 6–12. 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 6–34 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.

CAUTION

When the cam cover is removed from the printer, a rotating flywheel is hazardous and can cause personal injury. Keep hands, tools, and clothing away from the flywheel when the printer is on and the cam cover is removed.

12. Power on the printer.

13. Run a shuttle only test for 10 minutes. Check for rattle and increase the preload if necessary. Check for stalls or no–start conditions and decrease the preload if necessary.

14. Power off the printer.

15. Install the dust barrier (5).

16. Install the gasket, cam cover plate (4), and six screws (3).

17. Install the cam cover (2) and tighten the two captive cover screws (1).

18. Install the ribbon deck assembly by reversing the steps on page 6–2.

19. Install paper and close the printer cover.

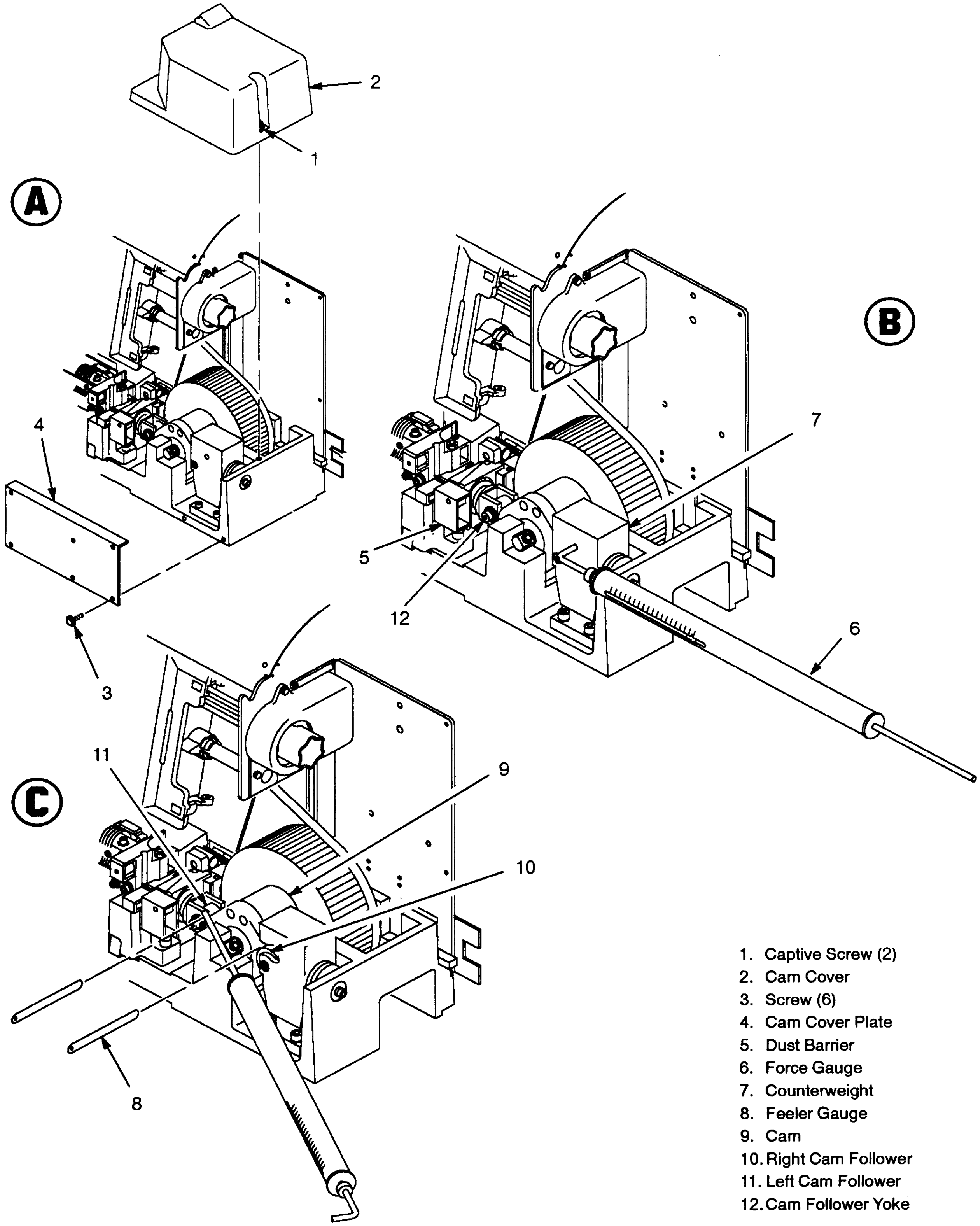


Figure 6–12. Setting Shuttle and Counterweight Preload

Shuttle and Counterweight Spring Adjustment (Figure 6–13)

IMPORTANT

The preload adjustment procedure on page 6–30 describes the use of a force gauge and is the preferred method. The following procedure describes how to adjust the shuttle and counterweight spring without using a force gauge. Use this procedure only if you do not have a force gauge; it is less accurate and is not recommended.

1. Power off the printer. 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 below.

CAUTION

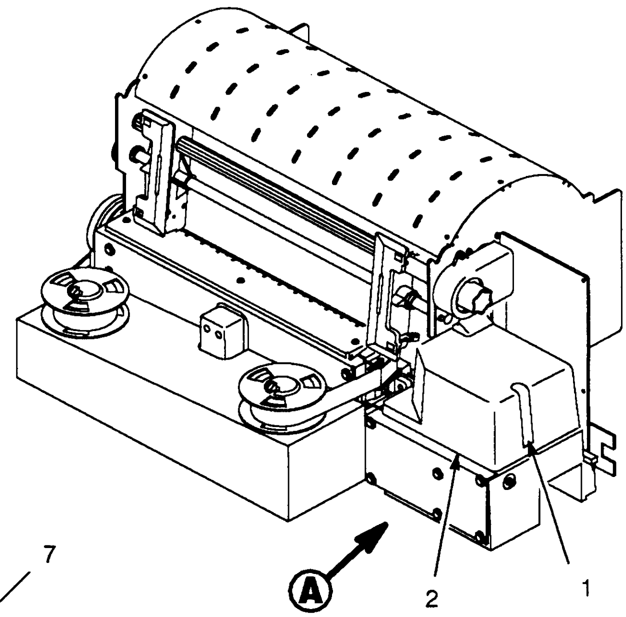
When the cam cover is removed from the printer, a rotating flywheel is hazardous and can cause personal injury. Keep hands, tools, and clothing away from the flywheel when the printer is on and the cam cover is removed.

4. Power on the printer. Run a shuttle 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) and listen for a rattling sound.
   a. If the rattling sound does not change, go to Step 6.
   b. If the rattling sound decreases, go to Step 7.
6. Install a 0.01 inch shuttle spring shim (P/N 57G7258) as follows:

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

   a. Power off the printer.
   b. Use a screwdriver to pry the spring away from the yoke (6), as shown in Figure 6–13.
   c. Insert a shim (7) and press it down until it is flush with the yoke (6).

1. Captive Screw (2)
2. Cam Cover
3. Shuttle Spring
4. Counterweight Spring
5. Counterweight
6. Yoke
7. Shim, P/N 57G7258
8. Screw
9. Shim, P/N 57G7258
10. Base Support



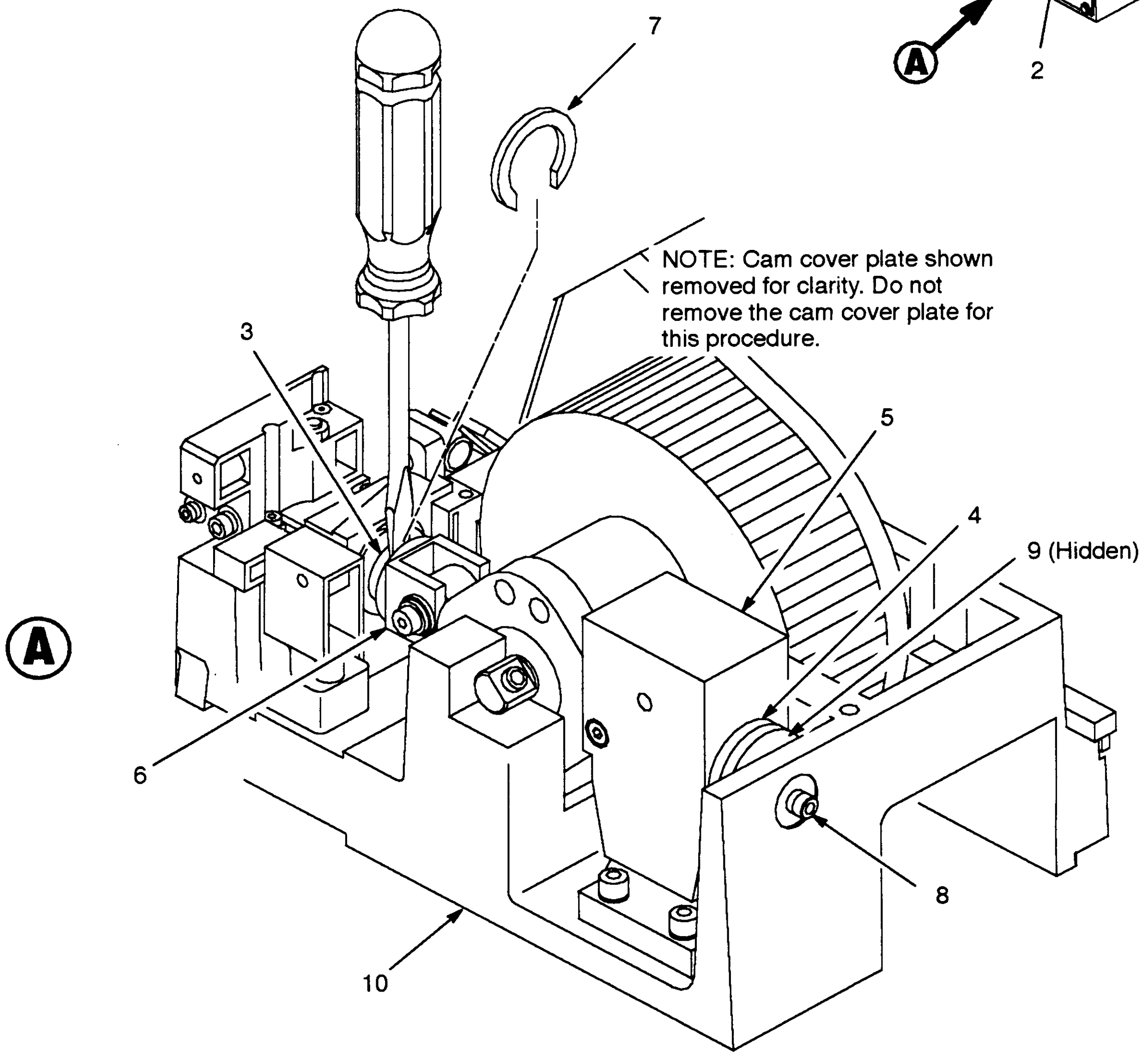


Figure 6–13. Shuttle Spring Force Adjustment

7. Install a counterweight spring shim (P/N 45F3753) as follows:

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

   a. Power off the printer.

   b. Loosen screw (8) about three turns.

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

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

   e. Tighten the screw (8).

8. Power on the printer.

CAUTION

When the cam cover is removed from the printer, a rotating flywheel is hazardous and can cause personal injury. Keep hands, tools, and clothing away from the flywheel when the printer is on and the cam cover is removed.

9. Run a shuttle only test for 10 minutes. Check for rattle and increase the preload if necessary. Check for stalls or no–start conditions and decrease the preload if necessary.

10. Install the cam cover and attached gasket. Tighten the two captive screws.

11. Close the printer cover.

12. Return the printer to normal operation.

1. Captive Screw (2)
2. Cam Cover
3. Shuttle Spring
4. Counterweight Spring
5. Counterweight
6. Yoke
7. Shim (P/N 45F3753)
8. Screw
9. Shim (P/N 45F3753)
10. Base Support

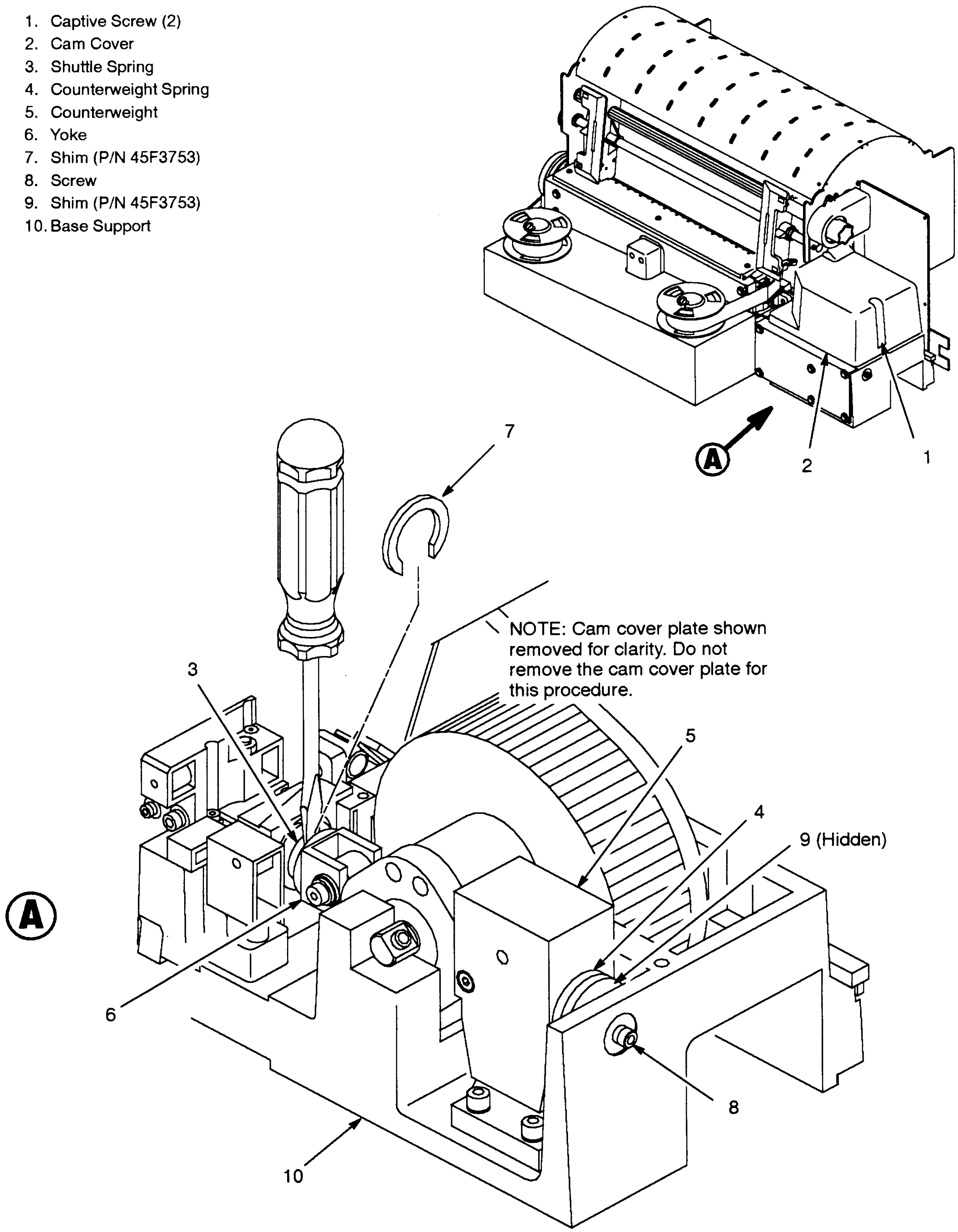


Figure 6–13. Shuttle Spring Force Adjustment

Shuttle Belt Tension (Figure 6–14)

Tension Check

1. Power off the printer.
2. Open the printer cover.
3. Loosen the two captive screws and remove the cam cover (1).
4. Press down with your finger in the middle of the shuttle belt (2) using about 2 ounces of force.
5. If the belt deflection is more or less than 0.20 inches (5.3 mm), do the adjustment procedure below.
6. If the belt has just been installed, run a ribbon/shuttle diagnostic test, power off the printer, and check the belt tension again.

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

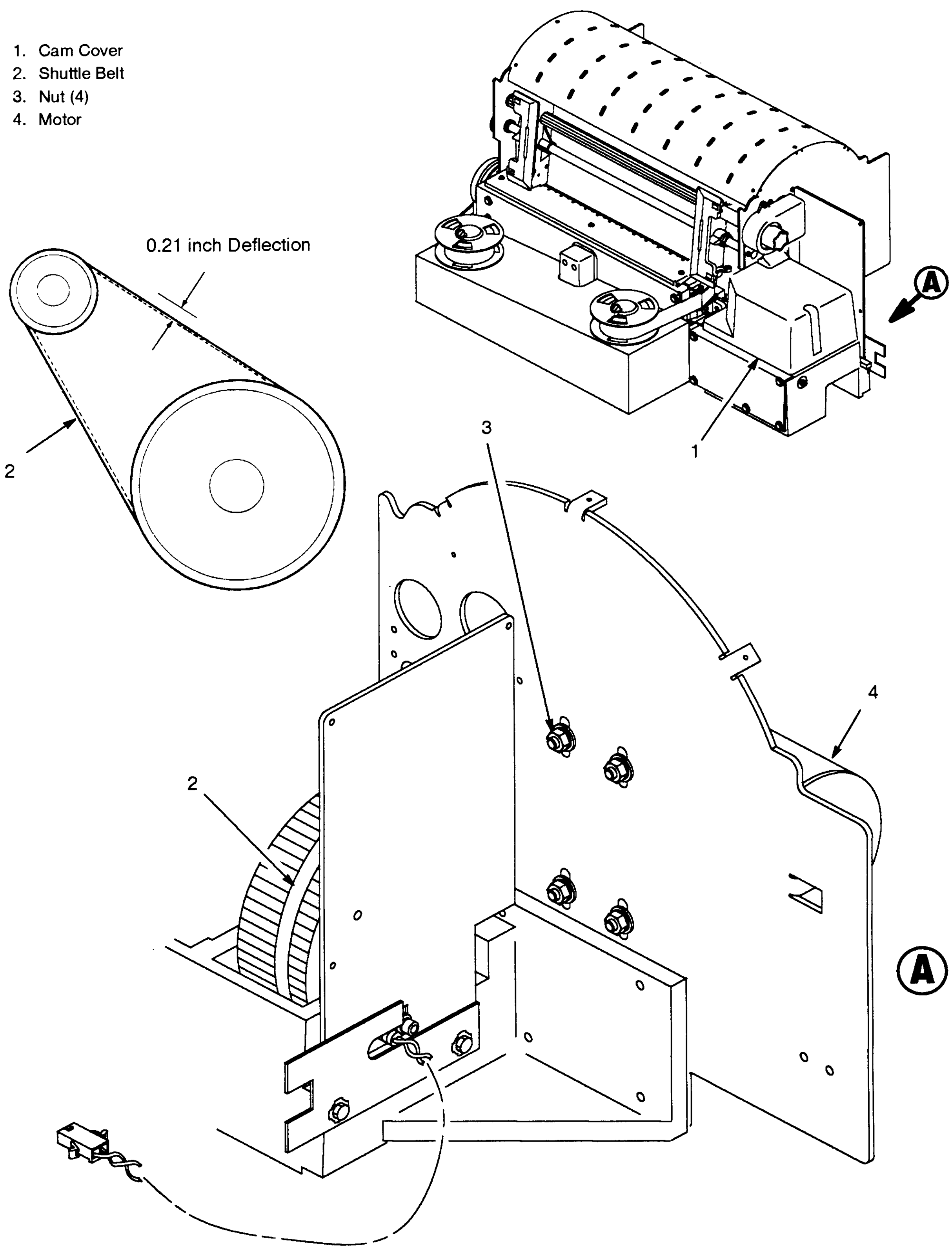


Figure 6–14. Shuttle Belt Tension Check and Adjustment

7 Replacement Procedures and Parts

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Blower Assembly

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper chains and paper stacker assembly (page 7–32).
4. Remove seven 5/16 inch screws and the inner access panel. (See Figure 7–22, page 7–75.)
5. The blower assembly is located in the right rear of the cabinet, above the power supply.
6. Loosen the hose clamp nearest the blower, slide it to the center of the blower hose, and remove the hose from the blower outlet. (See Figure 7–21, page 7–73.)
7. Using 5/16 inch nut driver or flat tip screwdriver, remove the braided ground strap from the cabinet end.
8. Remove the cabinet fan. (See page 7–5.)
9. Remove the blower power mate–n–lock connector J18.
10. From the top rear of the cabinet loosen the three blower mounting screws, and slide the blower forward and down for removal.
11. Reverse the removal steps to install a new blower motor.

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

Brush, Anti–Static

1. Unplug the printer power cord from the AC receptacle.
2. Remove the wire frame paper guide assembly (page 7–30).
3. Remove two screws securing the anti–static brush to the wire frame paper guide assembly.
4. Reverse the removal steps to install a new anti–static brush.

Cabinet Fan

1. Unplug the printer power cord from the AC receptacle.
2. Open the printer cover. The cabinet fan is located next to the gas shock that holds the cover open, and is mounted directly above the blower assembly. (See Figure 7–6, page 7–43).
3. Disconnect the power mate–n–lock connector from the fan.
4. Remove the two 1/4 inch fan retaining screws. Two of the four screws attach the grill to the fan; remove them and later install the grill on the new fan. (See Figure 7–21, page 7–73.)
5. Reverse the removal steps to install a new cabinet fan.

Cam and Flywheel Assembly

Removal

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper path assembly (page 7–32). This gives you access to the shuttle motor, which you will need when tightening the shuttle belt during re–assembly.
4. Loosen the four shuttle motor mounting nuts, to aid in the removal of the flywheel assembly.
5. Remove the counterweight assembly:
   a. Remove the cam cover, and the cam cover plate. (See Figure 7–9, page 7–49.)
   b. Remove the front two allen screws from the counterweight base plate, and just loosen the rear screw. (See Figure 7–15, page 7–61.)
   c. Remove one allen screw, from the counter–weight assembly. (See Figure 7–15, page 7–61.)
   d. To remove the counterweight, slide the assembly toward the front of the printer. Take care while removing the counterweight assembly not to lose the counterweight spring guide shims.

CAUTION

The gear teeth on the flywheel are sharp. To avoid hand injuries when handling the flywheel, hold the flywheel with a cloth.

6. Remove the two allen screws securing the flywheel assembly to the printer deck. Lift the flywheel up and away from the deck casting. (See Figure 7–16, page 7–63.)

Installation

CAUTION

The gear teeth on the flywheel are sharp. To avoid hand injuries when handling the flywheel, hold the flywheel with a cloth.

1. Position the flywheel in the base casting. Handle the flywheel carefully: do not to damage the magnetic pickup unit (MPU). (See Figure 7–16, page 7–63.)

2. Loop the shuttle motor belt over the shuttle motor sprocket, then slide it onto the flywheel.

3. Install the two allen screws that hold the flywheel in place, and torque them to 40 ± 3 in–lb.

4. Install the counterweight assembly:

   a. Remove the rear base plate allen screw which was loosened during the removal procedure. Position this screw in 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 yet.

   b. Replace the the counterweight allen screw that secures the right spring seat. (Right side of printer deck.) Do not tighten this screw yet.

   c. Replace the final front base plate allen screws.

   d. Tighten all four allen screws.

5. Check and adjust shuttle belt tension (page 6–38).

6. Install the paper path assembly (page 7–32).

7. Check and adjust the shuttle and counterweight preload (page 6–30).

8. Check and adjust the MPU gap (page 6–18).

9. Check and adjust MPU phasing (page 6–12).

Cam Follower Bearing

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the cam and flywheel assembly (page 7–6).
4. Remove the cam follower bearing screw and its two washers. Catch the two thrust shims and cam follower bearing as you draw the screw out of the cam follower yoke. (See Figure 7–4C, page 7–19.)
5. Apply a dab of IBM #20 lubricant to both sides of the thrust shims. Position the thrust shims and cam follower bearing in the cam follower yoke, and install the bearing screw and its washers. (See Figure 7–4C, page 7–19.)
6. Torque the cam follower bearing screw to 20 in–lb.
7. Install the cam and flywheel assembly (page 7–6).
8. Check and adjust the shuttle and counterweight preload (page 6–30).

Card Cage Fan

1. Unplug the printer power cord from the AC receptacle.
2. Remove the front panel (Figure 7–6, page 7–43):
   a. Loosen the retaining screw located inside the top of the cabinet, directly below the control panel.
   b. Lift and pull the panel away from the printer to remove it.
3. Remove seven 5/16 inch screws and the inner access panel. (See Figure 7–22, page 7–75.)
4. Remove the two 1/4 inch fan retaining screws. Two of the four screws attach the grill to the fan; remove these and later install the grill on the new fan.
5. Remove the fan from the front of the cabinet, and disconnect the mate–n–lock power connector P1.
6. Reverse the removal steps to install the new fan.

Counterweight Assembly

1. Unplug the printer power cord from the AC receptacle.
2. Remove the cam cover and the cam cover plate. (See Figure 7–9, page 7–49.)
3. Remove the front two allen screws from the counterweight base plate, and just loosen the rear screw. (See Figure 7–15, page 7–61.)
4. Remove one allen screw from the counter–weight assembly. (See Figure 7–15, page 7–61.)
5. To remove the counterweight, slide the assembly toward the front of the printer. Take care while removing the counterweight assembly 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 in step 3. above. Position this screw in 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 fully tighten this screw yet.
7. Next, replace the the counterweight allen screw which secures the right spring seat. (Right side of printer deck) Do not tighten this screw yet.
8. Replace the two front base plate allen screws, and tighten all four screws.
9. Check and adjust the shuttle and counterweight preload (page 6–30).

Cam Counterweight Roller Bearing

1. Remove the counterweight assembly (page 7–9).
2. Remove the self–locking shoulder screw and the roller bearing from the counterweight. (See Figure 7–15, page 7–61.)
3. Install a new roller bearing in the counterweight and install the self–locking shoulder screw.
4. Torque the shoulder screw to 11 in–lb.
5. Install the counterweight assembly (page 7–9).
6. Check and adjust the shuttle and counterweight preload (page 6–30).

Forms Thickness Lever

1. Unplug the printer power cord from the AC receptacle.
2. Remove the platen belt cover: (See Figure 6–10, page 6–27.)
   a. Press down on the cover to release the top tab.
   b. Lift the cover to release the bottom tab, then slide the cover towards the rear of the printer.
3. Rotate the forms thickness lever toward the rear of the printer until it stops against the printer side plate.
4. Loosen the clamp screw and remove the forms thickness lever. (See Figure 7–13, page 7–57.) Do not move the platen until you have installed the replacement lever.
5. Install the replacement lever with the upper arm against the printer side plate, and tighten the clamp screw.
6. Loop the platen open belt over the platen open motor pulley.
7. Slide the platen open belt over the forms thickness lever pulley. (If necessary, loosen the platen open motor screws to loosen the belt.)
8. Adjust the platen open belt (page 6–26).

Gas Spring Assembly

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper chains and paper stacker assembly (page 7–32).
4. Remove seven 5/16 inch screws and the inner access panel. (See Figure 7–22, page 7–75.)

CAUTION

Hold the printer cover securely while disengaging the gas spring assembly.

5. Raise the cover to its full height; if the cover does not stay in this position, ask another person to hold it up while you complete this procedure.
6. Remove the locking clip from the top swivel socket of the gas spring assembly. Pull the socket from the ball. Rotate the printer cover backward: The cover hinges will support weight of the cover, but use another means of support to hold the cover up. (See Figure 7–8, page 7–47.)
7. From inside the cabinet and directly above the power supply, remove the locking clip from the bottom swivel socket of the gas spring assembly.
8. Remove the gas spring assembly from the printer.
9. Reverse the removal steps to replace the new gas spring assembly.

Hammer Bank

Removal

1. Power off the printer.
2. Unplug the printer power cord.
3. Remove the ribbon and unload paper.
4. Disconnect the ribbon motor cables (1) on each side of the ribbon deck. Disconnect the ribbon guide cables. (See Figure 7–1.)
5. 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.
6. Remove the cam cover (3).
7. Remove the cam cover plate (4).
8. Remove the dust barrier block (5).
9. Remove the two velcro covers (7).
10. Disconnect the six hammer bank cables (6).
11. Remove the two screws (8) that attach the shuttle shroud to the bearing caps.
12. Remove the two anti–rotation block screws (9) and the anti–rotation shims (10). Do not discard the shims.
13. 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.
14. Remove the bearing cap screws (13 and 14).
15. Remove the right and left bearing caps (15 and 16).

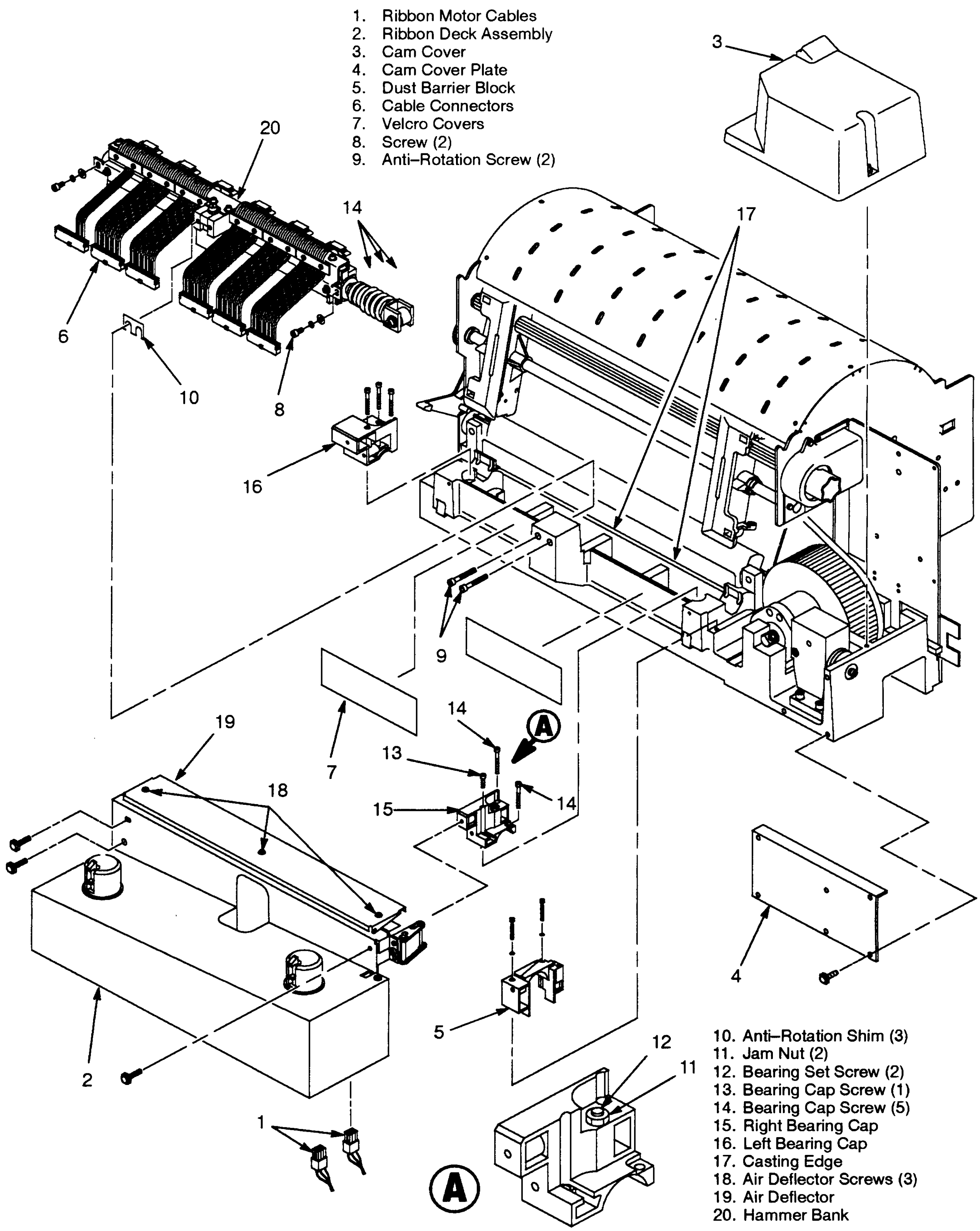


Figure 7–1. Hammer Bank Removal/Installation

16. Prepare to lift the hammer bank (20) up and out of the casting:

    a. Notice the U–shaped shims (21) installed at the end of the shuttle spring (22). (See Figure 7–2.)

    b. Do not lose these shims as you lift the hammer bank out of the casting.

    c. Also, make sure the left linear bearing sleeve (23) does not slip off the shaft.

17. Keeping the shuttle shroud, hammer bank cables, and antirotation pad (24) in place by holding the shuttle shroud screws (25) with your thumbs, lift the hammer bank out of the casting.

18. Clean the bearing seats, the anti–rotation block, and the base casting in the area of the hammer bank.

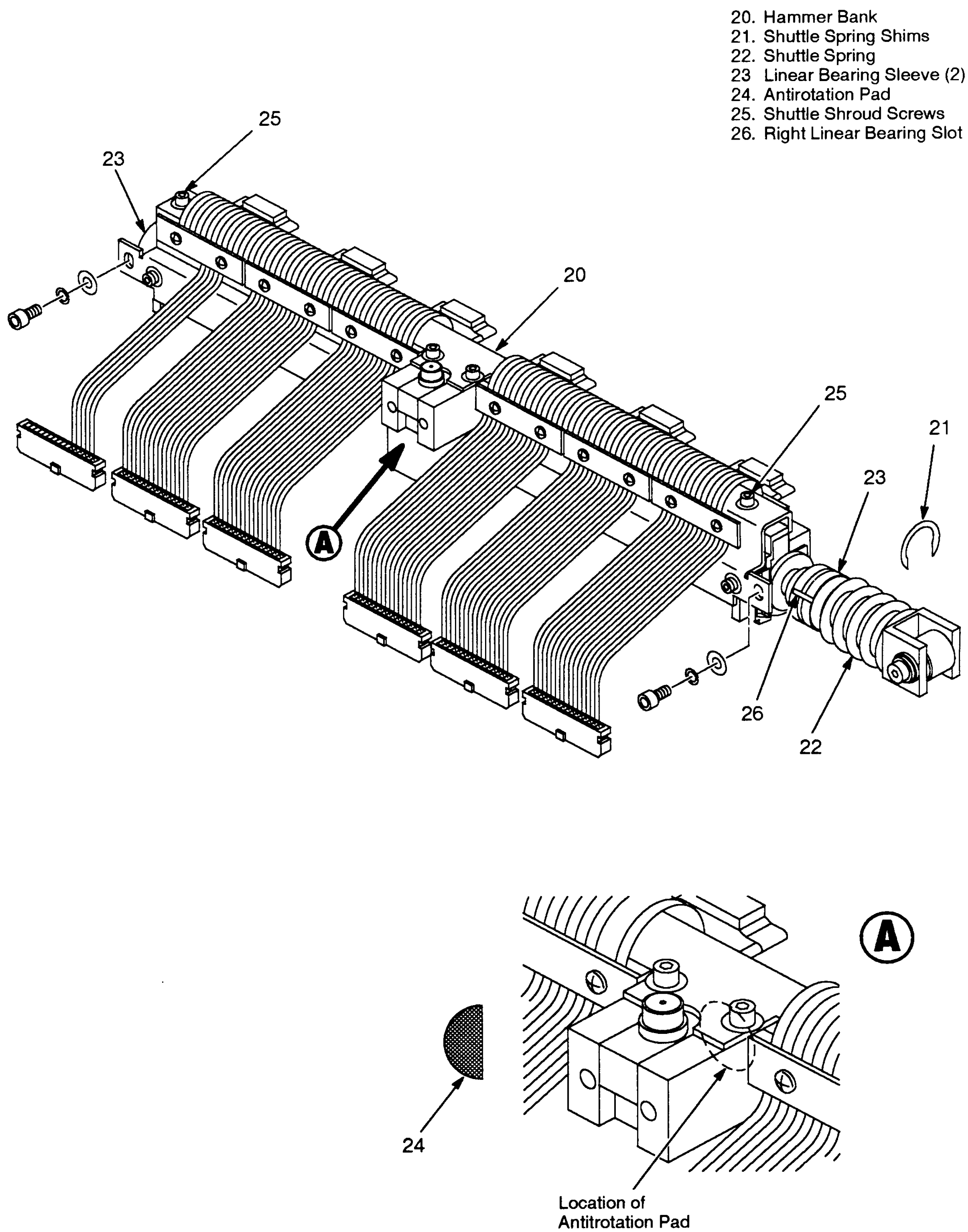


Figure 7–2. Hammer Bank Removal

Installation

WARNING

To prevent excessive noise, bearing failure, and poor print quality, do not skip or omit any steps in this procedure.

1. Clean the bearing seats, the anti–rotation block, and the base casting in the hammer bank area.

2. Prepare to install the new hammer bank (20) in the printer casting:

   a. Note the U–shaped shims (21) installed at the end of the shuttle spring (22). (See Figure 7–3.)

   b. These were installed at the factory to set the correct spring pre–load. Make sure that these shims stay in place as you install the hammer bank.

   c. Also, do not let the left linear bearing (23) slip off the shaft.

WARNING

The antirotation pad (24) must be kept in place inside the shuttle shroud (Figure 7–3A) to ensure good print quality. In the next step, avoid dislodging the antirotation pad when you lift the hammer bank.

3. Keeping the shuttle shroud, hammer bank cables, and antirotation pad (24) in place by holding the right and left shuttle shroud screws (25) with your thumbs, pick up the hammer bank assembly.

4. Position the hammer bank in the base casting with the shuttle spring shoulder washer (27) against the machined surface of the casting, the linear bearings near the center of their mounting blocks (Figure 7–4, A and B), and the cam follower bearing in contact with the cam (Figure 7–4C).

5. Rotate the bearing sleeves (23) until the slots (Figure 7–3) are facing the front of the printer. Make sure that the front edge of the shuttle shroud (28) fits behind the machined edge of the casting (Figure 7–1), and that the foam air seal (29) makes a tight seal against the casting.

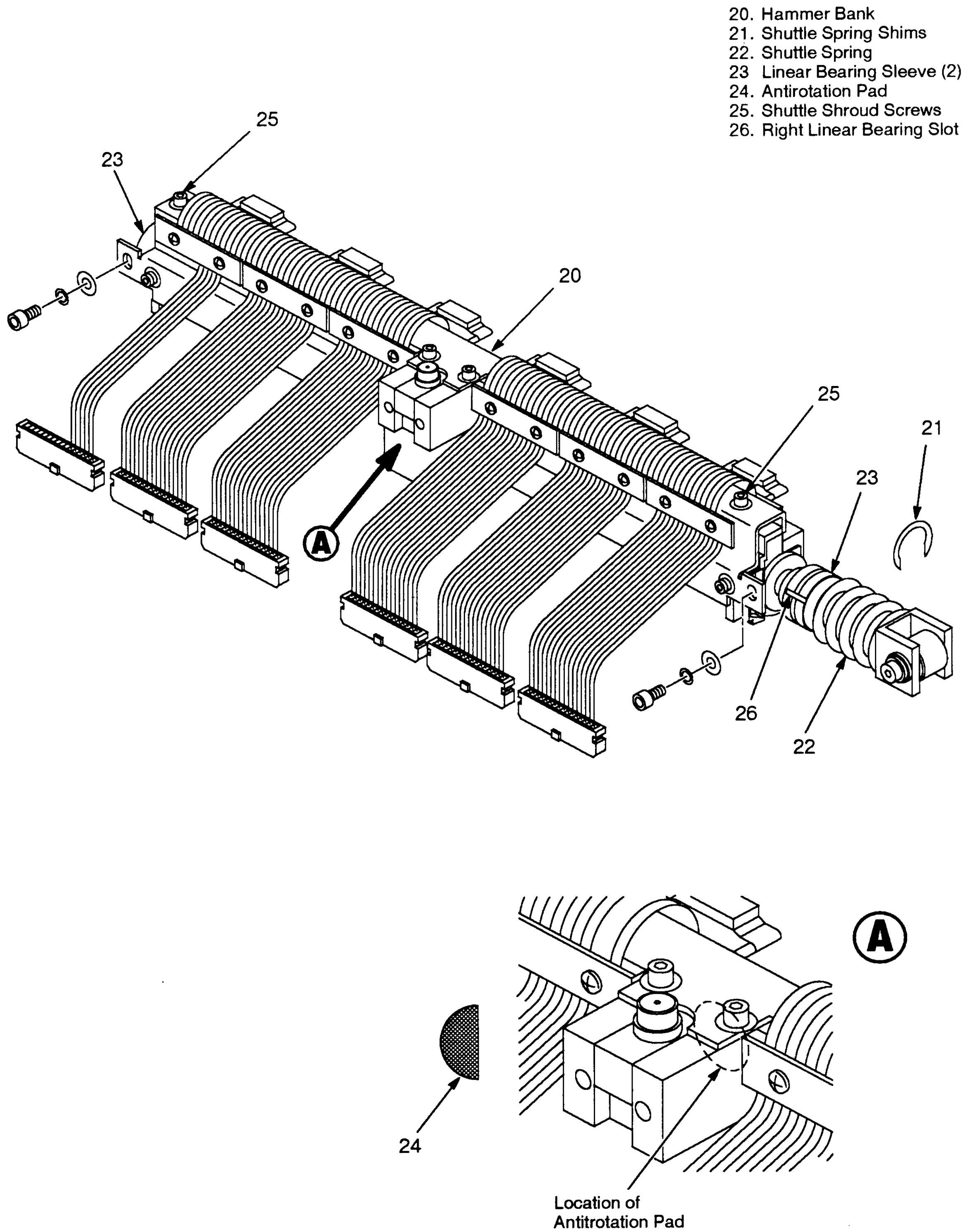


Figure 7–3. Replacement Hammer Bank

WARNING

Failure to do the next step can result in noisy operation, bearing failure, and poor print quality.

6. Line up the inner edge of the *right* bearing sleeve (Figure 7–4A) so that it is directly adjacent to the recessed bearing cap screw hole and base casting indentation, with the bearing sleeve slot facing forward. Verify that the slot faces forward by placing a small screwdriver or 1/16–inch Allen wrench (28) through the *right* bearing mounting block into the bearing sleeve slot. When the tool is in the slot, you will not be able to rotate the bearing sleeve by hand.

7. 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 with an Allen wrench, in the following order: first 13; second 14(2); third 14(3). Torque the right bearing set screw (12) to 10 in–lb.

8. Line up the inner edge of the *left* bearing sleeve (Figure 7–4A) so that it is directly adjacent to the recessed bearing cap screw hole and base casting indentation, with the bearing sleeve slot facing forward. Verify that the slot faces forward by placing a small screwdriver or 1/16–inch Allen wrench (28) through the *left* bearing mounting block into the bearing sleeve slot. When the tool is in the slot, you will not be able to rotate the bearing sleeve by hand.

9. Install the *left* bearing cap (16) and tighten the three mounting screws (14) finger tight. Then tighten them snugly with an Allen wrench, in the following order: first 14(1); second 14(2); third 14(3). Torque the left bearing set screw (12) to 10 in–lb.

10. Install the two screws (28) that attach the shuttle shroud to the bearing caps.

11. Install but do not tighten the anti–rotation block screws (9).

12. Install the anti–rotation shims (10) that were removed with the old hammer bank.

13. Tighten the anti–rotation block screws (9).

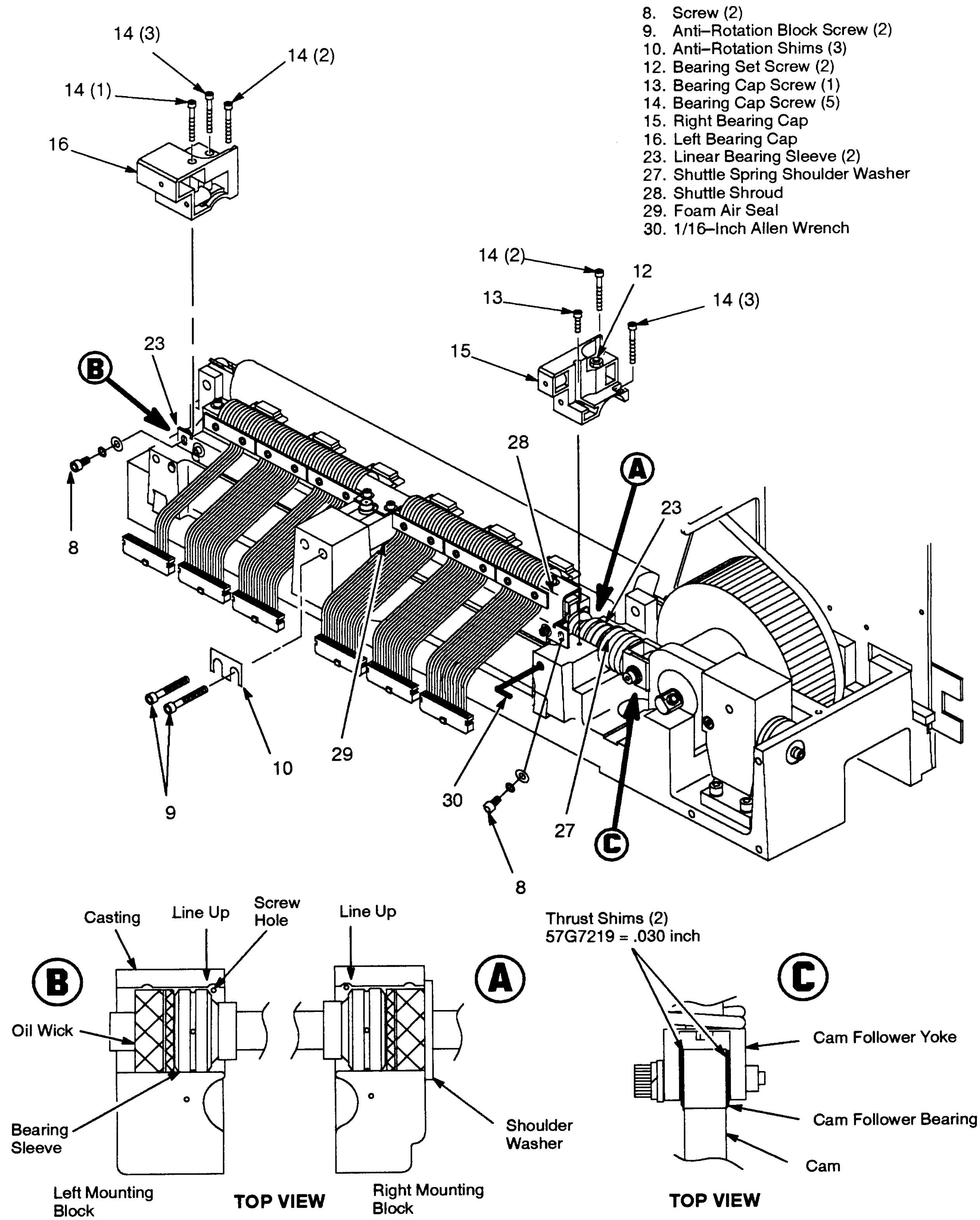


Figure 7–4. Installing Hammer Bank

WARNING

Failure to correctly align the cam follower yoke to the cam can result in noisy operation, bearing failure, and poor print quality.

14. Wedge the shank of a large screwdriver (32) between the yoke and the flywheel shank so that the cam follower bearing and cam are not in contact. (See Figure 7–5.) Remove the cam follower bearing screw (33), the cam follower bearing, and the two thrust shims. Remove the two washers from the screw, and install the screw with the antirotation tool (Figure 7–5A). Hand tighten the screw—do not use a wrench. The bracket is supposed to be at an angle, as shown in Figure 7–5A.

15. Try to slide a .004–inch feeler gauge (Figure 7–5B) between the side of the cam and the alignment tool at the top and bottom of the tool. If the feeler gauge fits in the top space (Figure 7–5B, left), add anti–rotation block shims (Figure 7–4). If the feeler gauge fits in the bottom (Figure 7–5B, right), remove shims. Usually, adding or removing one .005–inch shim will correct the alignment.

16. Remove the antirotation tool (34). Apply a small dab of bearing lubricant to both sides of the two thrust shims. Install the cam follower bearing screw (33) and the original washers, the roller bearing, and two thrust shims. Torque the bearing screw (33) to 20 in–lb. Remove the screwdriver (32) from between the yoke and fly wheel shank.

17. Connect the six hammer bank cables and install the velcro covers. Install the dust barrier block (Figure 7–1).

18. Adjust the platen gap (page 6–24) and shuttle counterweight preload (page 6–30).

19. Plug the printer power cord into the printer and power on the printer.

20. Insert a 1/16–inch Allen wrench into the slot of the *right* bearing sleeve to keep the slot forward. (See Figure 7–4.)

11. Jam Nut (2)
12. Bearing Set Screw (2)
31. Cam Follower Yoke
32. Screwdriver
33. Cam Follower Bearing Screw
34. Antirotation Tool (57G7259)
35. .004–inch Feeler Gauge

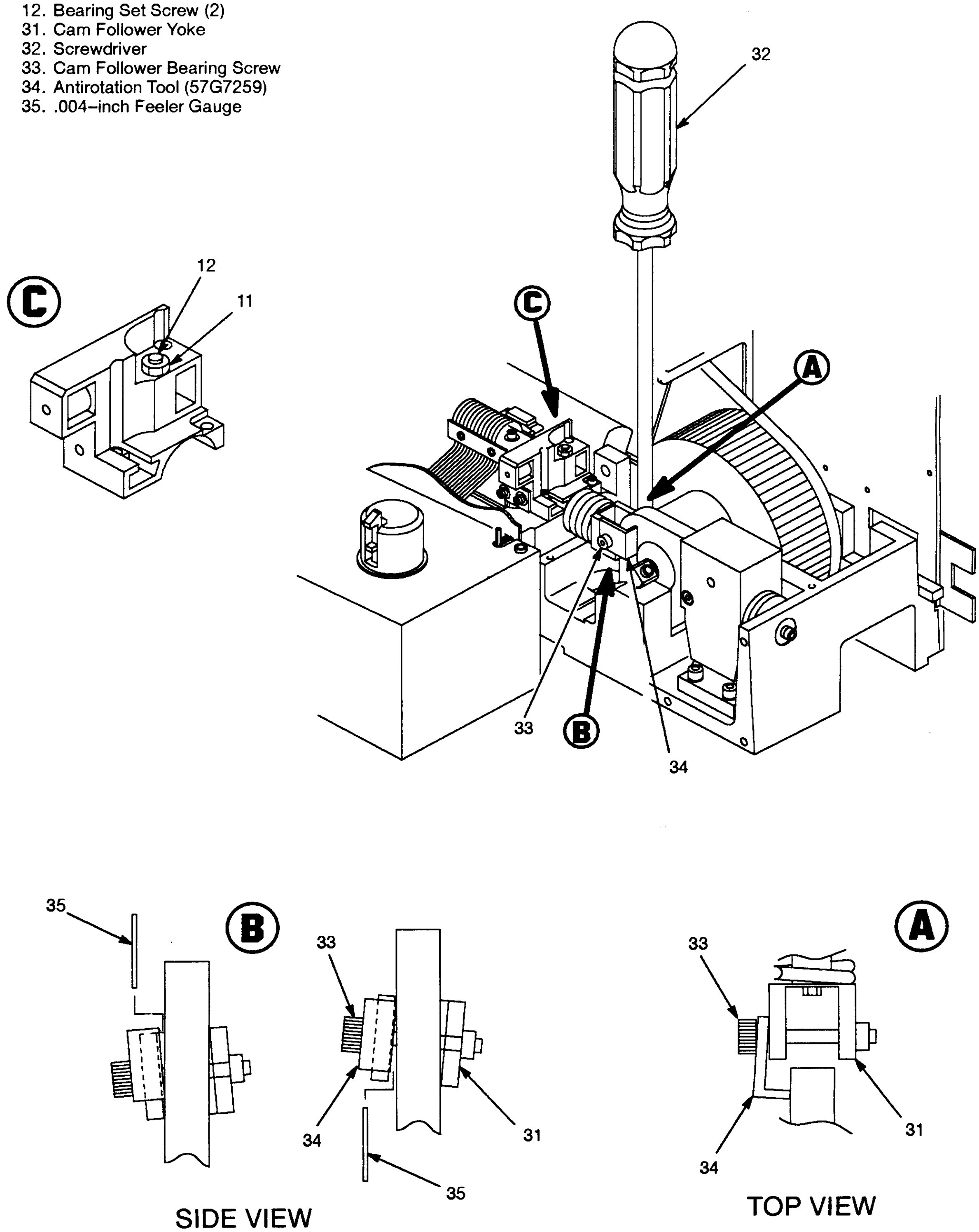


Figure 7–5. Yoke and Antirotation Shim Adjustment

CAUTION

When the cam cover is removed from the printer, a rotating flywheel is hazardous and can cause personal injury. Keep hands, tools, and clothing away from the flywheel when the printer is on and the cam cover is removed.

21. Adjust the right bearing set screw (Figure 7–5C) as follows:
    a. Run the shuttle only diagnostic test. As the printer is shuttling, loosen the bearing set screw two turns, then torque it to 10 in–lb.
    b. If a binding noise comes from the bearing, repeat step 21.a., loosening and tightening the bearing set screw while you hold the Allen wrench in the bearing sleeve slot.
22. Tighten the *right* jam nut (Figure 7–5C), then remove the Allen wrench.
23. Insert a 1/16–inch Allen wrench through the cutout in the *left* side of the ribbon deck and into the slot of the *left* bearing sleeve.
24. Run the shuttle only diagnostic test and adjust the *left* bearing set screw, as described in steps 21.a. and 21.b.
25. Tighten the *left* jam nut, then remove the Allen wrench.
26. Power off the printer.
27. Install the ribbon deck and connect the ribbon motor cables. (See Figure 7–1.)
28. Install a ribbon and load paper.
29. Power on the printer.
30. Check and adjust the magnetic pickup phasing (page 6–12).
31. Select a diagnostic print test and print some 132–column lines to verify printer operation.
32. Power off the printer.
33. Install the dust barrier block, cam cover plate, and cam cover. (See Figure 7–1.)
34. Check the alignment of the paper scale markings on the edge of the air deflector with the self–test printout, at columns 1 and 132.

35. If adjustment is required, loosen the air deflector screws. Position the air deflector so that columns 1 and 132 on the paper scale line up with the first and last characters on the 132 character printout, then tighten the air deflector screws. (See Figure 7–1.)

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

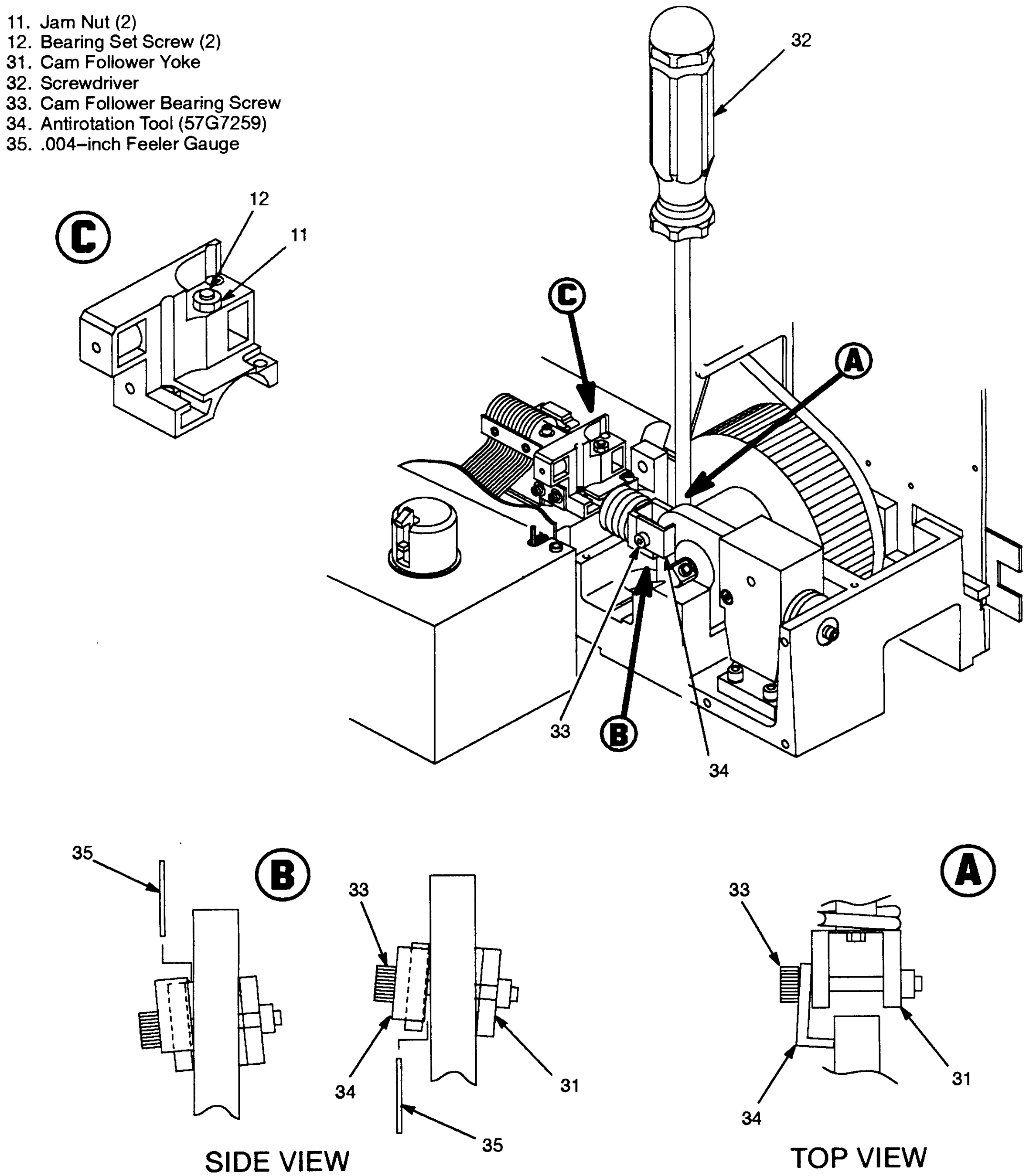


Figure 7–5. Yoke and Antirotation Shim Adjustment

Hammer Bank Cover/Ribbon Mask Assembly

1. Put the hammer bank in the service position (page 6–2).
2. Lift the hammer bank cover/ribbon mask assembly, which is magnetic, clear of the hammer bank and the two lower tabs that hold it in place. (See Figure 7–14, page 7–59.)
3. Install the new hammer bank cover/ribbon mask assembly by reversing the removal procedure.
4. Return the hammer bank to the operating position (page 6–6).

Hammer Spring and Hammer Coil

Spring Removal:

1. Put the hammer bank in the service position (page 6–2).

2. To remove a defective hammer spring, remove the two Allen screws that secure the hammer retaining clamp. Each clamp supports two hammer springs. (See Figure 7–14, page 7–59.)

3. After reassembling the hammer bank, adjust the hammer tips (page 6–16).

Coil Removal:

1. Remove the corresponding hammer spring to expose the defective coil. (See above.)

2. Remove the two Allen screws that secure the coil clamp and the two Phillips screws that secure the coil lead bracket. (See Figure 7–14, page 7–59.)

NOTE: Blue wires are used to hold some coils on the hammer bank when the printer is assembled at the factory. You must cut the blue wires when replacing these coils—but be careful not to cut the coil lead wires. It is not necessary to replace blue wires when a new coil is installed.

3. Carefully remove the hammer coil by prying it upward with a plastic tool.

4. At the berg header of the defective hammer coil, depress the silver locking tab of the female contact inward with a pointed tool to release the red and white wires.

5. After reassembling the hammer bank, adjust the hammer tips (page 6–16).

I/O Panel and Cable Assembly

DANGER

To prevent serious personal injury from electrical shock when connecting or disconnecting the signal cable, set the printer power switch to the off position and unplug the power cable.

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper chains and paper stacker assembly (page 7–32).
4. Remove the inner access panel by removing seven 5/16 inch screws. (See Figure 7–22, page 7–75.)
5. Remove the four 5/16 inch retaining screws from the I/O panel assembly, and rest the panel on the cabinet floor.
6. Remove the front panel (Figure 7–6, page 7–43) from the cabinet to gain access to the card cage:
   a. Loosen the retaining screw located inside the top of the cabinet, directly below the control panel.
   b. Lift and pull the panel away from the printer.
7. Remove the card cage access panel by removing the five screws that hold it in place. (See Figure 7–17, page 7–65.)
8. Follow I/O panel ribbon cable to the berg connector on the top of the common controller board, and disconnect the cable connector.
9. Pull the connector end of the cable through the side of the card cage to free the I/O panel assembly from the printer.
10. Reverse the removal steps to install the new I/O panel.

Magnetic Pickup Assembly (MPU)

1. Unplug the printer power cord from the AC receptacle.
2. Loosen the MPU locking screw. (See Figure 6–6, page 6–19.)
3. Remove the MPU guide bracket. (See Figure 7–16, page 7–63.)
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 6–18).
7. Check and adjust the MPU phasing (page 6–12).

Oil Wick

1. Remove the cam and flywheel assembly (page 7–6).
2. Remove the two 5/16 inch screws that secure the oil wick. (See Figure 7–16, page 7–63.)
3. Install the new oil wick, then reverse the cam and flywheel removal steps (page 7–6).
4. Adjust the shuttle and counterweight spring preload (page 6–30).
5. Adjust the MPU gap (page 6–18).
6. Adjust the hammer phasing (page 6–12).

Operator Panel

1. Unplug the printer power cord from the AC receptacle. It is also highly recommended that you wear an anti–static wrist strap whenever you handle circuit boards.

2. Remove the front panel (Figure 7–6, page 7–43), from the cabinet to gain access to the card cage:

   a. Loosen the retaining screw located inside the top of the cabinet, directly below the control panel.

   b. Lift and pull the panel away from the printer to remove.

3. Follow the control panel ribbon cable to the connector above the card cage and disconnect it.

4. Using the tip of a screwdriver, release the latch on top of the operator panel, slide the panel down and out of the printer. (See Figure 7–17, page 7–65.)

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

Paper Feed Motor and Belt

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper path assembly. (See page 7–32.)
4. Remove the Paper Feed Belt Cover.
5. Loosen the four 5/16 inch nuts that secure the paper feed motor. (See Figure 7–12, page 7–55.)
6. Slide the new belt onto the paper tractor shaft sprocket and the paper feed motor sprocket.
7. Adjust the paper feed belt tension (page 6–20).
8. If you are going to replace the paper feed motor, remove the four 5/16 inch nuts that secure the paper feed motor, disconnect the power and signal cable connector, and remove the motor.
9. Install a new paper feed motor using the 5/16 inch hardware, and adjust the belt tension (page 6–20).
10. Reverse the removal steps to replace the paper feed belt cover and paper path assembly.

Paper Guide Assembly, Machined

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper chains.
4. Disconnect the mate–n–lock connectors, and cut the necessary tie–wraps to allow removal of the machined and front paper guide assembly. (See Figure 7–12, page 7–55.)
5. Working from the rear of the paper cabinet, remove the three 5/16 inch screws that hold the machined and front paper guide assembly in place. (See Figure 7–12, page 7–55.)
6. To remove the paper motion/out switch assembly, remove the two 1/4 inch screws securing it to the machined and front paper guide assembly.
7. Reverse the removal procedure to reinstall the machined and front paper guide assembly.
8. If the paper motion/out detector switch was removed, adjust the end of forms distance (page 6–8).

Paper Guide Assembly, Wire Frame

1. Unplug the printer power cord from the AC receptacle.
2. Open the printer top cover.
3. Remove the screw securing the paper path ground wire to the wire clip on the right side of the top cover. (See Figure 7–8, page 7–47.)
4. Lift the wire frame paper guide and chains off the clips inside the top cover.
5. Reverse the removal procedure to reinstall the wire frame paper guide.

Paper Ironer

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper chains.
4. Working from the rear of the floor cabinet, remove the three 5/16 inch screws that hold the machined and front paper guide assembly in place. (See Figure 7–12, page 7–55.)
5. Disconnect the mate–n–lock connectors, and cut the necessary tie–wraps to allow removal of the machined and front paper guide assembly. Move the machined and front paper guide assembly to one side.
6. Loosen the four paper ironer clamp screws and remove the paper ironer. (See Figure 7–12, page 7–55.)
7. Reverse the removal procedure to install the machined and front paper guide assembly.
8. If the paper motion/out detector switch was removed, adjust the end of forms distance (page 6–8).

Paper Motion/Out Detector

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper chains.
4. Working from the rear of the floor cabinet, remove the three 5/16 inch screws that hold the machined and front paper guide assembly in place. (See Figure 7–12, page 7–55.)
5. Disconnect the connectors, and cut the necessary tie–wraps to allow removal of the machined and front paper guide assembly.
6. To remove the paper motion/out switch assembly, remove the two 1/4 inch screws securing it to the machined and front paper guide assembly.
7. Reverse the removal procedure to install the paper motion/out switch assembly, then adjust the end of forms distance (page 6–8).

Paper Path

1. Unplug the printer power cord from the AC receptacle.
2. Unload the paper.
3. Remove buttonhead screws securing the paper path. (See Figure 7–9, page 7–49.)
4. Lift the paper path off the print mechanism.
5. Reverse the removal steps to replace the paper path. Torque the screws to 11 in–lbs.

Paper Stacker Assembly

1. Unplug the printer power cord from the AC receptacle.
2. Open the rear cabinet door. Remove the paper supply from the print station and tractors.
3. Remove the four screws securing the paper stacker rails. (See Figure 7–7, page 7–45.)
4. Remove the paper stacker assembly, two rails, and four spacers.
5. Reverse the removal procedure to install the paper stacker assembly.

Platen Open Motor and Belt

1. Unplug the printer power cord from the AC receptacle.

2. Remove the platen belt cover:

   a. Press down on the cover to release the top tab.

   b. Lift the cover to release the bottom tab, then slide the cover towards the rear of the printer.

3. If you are replacing just the platen open belt:

   a. Slide it off the forms thickness lever, then off the platen open motor pulley. (See Figure 7–11, page 7–53.)

   b. Install the replacement belt on the platen open motor pulley, then slide it over the forms thickness lever pulley. (If necessary, loosen the platen open motor screws to loosen the belt.)

   c. Adjust the platen open belt (page 6–26).

   d. Return the printer to normal operation.

4. If you are replacing the platen open motor:

   a. Remove four 1/4 inch screws and the paper path. (See Figure 7–9, page 7–49.)

   b. Disconnect the platen open motor cable connector (PLM).

   c. Remove the mounting screws, washers, and nutplate. Remove the platen open motor. (See Figure 7–12, page 7–55.)

   d. Install a new platen open motor, nutplate, washers, and screws. Torque the motor mount screws to 11 ± 2 in–lb.

   e. Adjust the platen open belt (page 6–26).

   f. Return the printer to normal operation.

Platen Open Switch

1. Unplug the printer power cord from the AC receptacle.
2. Remove the platen belt cover by pressing it down to release the top tab, then tip the cover out while pulling upward.
3. Remove four 1/4 inch screws and the lower paper guide. (See Figure 7–9, page 7–49.) This will allow access to the platen open switch nutplate.
4. Remove the two connectors from the platen open switch, and tag them for correct reinstallation.
5. Remove the two allen screws while holding the mating nutplate. Be careful not to drop the two spacers behind the switch.
6. To install a new switch, reverse the removal steps.

Power Supply

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper chains and paper stacker assembly (page 7–32).
4. Remove the inner access panel by removing seven 5/16 inch screws. (See Figure 7–22, page 7–75.)
5. Remove the six 5/16 inch screws that secure the power supply from the rear of the cabinet.
6. From inside the printer, remove the two 5/16 inch screws that secure the power supply to the floor of the cabinet.
7. Remove the 5/16 inch nut from the power supply ground strap stud, and remove the strap.
8. Release the two cables from the rear of the power supply, and from the back of the printer
9. Pull the power supply assembly out of the cabinet.
10. Reverse the removal steps to install the new power supply.

Printed Circuit Board Assemblies (PCBAs)

1. Unplug the printer power cord.

2. Remove the front panel (Figure 7–6, page 7–43), from the cabinet to gain access to the card cage:

   a. Loosen the retaining screw located inside the top of the cabinet, directly below the control panel.

   b. Lift and pull the panel away from the printer to remove it.

3. Remove the card cage access panel by removing the five (5) screws that secure it.

WARNING

To prevent electrostatic damage to electronic components, wear a properly grounded anti–static wrist strap when handling PCBAs.

4. Identify the correct PCBA to be replaced, and, with your wrist strap on and properly grounded, remove and replace the defective PCBA.

NOTE: Cable interconnections for circuit boards are shown in Appendix A. Before reinstalling the front covers, power on the printer and make sure the problem has been corrected.

5. Install the front covers, and return the printer to normal operation.

Ribbon Guide Assembly (L/R)

NOTE: This procedure is the same for both left and right ribbon guide assemblies.

Removal:

1. Unplug the printer power cord from the AC receptacle.
2. Open the printer top cover and the front door of the floor cabinet.
3. Remove the ribbon.
4. Remove the ribbon deck (page 6–2, steps 5 through 7).
5. Slide the ribbon guide wire grommet out of the slot in the ribbon deck. (See Figure 7–10, page 7–51.)
6. Cut through one side of the wire grommet and remove it from the ribbon guide wires. Save the grommet for reinstallation on the new ribbon guide.
7. Remove the two screws and washers securing the ribbon guide.
8. Remove the ribbon guide assembly.

Installation:

1. Position the ribbon guide assembly on the ribbon deck flange. (See Figure 7–10, page 7–51.)
2. Install the two screws and washers securing the ribbon guide.
3. Push the ribbon guide wires through the slice in the wire grommet.
4. Push the grommet into the slot on the ribbon deck. Rotate the slice in the grommet so that it is opposite the slot in the ribbon deck.
5. Install the ribbon deck by reversing steps 5 through 7 on page 6–2.
6. Install the ribbon.
7. Check and adjust the ribbon tracking (page 6–28).
8. Return the printer to normal operation.

Ribbon Hub

1. Unplug the printer power cord from the AC receptacle.
2. Remove the printer ribbon.
3. Loosen the hub set screw and remove the ribbon hub. (See Figure 7–10, page 7–51.)
4. Reverse the removal steps to install the new ribbon hub.

Ribbon Motor

1. Unplug the printer power cord from the AC receptacle.
2. Open the printer cover and the front door of the lower cabinet.
3. Disconnect four connectors from the bottom of the ribbon deck assembly. (See Figure 6–1, page 6–3.)
4. Squeeze the lock tabs and remove the ribbon spools from the ribbon hubs.
5. Remove three hex head screws securing the ribbon deck.
6. Raise the ribbon deck assembly slightly and lift it off the retaining clips.
7. On the ribbon motor to be replaced, loosen the ribbon hub set screw and remove the hub from the motor shaft. (See Figure 7–10, page 7–51.)
8. Remove the four screws and nuts securing the ribbon motor to the ribbon deck.
9. Reverse the removal steps to install the new ribbon motor.
10. Complete this procedure by performing the ribbon tracking check and adjustment (page 6–28).

Shuttle Motor

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the paper path. (See Figure 7–9, page 7–49.)
4. Remove the cam cover. (See Figure 7–9, page 7–49.)

CAUTION

The gear teeth on the flywheel are sharp. To avoid hand injuries when handling the flywheel, hold the flywheel with a cloth.

5. Remove the paper feed belt guard. (See Figure 7–11, page 7–53.)
6. Remove the shuttle motor belt guard by removing one bottom 5/16 inch screw, and one 5/16 inch nut/bolt pair from the top, being careful not to drop the nut into the printer. This cover fits snugly and you will have to flex it for removal.
7. Remove the shuttle motor power and signal cables from their mate–n–lock connectors.
8. Remove the four 7/16 inch shuttle motor mounting nuts to free the motor from its mounting plate.
9. Install the new shuttle motor, while looping the belt around the shuttle motor sprocket prior to installing the four shuttle motor mounting bolts.
10. Reconnect the power and signal cables.
11. Adjust the shuttle belt tension (page 6–38).
12. Reverse the remaining removal steps to complete the shuttle motor replacement.

Shuttle Motor Belt

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Remove the flywheel assembly (page 7–6).
4. Discard the old belt, loop the new belt around the flywheel, and reinstall the flywheel assembly.
5. Loop the free end of the belt around the shuttle motor sprocket, and adjust the belt tension (page 6–38).
6. Install the counterweight assembly (page 7–9).
7. Check and adjust the shuttle and counterweight preload (page 6–30).
8. Check and adjust the MPU gap (page 6–18).
9. Adjust the MPU phasing (page 6–12).
10. Replace all remaining belt guards and covers.

Tractor Assemblies

1. Unplug the printer power cord from the AC receptacle.
2. Remove the paper supply from the print station and tractors.
3. Loosen the 3/32 inch set screw in the left bushing and remove the bushing from the splined shaft. (See Figure 7–11, page 7–53.)
4. Loosen the two 5/64 inch set screws in the adjustment knob and remove the knob from the tractor support shaft. (See Figure 7–11, page 7–53.)
5. Hold the tractor support shaft to prevent it from turning and remove the 5/16 inch screw from the left end of the shaft.
6. Remove the paper feed belt cover and belt (page 7–29).
7. Slide both the splined shaft and the tractor support shaft to the right.
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 unlock left tractor and remove the assembly from the two shafts.
10. Reverse the removal steps to install the new tractor assemblies.

IMPORTANT

Make sure the paper pins on the right and left tractors are aligned vertically when installing tractors.

Item No.	Part Number	Description	Notes
	57G7180	Ship Kit, 6412–CT0	
	57G7188	Ship Kit, 6412–A00	
1	57G7267	Front Panel	
2	57G7193	Front Door	
3	57G7192 57G7271	Rear Door Wire Form, Rear Door	(Not shown in Figure 7–6.)
4	57G7194 57G7195	Caster, w/Brake (2) Caster, w/o Brake (2)	Front Rear
5		Screw, Hex w/Lockwasher (16)	Four per caster
6	93F7037 57G1484	Hingeplate, Door, Top (2) Hingeplate, Door, Bottom (2)	
7		Screw, Hex w/Lockwasher (16)	Four per hinge
8	57G7266	Dummy Panel, Disk Drive	
9	57G7268 57G7269	Rope, Wire, Front Rope, Wire, Rear	Limits door opening (Not shown in Figure 7–6.)

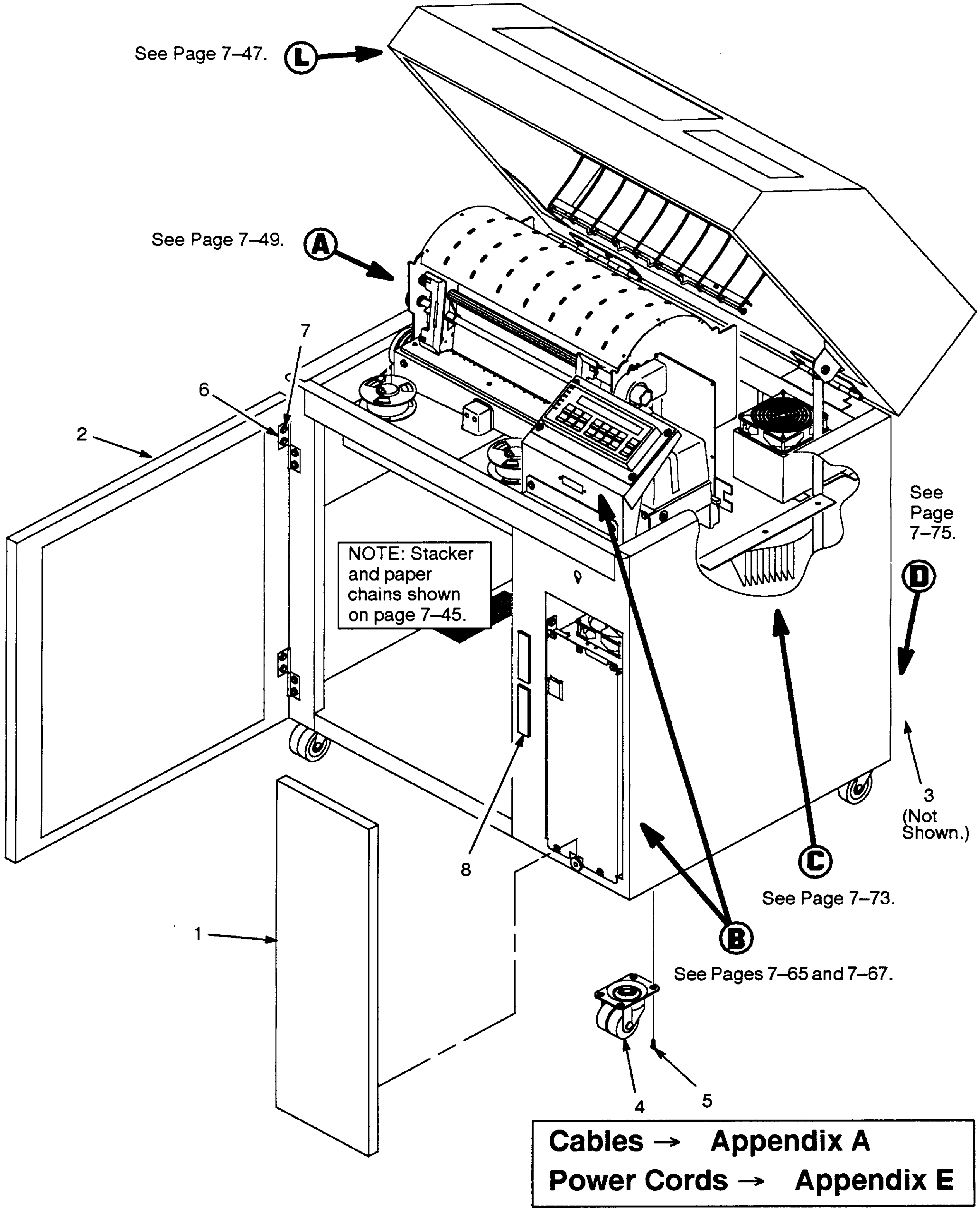


Figure 7–6. Printer Assembly

Item No.	Part Number	Description	Notes
1	57G7176	Stacker	
2	57G7177	Spacer	
3	57G7178	Runner, Stacker	
4		Screw, Hex (4)	
5	57G7198	Chain Assembly, Stacker	Long chains outside, short chains inside
6	57G1582	Label, Forms Length	

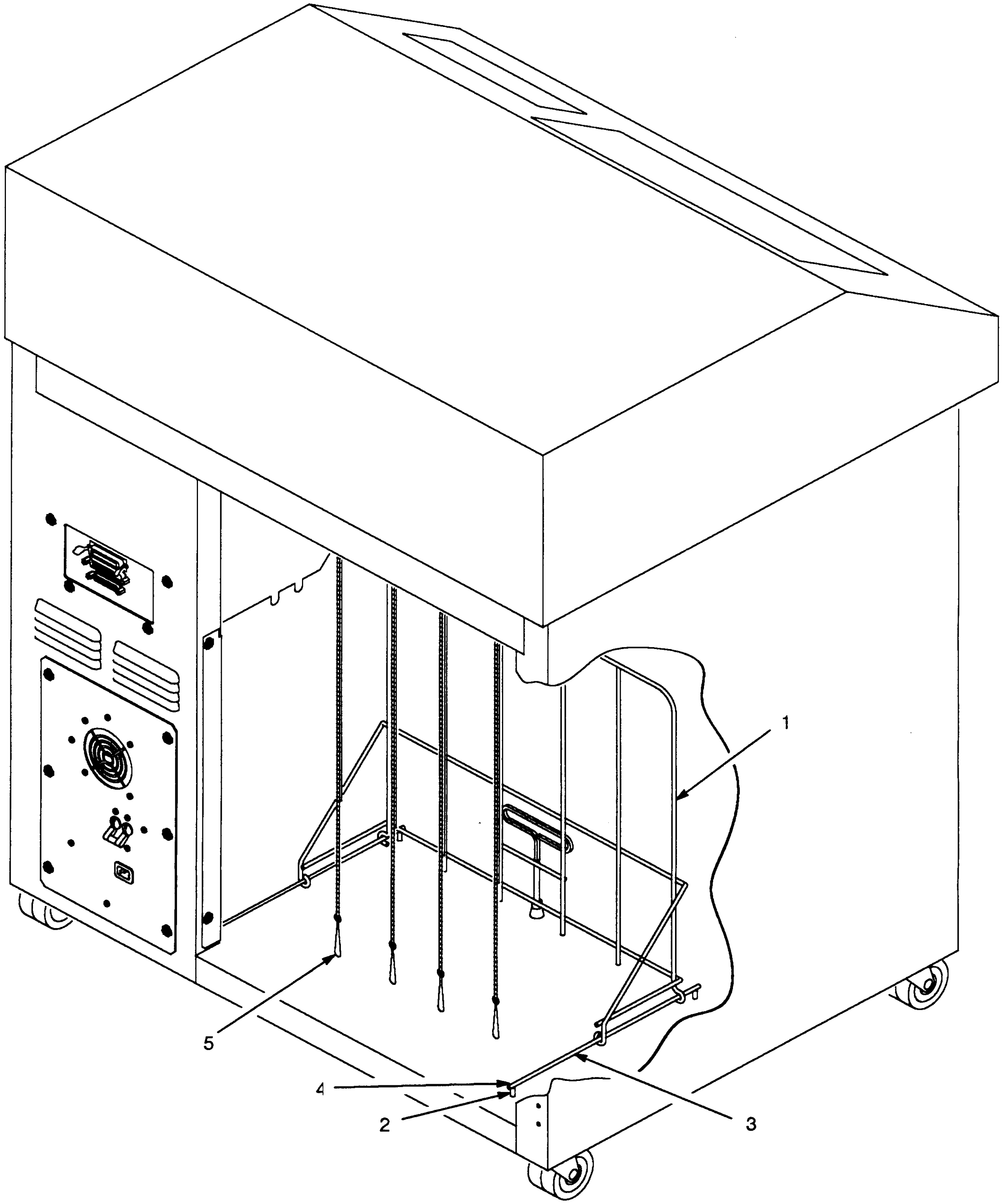


Figure 7–7. Stacker Assembly and Paper Chains

Item No.	Part Number	Description	Notes
1	57G7196	Paper Guide, Wire Frame	
2	57G1492	Window	
3	Ref	Wire, Ground, Paper Path	Tie–wrapped along outer wire of wire frame
4	57G7191	Top Cover	
5		Screw, Hex, w/Lockwasher (2)	6x.31; w/Washer #6 (2)
6	75X5972	Tie wraps (2)	
7		Nut, Hex (2)	.312–18
8		Washer, Split Lock (2)	5/16
9	57G7199	Brush, Anti–Static	
10	57G1483	Ball Stud (2)	
11	57G1481	Gas Spring Assembly	w/Spring Retaining Clip (2)
12		Screw, Hex, Washer (7)	Torque: 20 in–lb
13	Ref	Access Panel	
14		Screw, Hex w/Washer (6)	10–24x.50
15	57G7270	Wiper, Grounding	Not shown

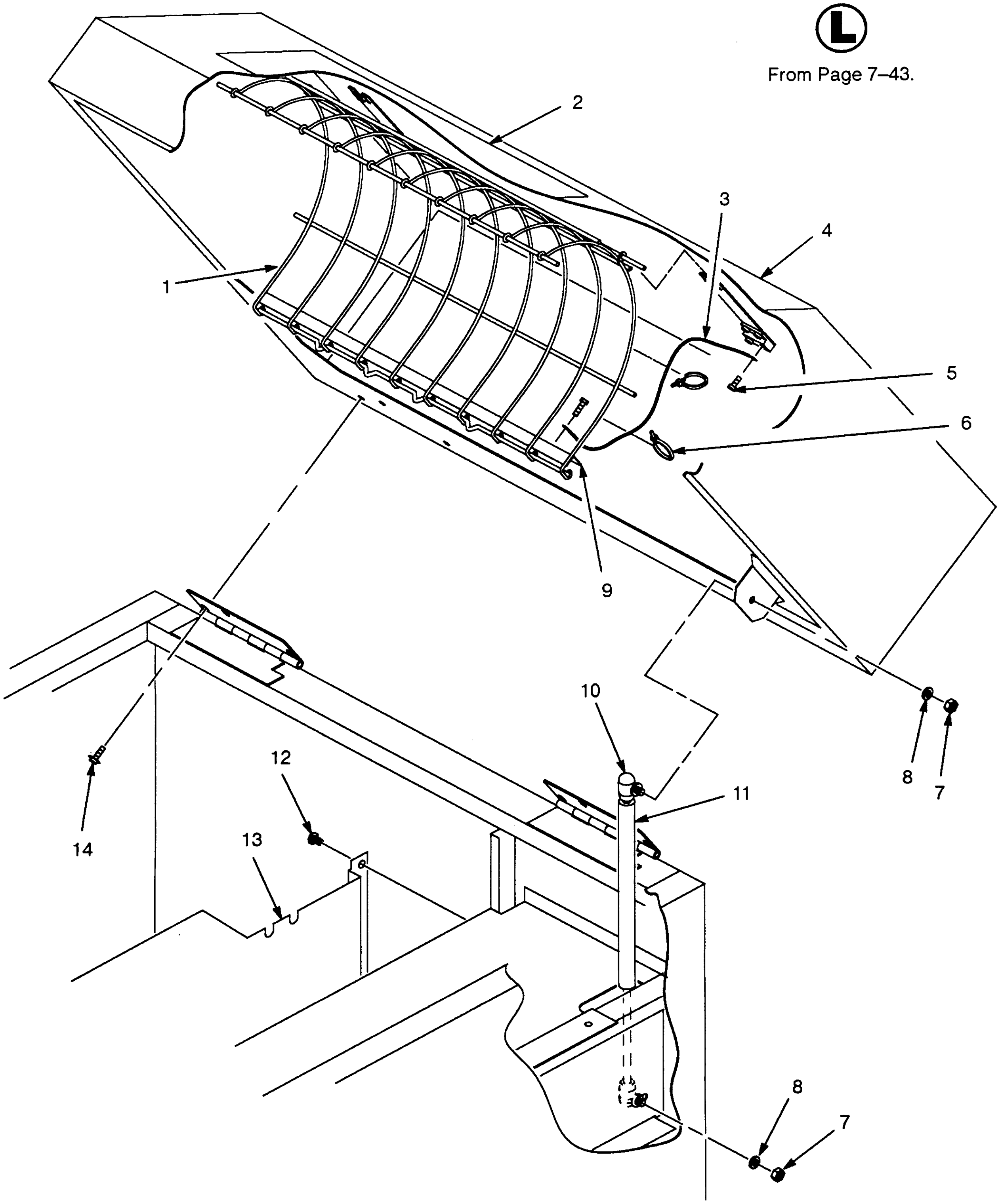


Figure 7–8. Top Cover Assembly

Item No.	Part Number	Description	Notes
1		Screw, Hex w/Lockwasher (6)	6x.31; Torque: 11 in–lb
2		Washer, Flat #6 (4)	
3	57G7246	Paper Path	
4	11F9644	Cam Cover	
5	57G7292	Gasket	
6	57G7239	Captive Screw (2)	
7	57G7293	Cam Cover Plate	
8		Screw, Hex, w/Lockwasher (6)	Torque: 20 in–lb
9		Screw, Hex, w/Lockwasher (3)	Torque: 20 in–lb
10	57G1584	Clip, Retaining (2)	

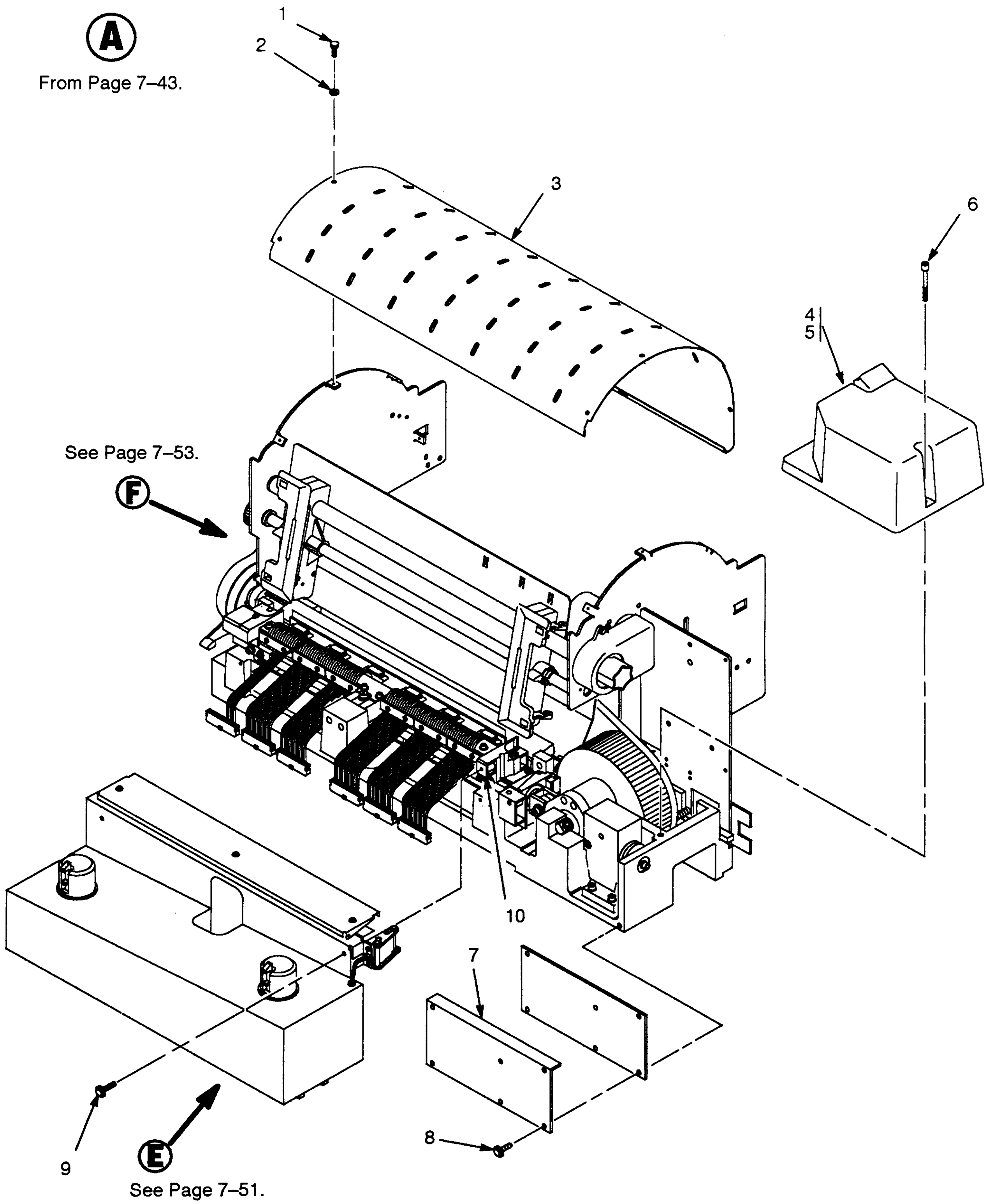


Figure 7–9. Print Mechanism

Item No.	Part Number	Description	Notes
1	57G1479	Hub, Stp Mtr, Rbn Spool (2)	Comes with 6–19x.5 screw
2		Screw, Btn Hd, Hex Dr (3)	6–32x.25
3		Washer, Flat #6 (3)	
4	57G1583	Deflector Assy, Air	
5	57G7202 57G7201	Rbn Guide Assy, Stepper, Rt Rbn Guide Assy, Stepper, Left	 (Left guide not shown.)
6	57G7200	Ribbon Deck Assembly	
7		Nut, Hex w/Lockwasher (8)	6–32
8	57G1577	Motor Assy, Stepper, Long Stack (2)	
9		Washer, Flat #6 (8)	
10		Screw, Hex w/Lockwasher (8)	6x.50

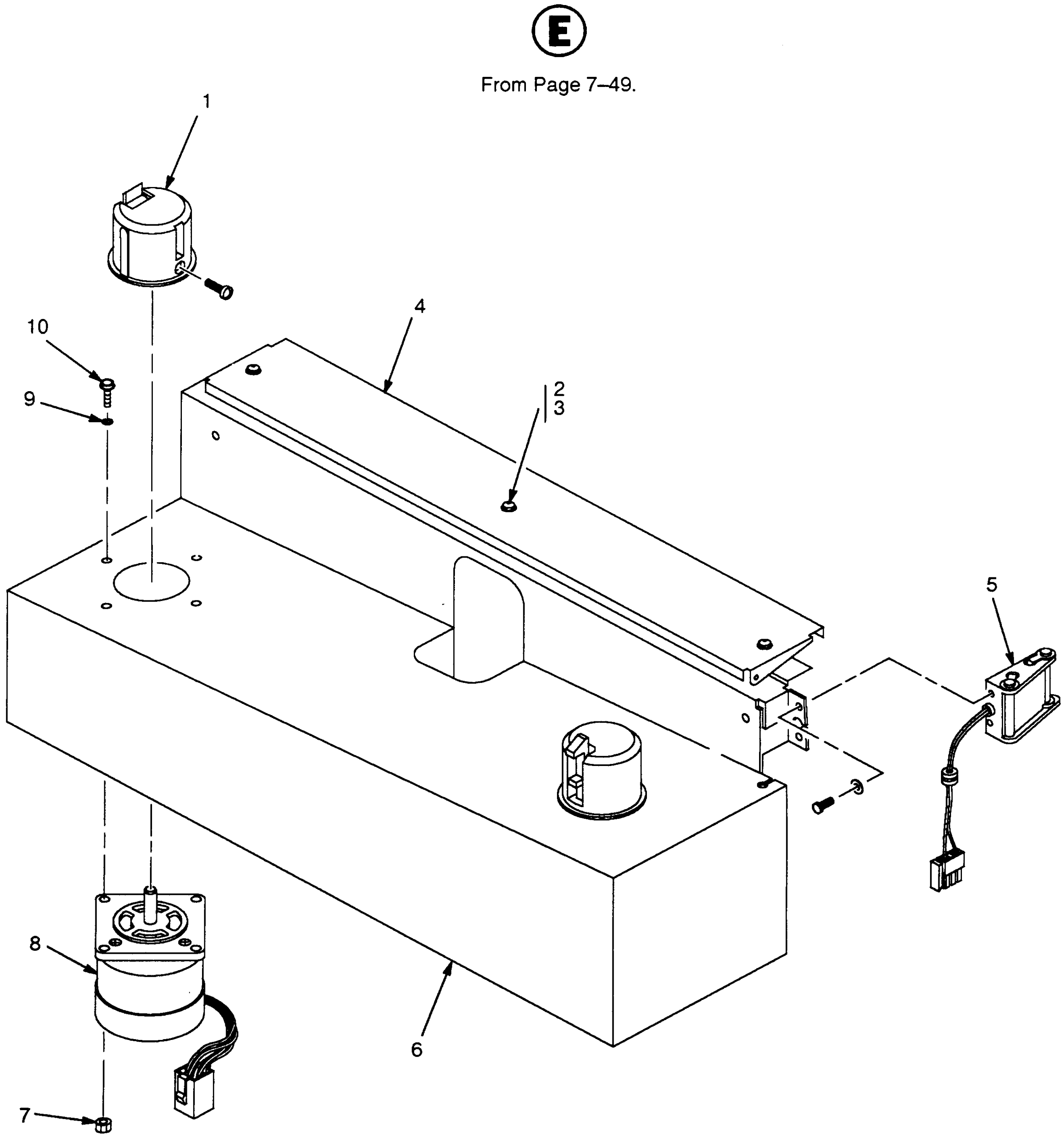


Figure 7–10. Ribbon Deck

Item No.	Part Number	Description	Notes
1	57G1421	Pulley, Paper Feed/Platen	
	57G1507	Collar, Shaft, Alum	Next to pulley.
2		Screw, Hex w/Lockwasher (2)	6x.62
3	57G7286	Belt Guard	
4	45F3750	Belt, .080P, 103T, .50W	
5	93F7045	Splined Shaft Assy	
6		Screw, Hex w/Lockwasher (2)	6x.31
7	04H4726	Tractor Shaft Plate	
8	57G7237	Tractor Support Shaft	
9	57G7252	Tractor Assy, RPF, Right	
10	57G7251	Tractor Assy, RPF, Left	
11	57G7287	Lever, Forms Thickness	
12	57G7244	Belt, Timing, .080P, 3.8W, 170T	
13	57G7288	Cover, Belt, Reverse Paper Feed	
14		Screw, Hex w/Lockwasher	6x.31
15		Washer, Flat #6	
16	93F6359	Knob, Adjust	
17		Setscrew (2)	8–32x.25
18	30F9826	Left Bushing	
19	57G1585	Washer, Curved Spring	
20	04H4727	Washer, Flat, Nylon	1/2 inch
21	57G7284	Clip, Grounding	
22	93F7056	Bearing, Nylon, .626	
23	57G7236	Bushing, Tractor Adjust	
24	04H4727	Washer, Flat, Nylon	1/2 inch
25		Setscrew	10–24x.25

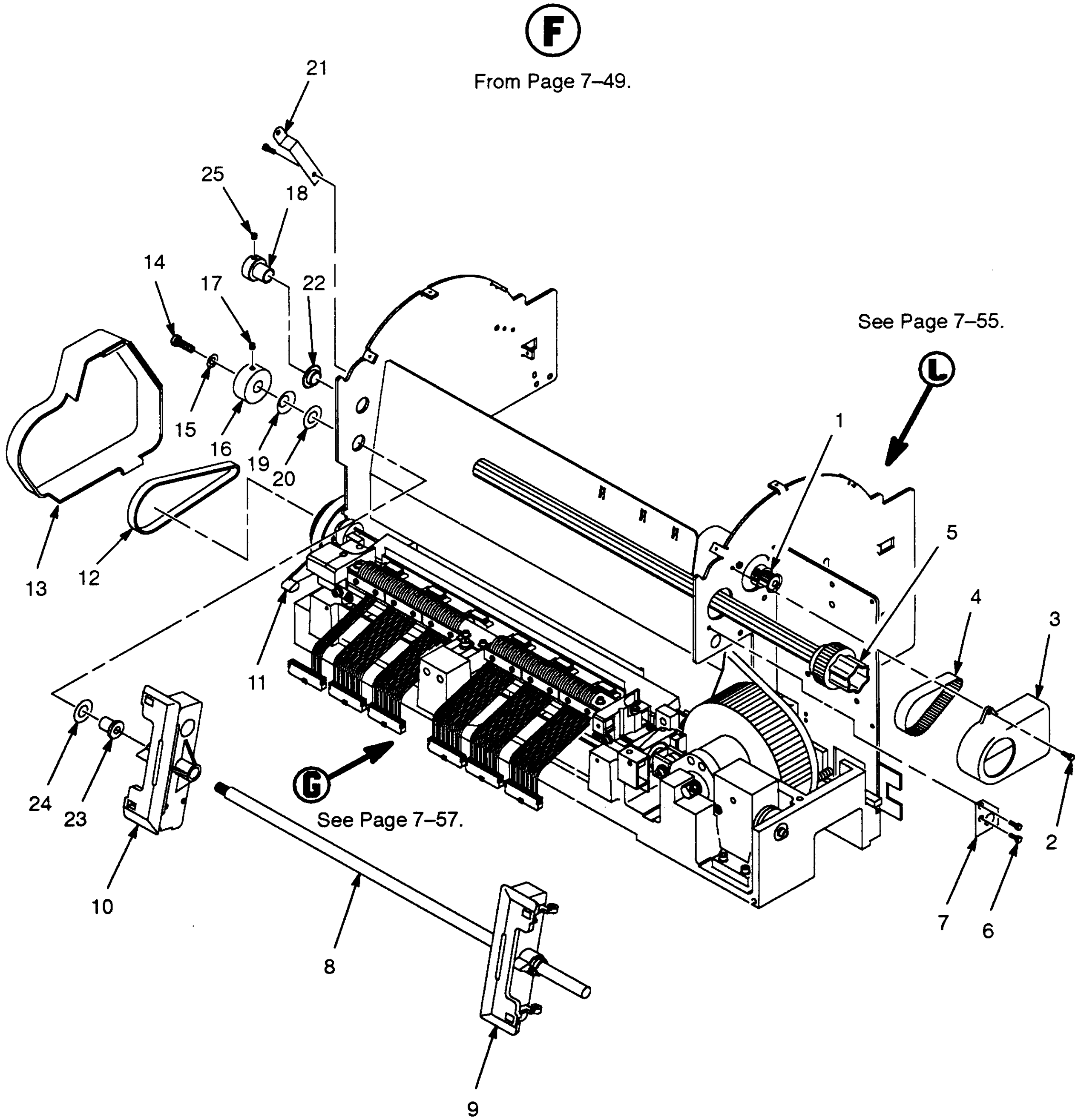


Figure 7–11. Tractor Shafts

Item No.	Part Number	Description	Notes
1	57G7290	Guide, Paper, Machined	Remove belt guard before removing this assy.
2	57G7289	Guide, Paper, Front	
3		Screw, w/Lockwasher (2)	4–40x1; Torque: 5 in–lb
4		Washer, Flat #4 (2)	
5	Ref	Red and White leads	
6	45F4256	Switch, Snap Action	1.0A, 125 VAC
7	57G7291	Spacer, Round (2)	.115/.375x.200 LN
8	57G7275	Nutplate, Switch Mating	
9	57G7276	Angle Clip, 90 degree (2)	
10		Screw, Skt Hd Cap (2)	Torque: 11 ± 2 in–lb
11		Washer, Split Lock #6 (2)	
12		Washer, Flat #6 (2)	
13	57G7277	Side Plate, Left	
14	57G1463	Motor Assy, Platen Open	No ferrite core used
15	57G1421	Pulley, Paper Feed	
16	57G1515	Nut Plate	
17	45F4248	Shuttle Motor Assy	Ferrite core over red, blue, and black wires
18		Carriage Bolt (4)	1/4–20x.75
19		Washer, Flat 1/4 (4)	
20		Washer, Split Lock, 1/4 (4)	
21		Nut, Hex, 1/4–20 (4)	Torque: 105 in–lb
22	57G7278	Plate, Right Side	
23	45F4265	Pickup Assy, Magnetic	
24		Nut, Hex w/Lockwasher (4)	6–32; Torque: 14 in–lb
25		Washer, Flat #6 (4)	
26		Washer, Split Lock #6 (4)	
27	57G7232	Motor Assy, Paper Feed	Ferrite core over all wires
28		Screw, Skt Hd Cap (4)	Torque: 14 in–lb
29	57G1453	Switch Assy, Paper Detector	
30		Screw, TF, 6–32x.375 (2)	Torque: 5 in–lb
31		Screw, 5/16 inch Hex Hd (3)	Torque: 20 in–lb
32		Screw, Skt Cap	10x.75
33		Washer, Splitlock #10	
34		Washer, Flat #10 (2)	

J

From Page 7–53.

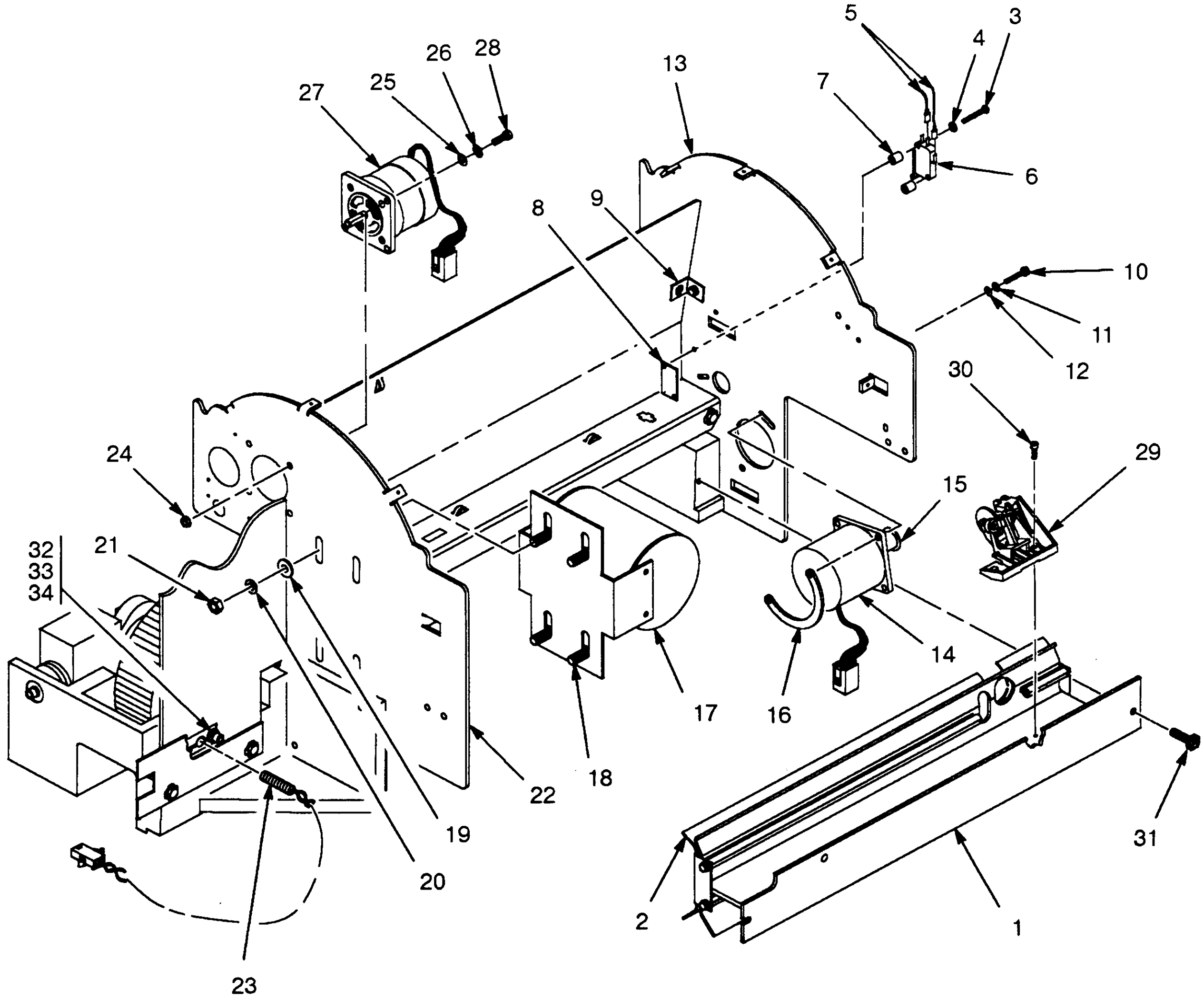


Figure 7–12. Paper Feed Motor, Platen Open Motor and Switch, and Paper Out Switch

Item No.	Part Number	Description	Notes
1		Screw, Skt Cap, 6x.31 (2)	Torque: 8 in–lb
2		Washer, Split Lock, #6 (2)	
3	57G7222	Shroud, Shuttle	
4	57G7241	Cap, Bearing, Right	
5		Washer, Flat #10 (2)	
6		Washer, Split Lock #10 (2)	
7		Screw, Skt Cap, 10x.38 (2)	Torque: 10 in–lb
8		Screw, Skt Cap, 4x1.00 (2)	Torque: 8 in–lb
9		Washer, Split Lock #4 (2)	
10	57G7245	Block, Dust Barrier, Machined	
11	57G7211	Hammerbank Assy, with	
	57G7228	Yoke Assembly	
	57G7250	Spring, Shuttle	
	57G7219	Shim(s), Shuttle Spring	
	57G7258	Shim(s), Thrust, Shuttle	
	57G7220	Bearing Assy, Rt	
	57G7221	Bearing Assy, Lt	
12	57G7272	Foam, Air Seal	
13	57G7248	Shim, Antirotation, .010 in.	
	57G7249	Shim, Antirotation, .005 in.	
14	57G7279	Paper Ironer	
15	57G7280	Tape, Hooks, 2.00 W	Placed to top of coil leads.
	57G7281	Tape, Loops, 2.00 W	Attached to base support.
16		Screw, Skt Cap, 10x1.375 (2)	Torque: 20 in–lb
17		Screw, Skt Cap, 4x.31 (2)	Torque: 8 in–lb
18		Washer, Split Lock #4	
19		Washer, Flat #4	
20	57G7242	Cap, Bearing, Left	
21		Screw, Skt Cap, 6x1.25 (5)	Torque: 15 in–lb
22		Screw, Skt Cap, 6x.62 (1)	Torque: 15 in–lb
23	93F7040	Block, Antirotation, with	
	57G7223	Pad, Anti–Recoil	
	57G7226	Slide, Anti–Recoil	
	57G7214	Plate, Anti–Rotation	
	57G7225	Bracket, Shroud Seal	
24	57G7230	Platen	
25	57G1507	Collar, Shaft	
26	57G7287	Lever Kit, Forms Thickness	
27		Washer, Flat #6	
28		Screw, Skt Cap	6x.75
29		Screw, Hex w/Lockwasher (4)	6x.38
30		Plate, Paper Ironer	
31	57G7224	Pad, Antirotation	(Not visible in Figure 7–13.)
32	04H4721	Plate, Platen Wear Lower	

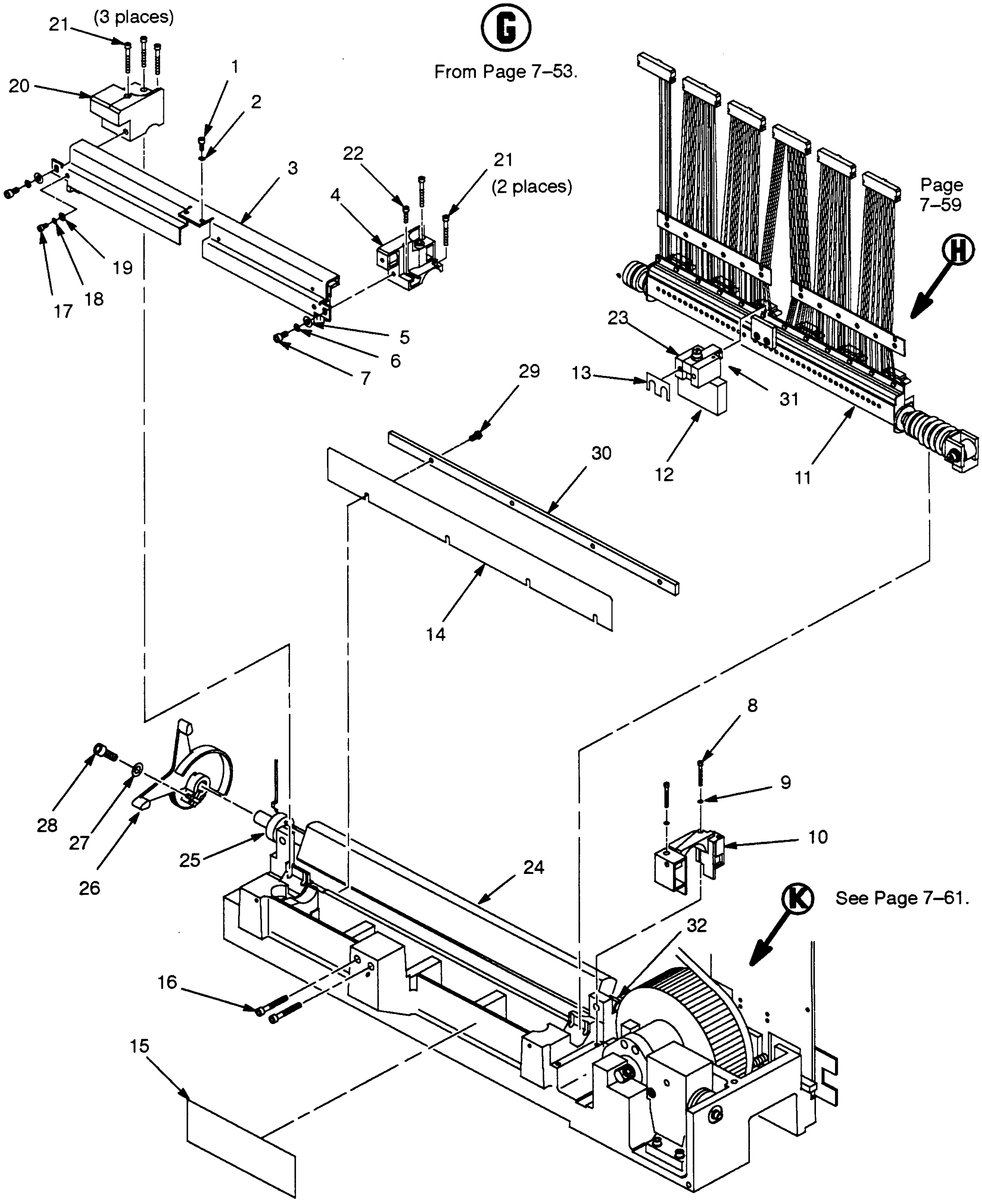


Figure 7–13. Hammer Bank Assembly

Item No.	Part Number	Description	Notes
1	45F4264	Cover, Hammer Bank/ Ribbon Mask, Assembly	
2	57G7212	Hammer Bank Assy	
3		Screw, Skt Cap–U (88)	Torque: 6–9 in–lb
4	57G7273	Plate, Clamp, Hmr Spring (44)	
5	45F4261	Hammer Spring Assy (88)	
6	45F4262	Coil Assy (88)	
7		Screw, Skt Cap–U (22)	Torque: 12 ± 2 in–ounce
8		Washer, Flat #2 (22)	
9	57G7218	Clamp, Coil (11)	
10		Screw, Philips, Self–Lock (12)	6–4x.10; Torque: 10 in–lb
11	57G7216	Clamp Assy, Coil Leads (6)	
12	57G7217	Bracket Assy, Coil (2)	
13	57G7274	Conn, Socket, 34–pin (6)	
14	Part of item 6	Coil Assy Lead Wire	
15	Part of item 6	Coil Assy Lead Wire Conn	

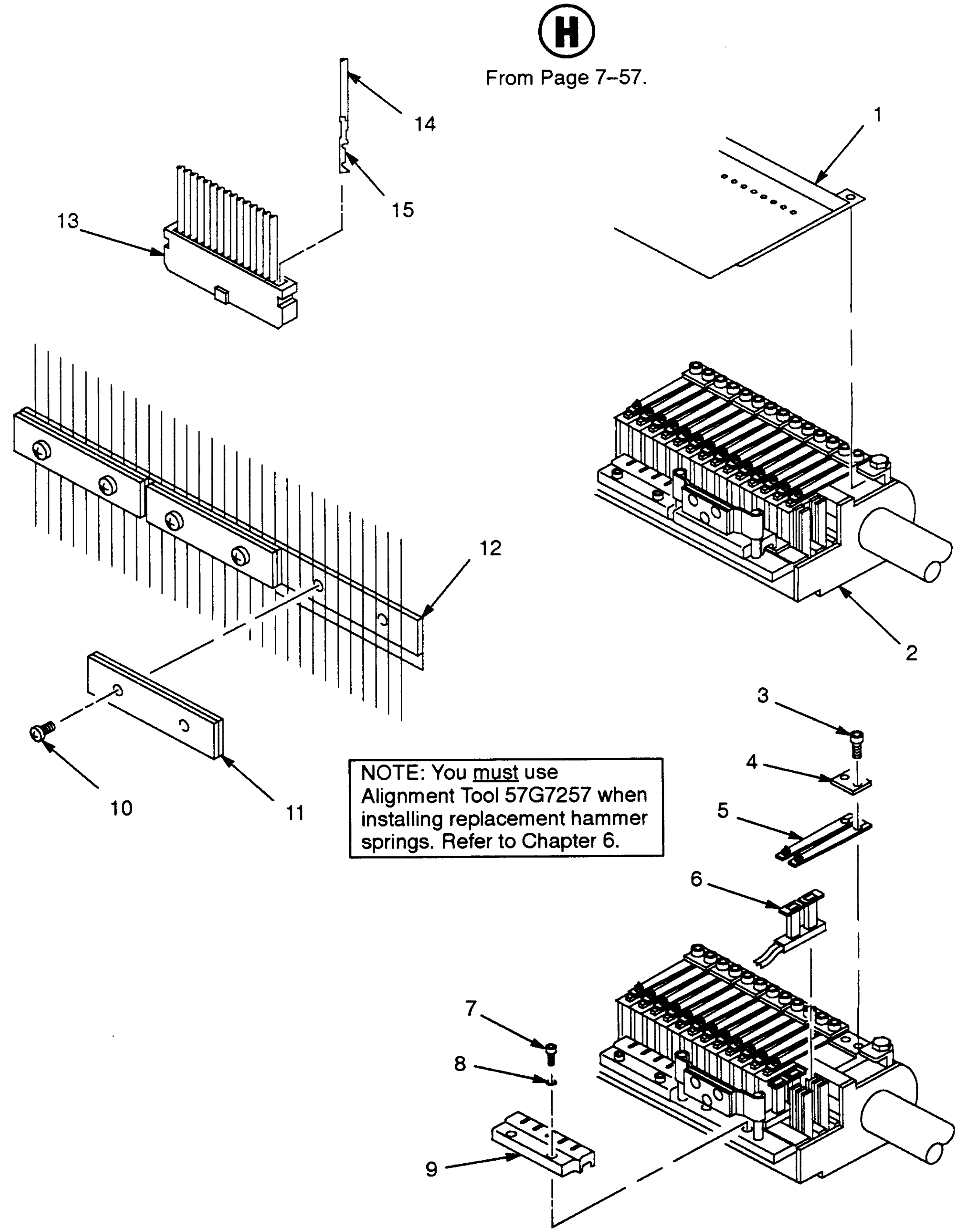


Figure 7–14. Hammer Springs and Coils

Item No.	Part Number	Description	Notes
1		Washer, Flat #10	
2		Washer, Split Lock #10	
3		Screw, Counterweight, 10x.75	Torque: 20 in–lb
	45F5212	Counterweight Assy, includes:	
4	45F3753	Shim, Counterweight, Spring Guide	
5	57G7282	Seat, Spring	
6	57G7250	Spring, Counterweight	
7	57G7282	Seat, Spring	
8		Screw, Skt Cap, 4x.38 (4)	Torque: 8 in–lb
9		Washer, Split Lock #4 (4)	
10		Washer, Flat #4 (4)	
11		Screw, Skt Cap, 10x.75 (3)	Torque: 20 in–lb
12		Washer, Split Lock #10 (3)	
13		Washer, Flat #10 (3)	

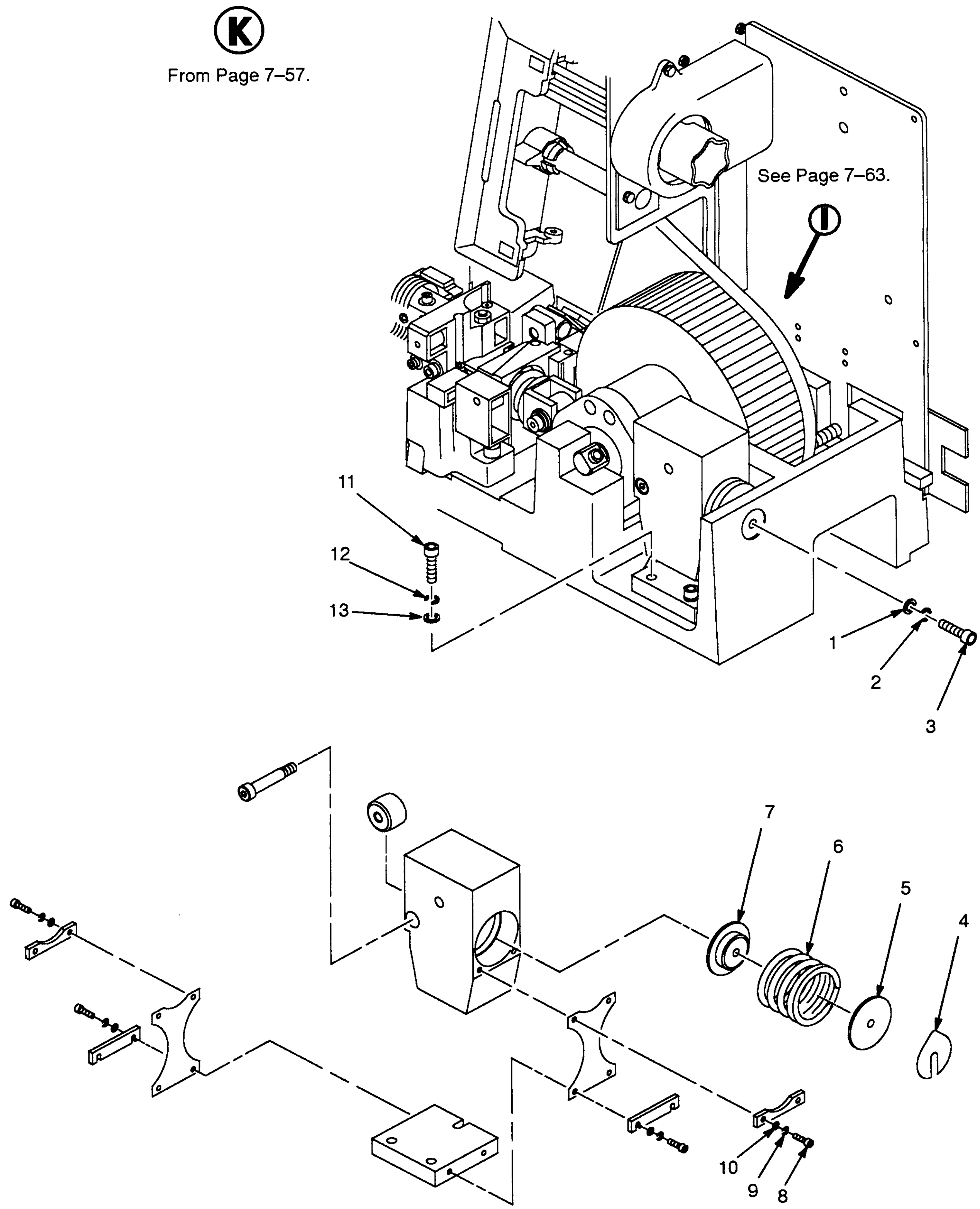


Figure 7–15. Shuttle Counterweight Assembly

Item No.	Part Number	Description	Notes
1	04H4728	Belt, Shuttle	
2		Screw, Skt Cap, 10x.75	
3	57G7283	Bracket, Guide, Mag Pickup	
4	57G7234	Magnetic Pickup Arm	
5	04H4725	Wick Assembly Field Kit	
6		Screw, w/Lockwasher (2)	Torque: 5 in–lb
7	Part of item 8	Cam	
8	57G7240	Flywheel Assy	
9		Washer, Split Lock #10 (2)	
10		Screw, Skt Cap, 10x1.00 (2)	Torque: 40 ± 3 in–lb

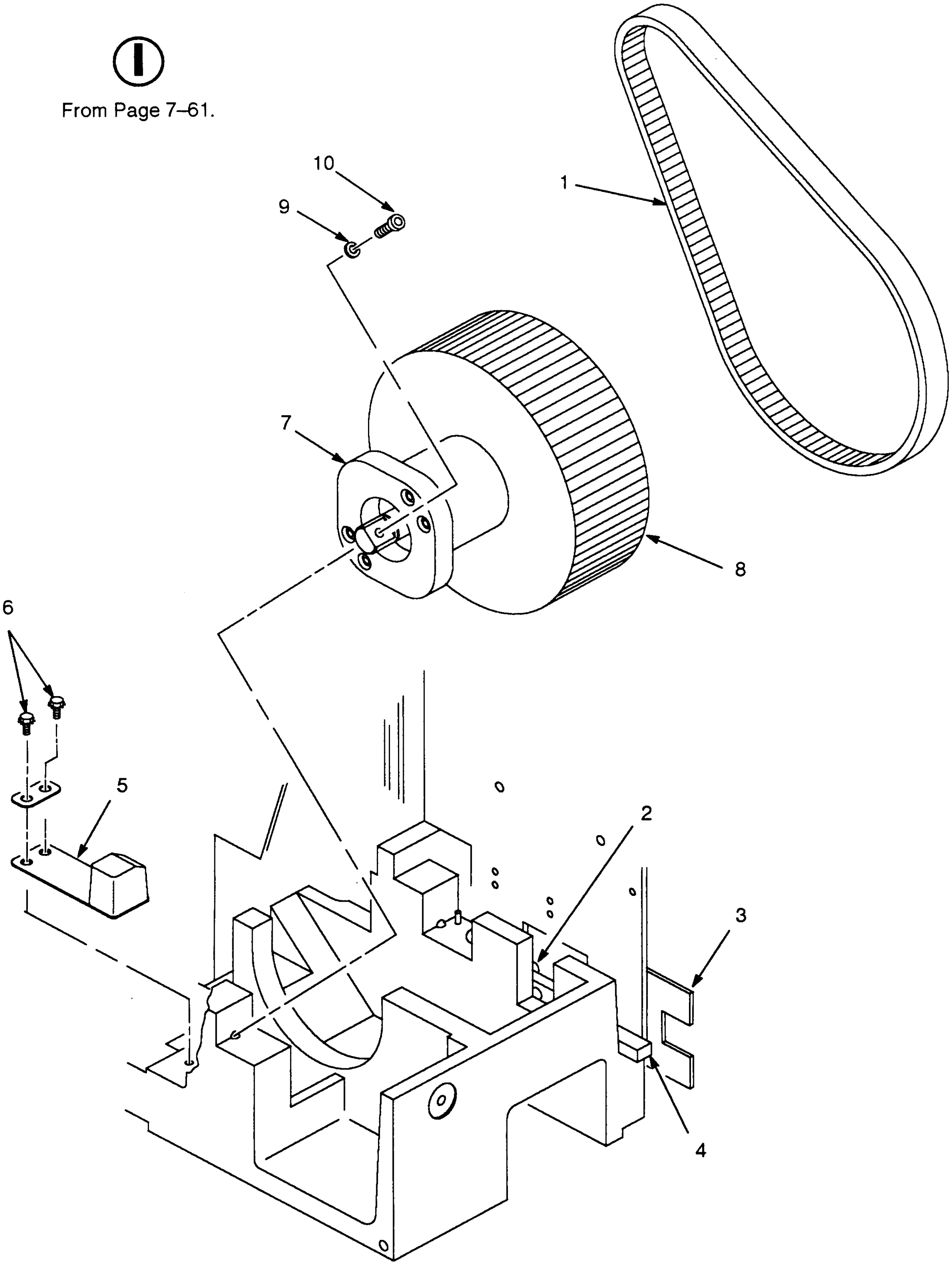


Figure 7–16. Shuttle Cam and Flywheel

Item No.	Part Number	Description	Notes
1	57G1418	Operator Panel Assy	See Figure 7–17 for overlays
2	57G1526	Plate, Operator Panel	
3		Screw, Hex, w/Lockwasher (4)	6–32x.375
4	57G7296	Panel Bracket	
5		Screw, w/Lockwasher (2)	10–24x.50
6	57G1440	Fan Assy, 48VDC	
7	Ref	Weldment, Card Cage	
8	57G7187	Cable Assy, Multi I/O	
9	57G7265	Cable, Operator Panel Short	Both operator panel cables
9a	57G1573	Cable, Operator Panel Long	required.
10	57G1454	Cable Assy, CCB/Mech Dr	
11	57G7204	Cable Assy, Hmr Dr/Mech Dr	
12	57G7189	Hammer Driver board	
13	57G1446	Mechanism Driver board	
14	57G1445	Common Controller board	
	57G7179	PROM Kit, CT0	
	57G7255	PROM Kit, A00	
15	57G7206	Cable Assy, Hammer Bank	
16	Ref	Cover, Card Cage	
17		Screw, Hex w/Washer (5)	
18	57G7266	Dummy Panel, Disk Drive	
19	57G7270	ESD Grounding Pad	Riveted

Operator Panel Overlays

Language	IBM 6412–CT0	IBM 6412–A00
English	57G1403	57G1397
French	57G1405	57G1399
German	57G1407	57G1401
Spanish	57G1404	57G1398
Italian	57G1406	57G1400
Dutch	57G1408	57G1402

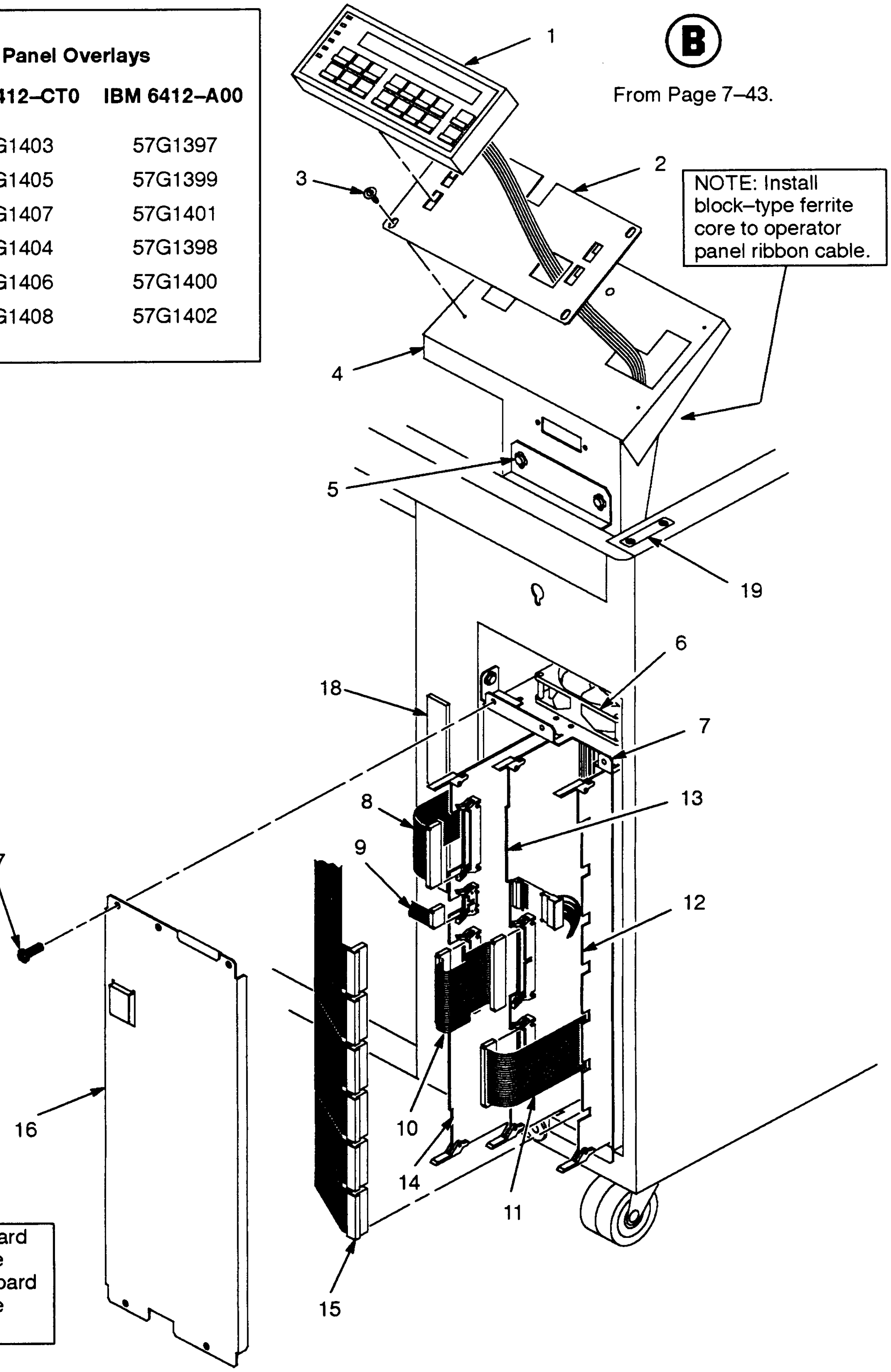


Figure 7–17. Card Cage and Operator Panel

Item No.	Part Number	Description	Notes
1	57G1409	IGP–2x0 board	Board without PROMs
	57G1578	IGP–200 Field Kit	
	57G1579	IGP–210 (Code V) Field Kit	
	57G1580	PROM Kit, IGP–200	
	57G1581	PROM Kit, IGP–210 (Code V)	
2	57G7187	Cable Assy, Multi I/O	
3	57G1410	Cable Assy, IGP/CCB Interconnect	
4	57G7263	Switch Assembly, IGP	
5	57G7264	PCBA, CTPC/IGP–2x0 Power	
6		Screw, Hex w/Lockwasher (2)	

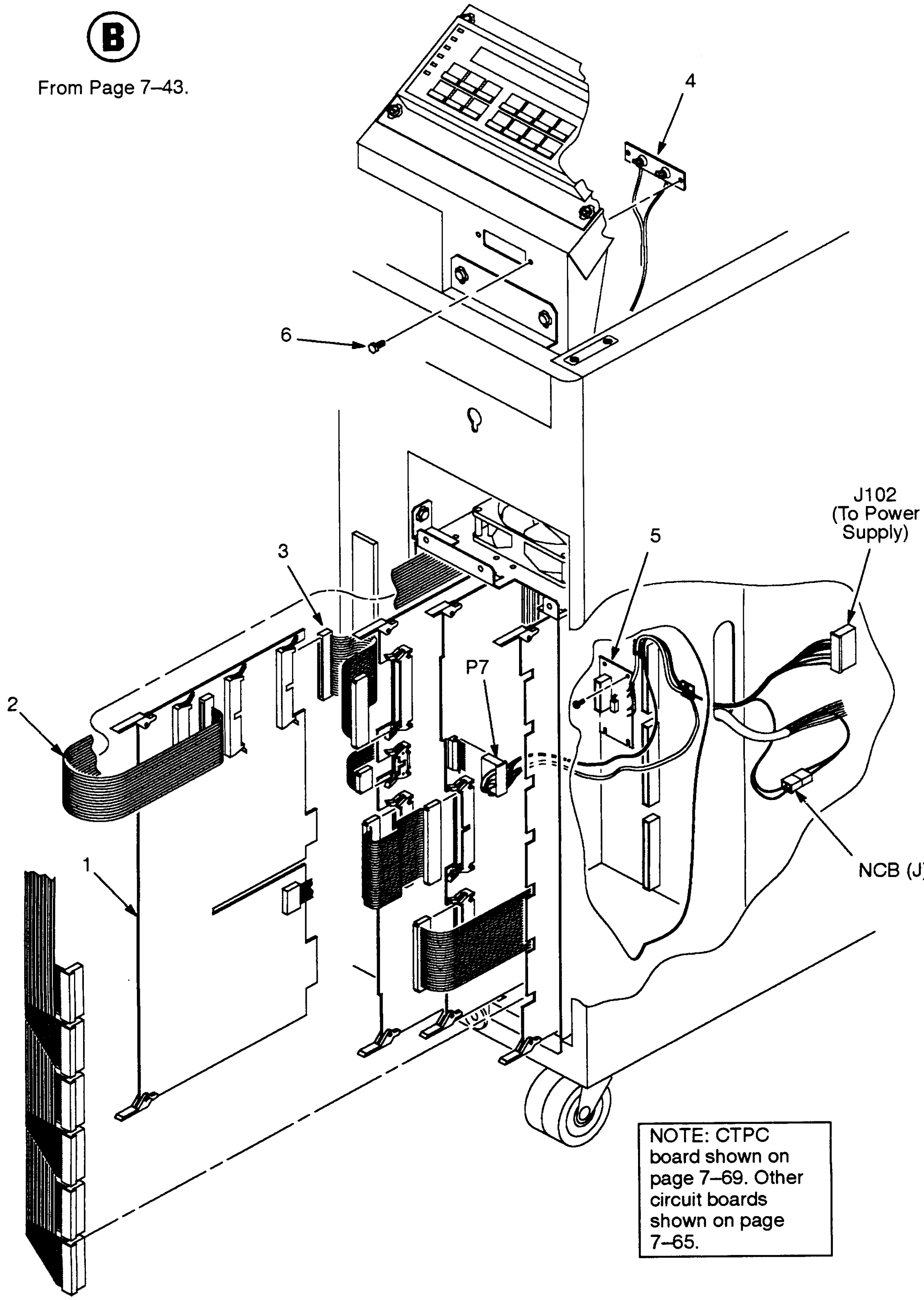


Figure 7–18. Intelligent Graphics Processor (IGP)

Item No.	Part Number	Description	Notes
1	57G1430	Coax/Twinax Integrated Interface Board (CT)	
2	57G1411	Cable Assy, 50 Cond, CTPC/CCB	
3		Screw, SEMS, Hex w/Washer (2)	10–24x.375
4	Ref	Card Cage (left side)	
5	Ref	Bracket, Card Cage	
6	57G7295	Cable Assembly, Power, 5V, CTPC	Without IGP
	57G7264	PCBA, CTPC/IGP–2x0 Power	With IGP (page 7–67 and 7–71)
7	57G1506	Gray CT I/O Cable	
8	57G1506	Orange CT I/O Cable	
9	57G1511	Card Guide (2)	

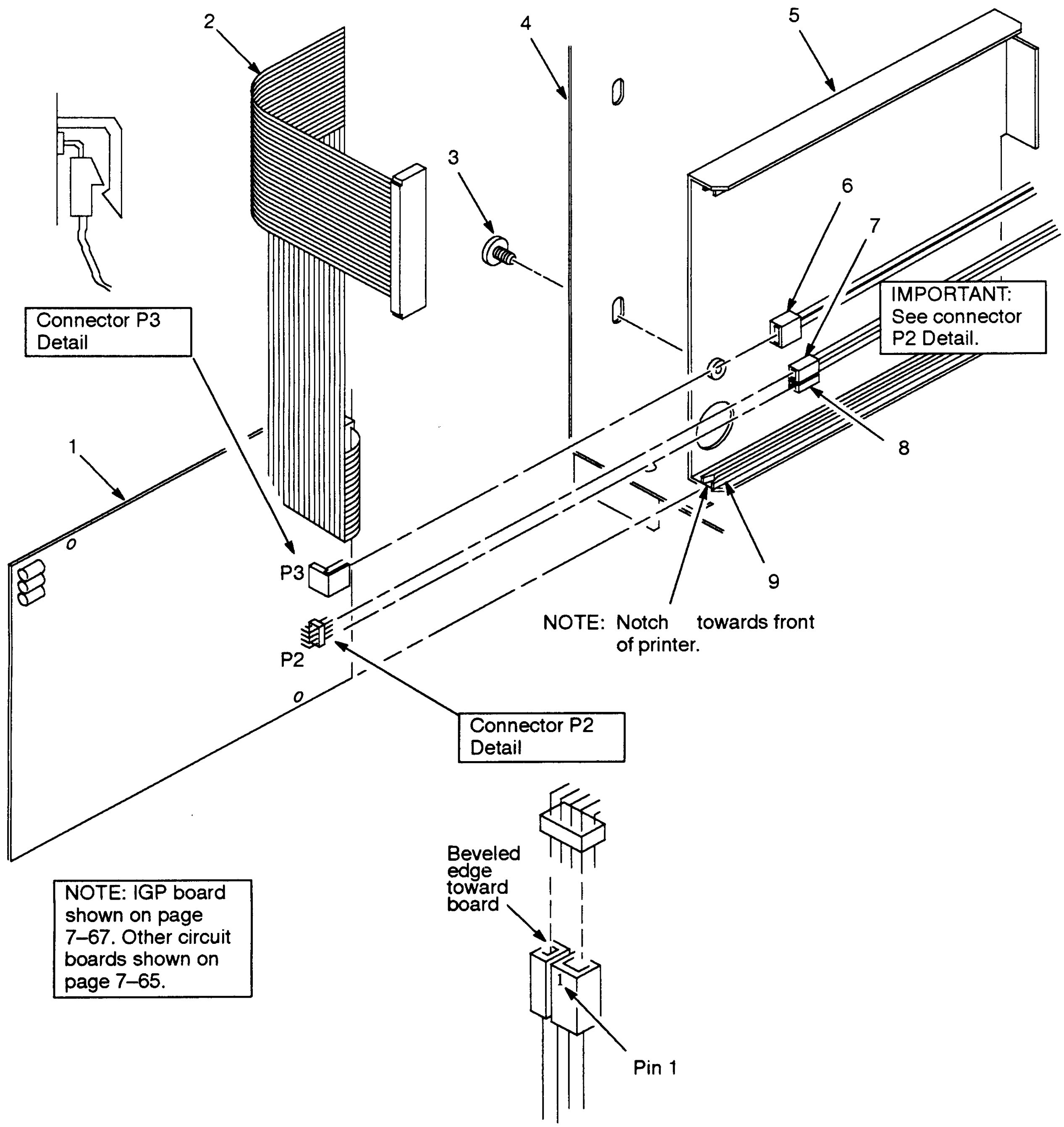


Figure 7–19. CT Board

Item No.	Part Number	Description	Notes
1	2361667	Bolt, Nylon, Pan Head (4)	6–32x.50
2	57G1569	Spacer, Nylon (4)	.171 ID x .187 LG
3	8972134	Nut, Nylon, Hex (4)	6–32
4	Ref	IGP–2x0 board	(See page 7–67.)
5	57G1574	CT–IGP Interconnect Cable	
6	57G1430	Coax/Twinax Integrated Interface Board (CT)	

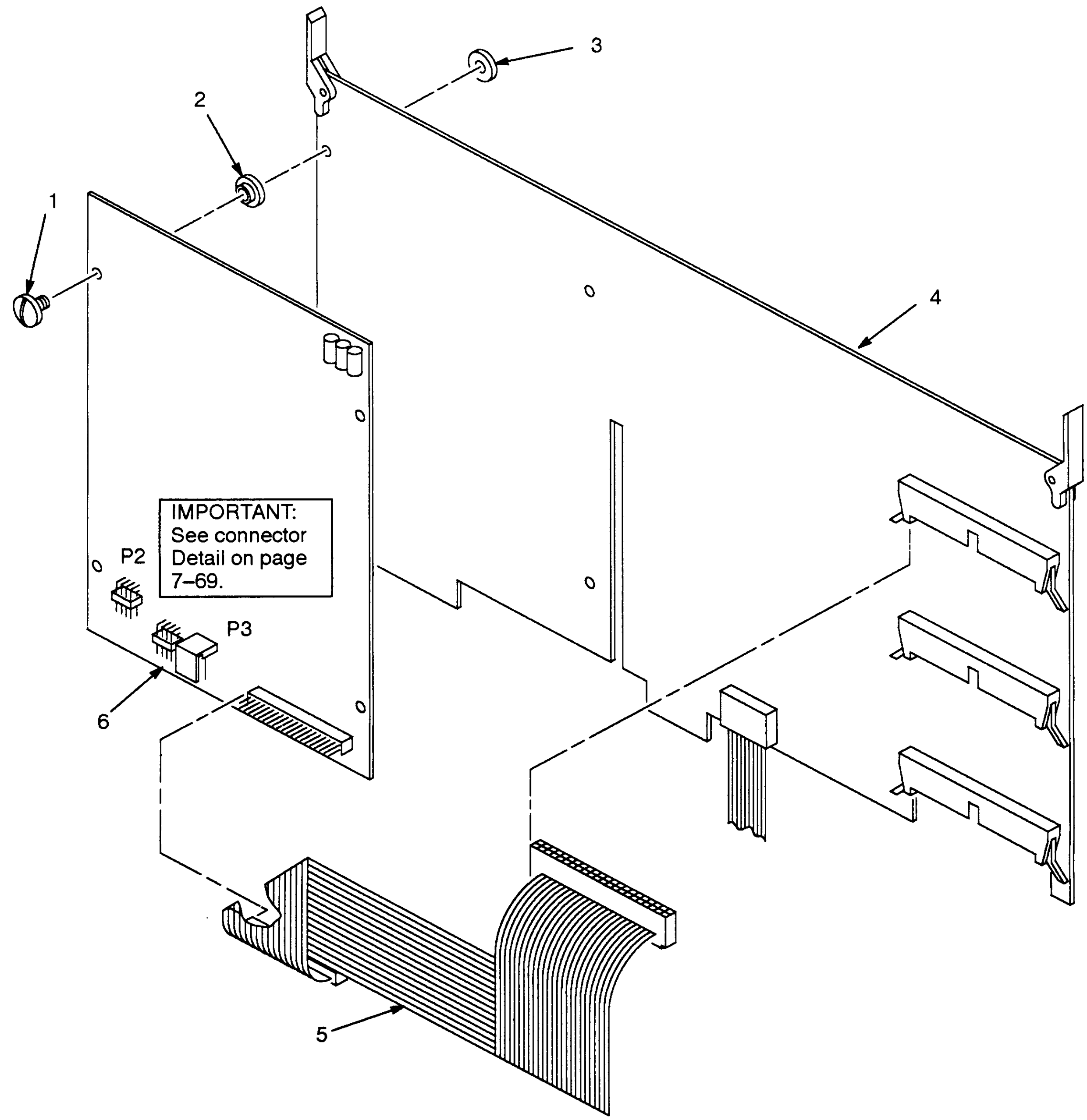


Figure 7–20. CTPC/IGP Assembly

Item No.	Part Number	Description	Notes
1		Screw, w/Lockwasher (2 long)	6x1.75; Torque: 11 in–lb
2		Screw, w/Lockwasher (2 short)	
3	57G1440	Fan Assy, 48VDC	(Cabinet Fan)
4		Screw, Skt Cap, 10–32x.38 (3)	Torque: 14 in–lb
5		Washer, Split Lock #10 (3)	
6		Washer, Flat #10 (3)	
7	Ref	Frame Assy	
8	90G6329	Blower Assy, 48VDC	
9	Part of item 8	Connector, Blower Assy	
10		Clamp, Hose, SS, 2 inch (2)	
11	04H4720	Hose, Air Flow	
12	Ref	Air Duct	

From Page 7–43.

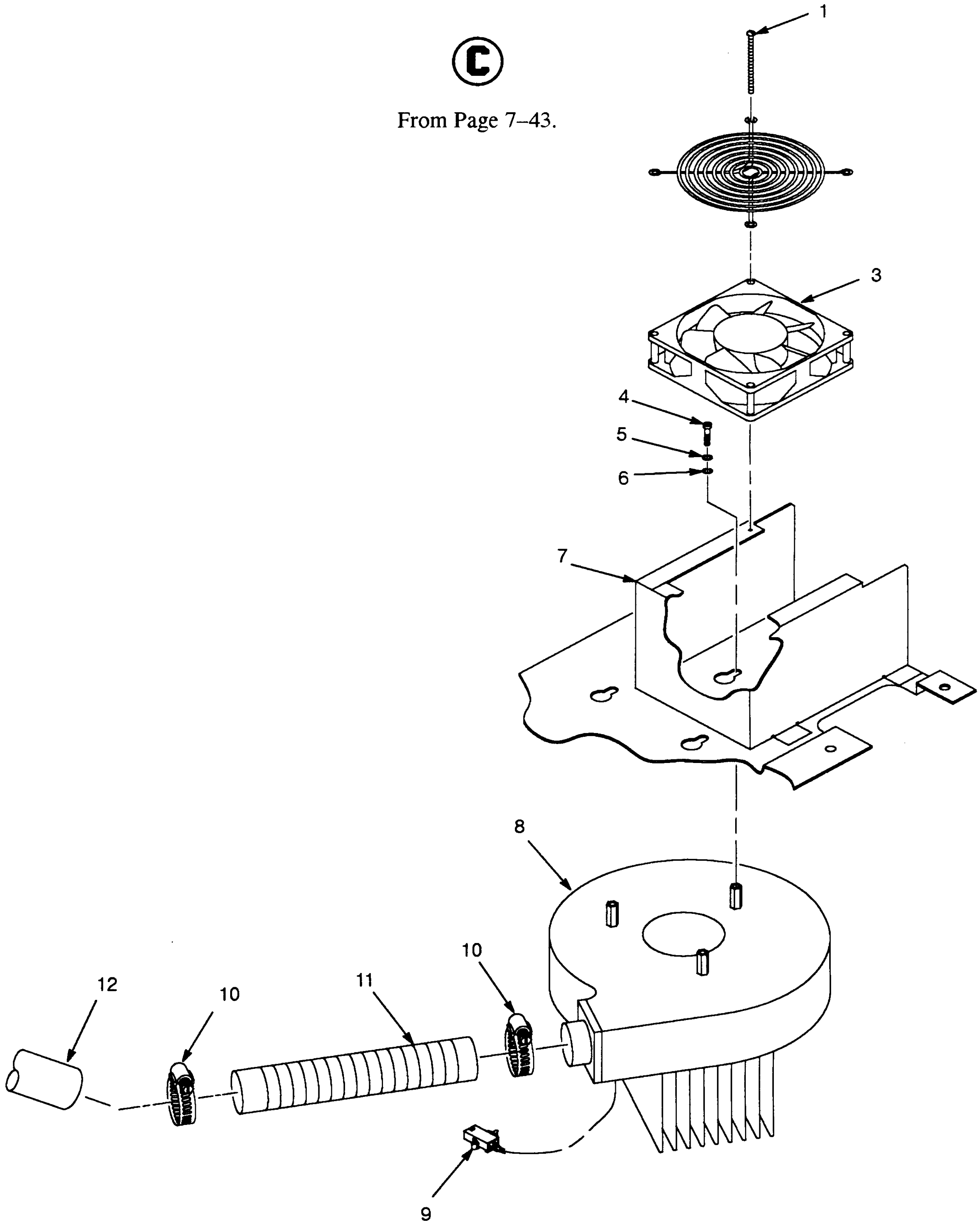


Figure 7–21. Blower Assembly

Item No.	Part Number	Description	Notes
1	57G7187	Cable Assy, Multi I/O	Model A00
2	57G1506	Cable Assy, CTPC I/O	Model CT0
3	Ref	Access Panel	
4		Screw, Hex, Washer (7)	Torque: 20 in–lb
5	Ref	Ground Stud	#6 Stud
6		Nut, Hex, w/Lockwasher, 6–32	Torque: 8 in–lb
7	Part of item 7	18 AWG wire, w/ring terminal	Green with yellow stripe.
8	57G7197	Power Supply Assembly	On/Off switch, fan, and power outlet are part of the assembly.
9		Screw, Hex, w/Washer (6)	Torque: 20 in–lb
10		Screw, Hex, w/Washer (4)	Torque: 20 in–lb
11		Screw, Hex w/Washer (2)	Torque: 20 in–lb

From Page 7–43.

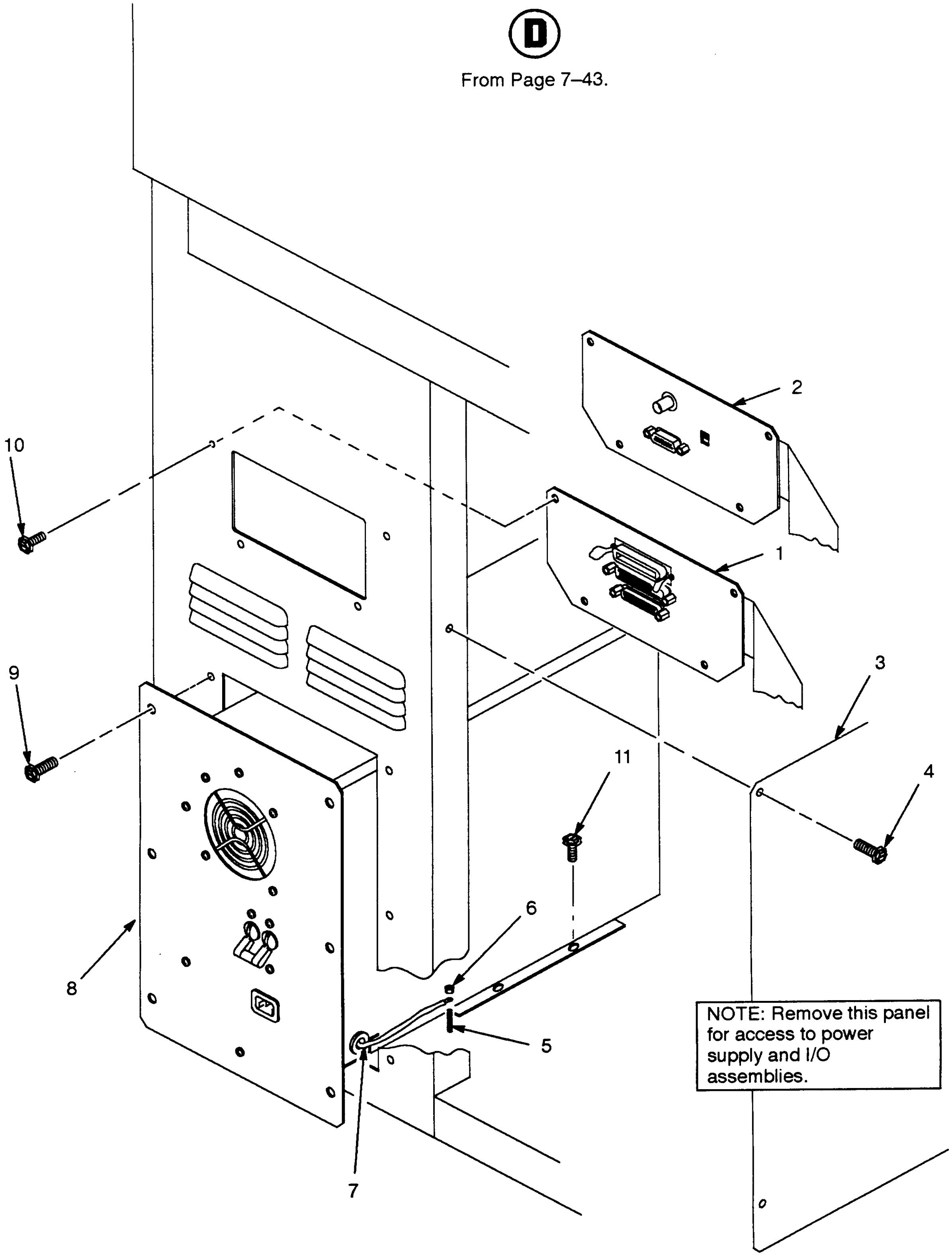


Figure 7–22. Power Supply and I/O Assemblies

A Wire Data

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

IBM 6412–A00 Interconnection Diagram A–3

IBM 6412–CT0 Interconnection Diagram A–4

Printed Circuit Boards A–5

  Common Controller Board (CCB) A–5

  Mechanism Driver Board A–7

  Hammer Driver Board A–10

  Power Supply A–14

  CT Board A–15

  CTPC/IGP–2x0 Power Board A–16

  IGP 2x0 Board A–18

Printer Interfaces A–20

  Triple I/O Interface A–20

  CTPC I/O Cable Assembly A–21

Cable Assemblies A–34

  Hmr Dr / Mech. Dr 2 .... A–22

  Hmr Dr / Mech. Dr A–23

  Hmr Dr / Mech. Dr 1 .... A–24

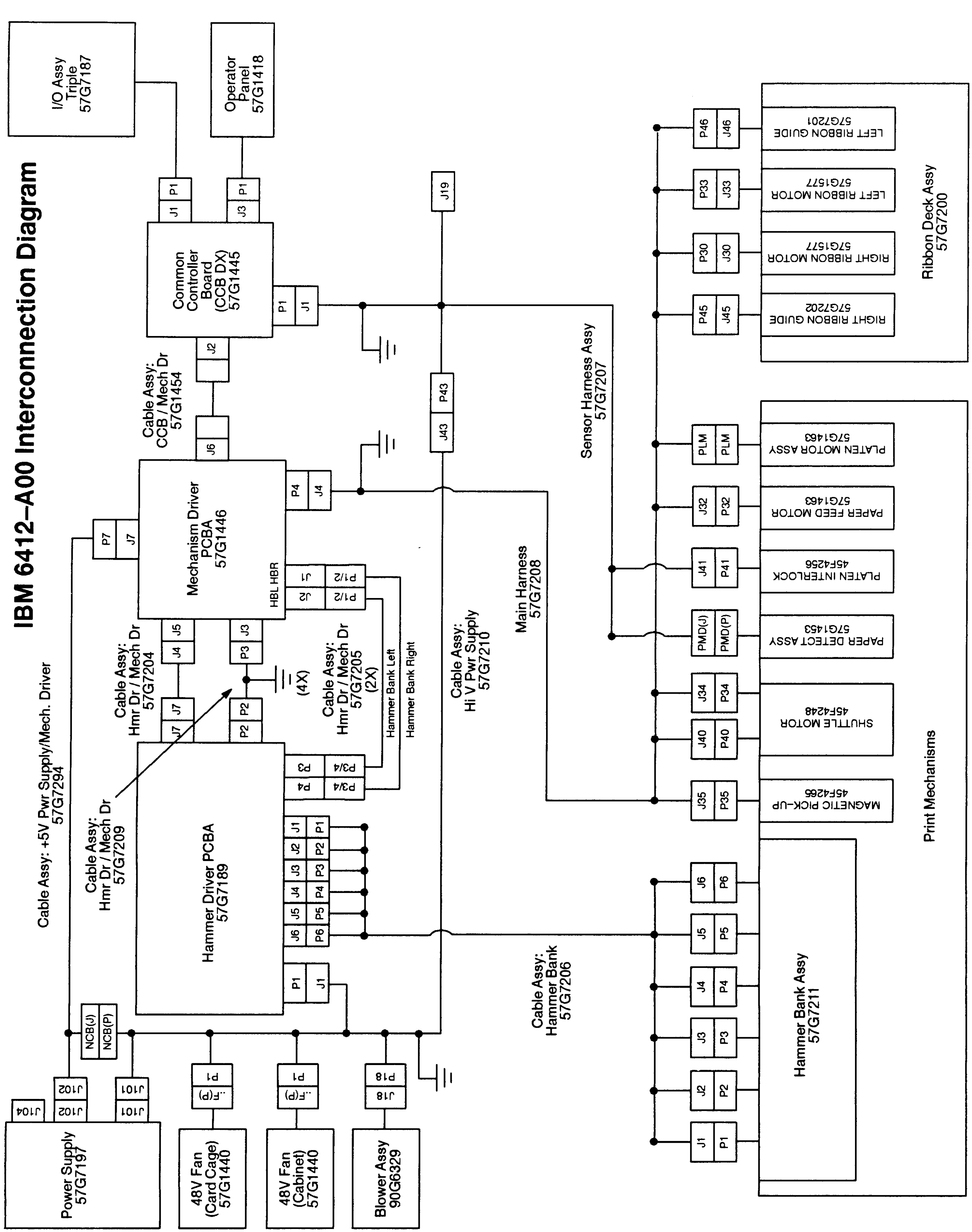
  Hammer Bank A–25

  Sensor Harness Assembly A–26

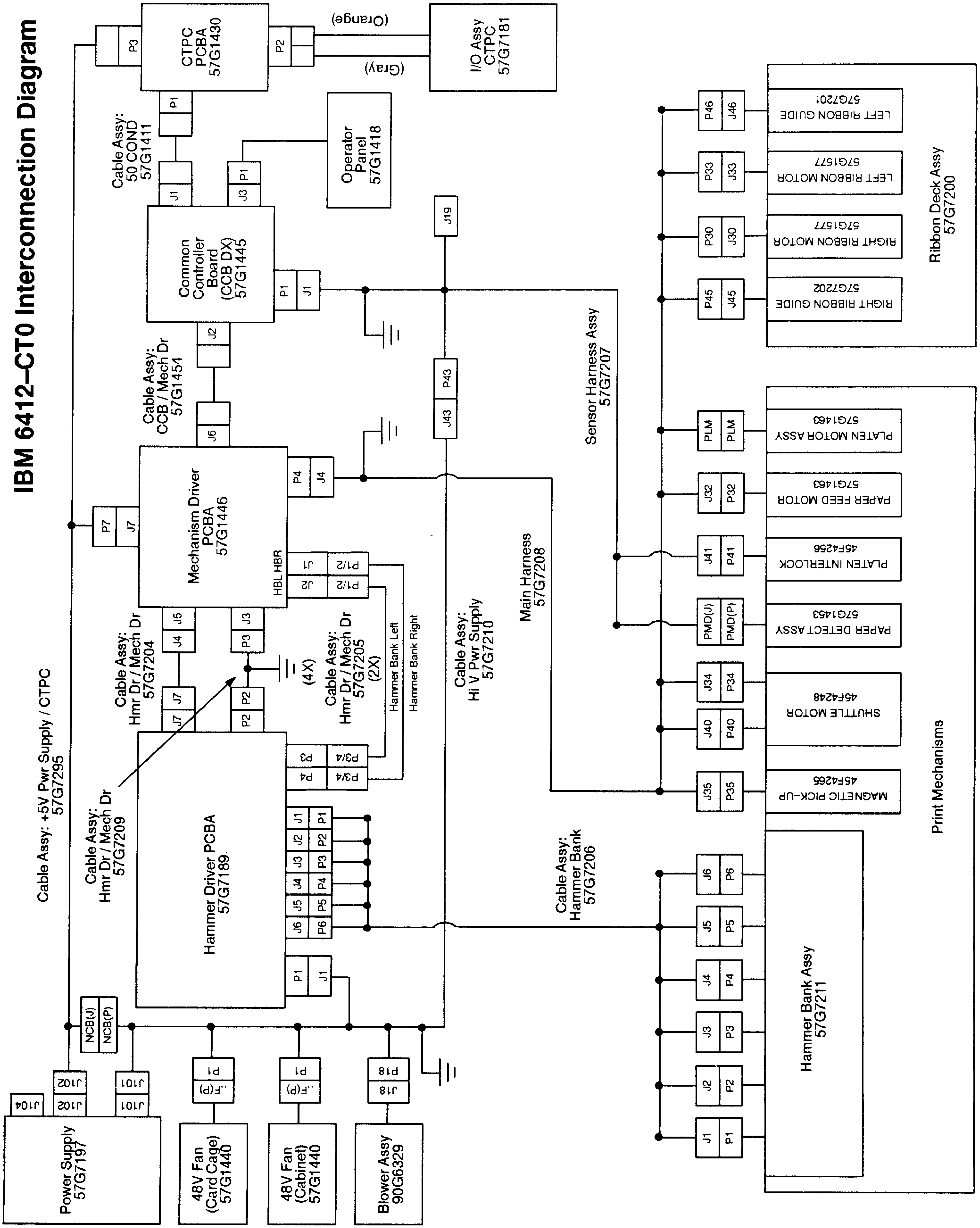
  Wire Harness, Main A–28

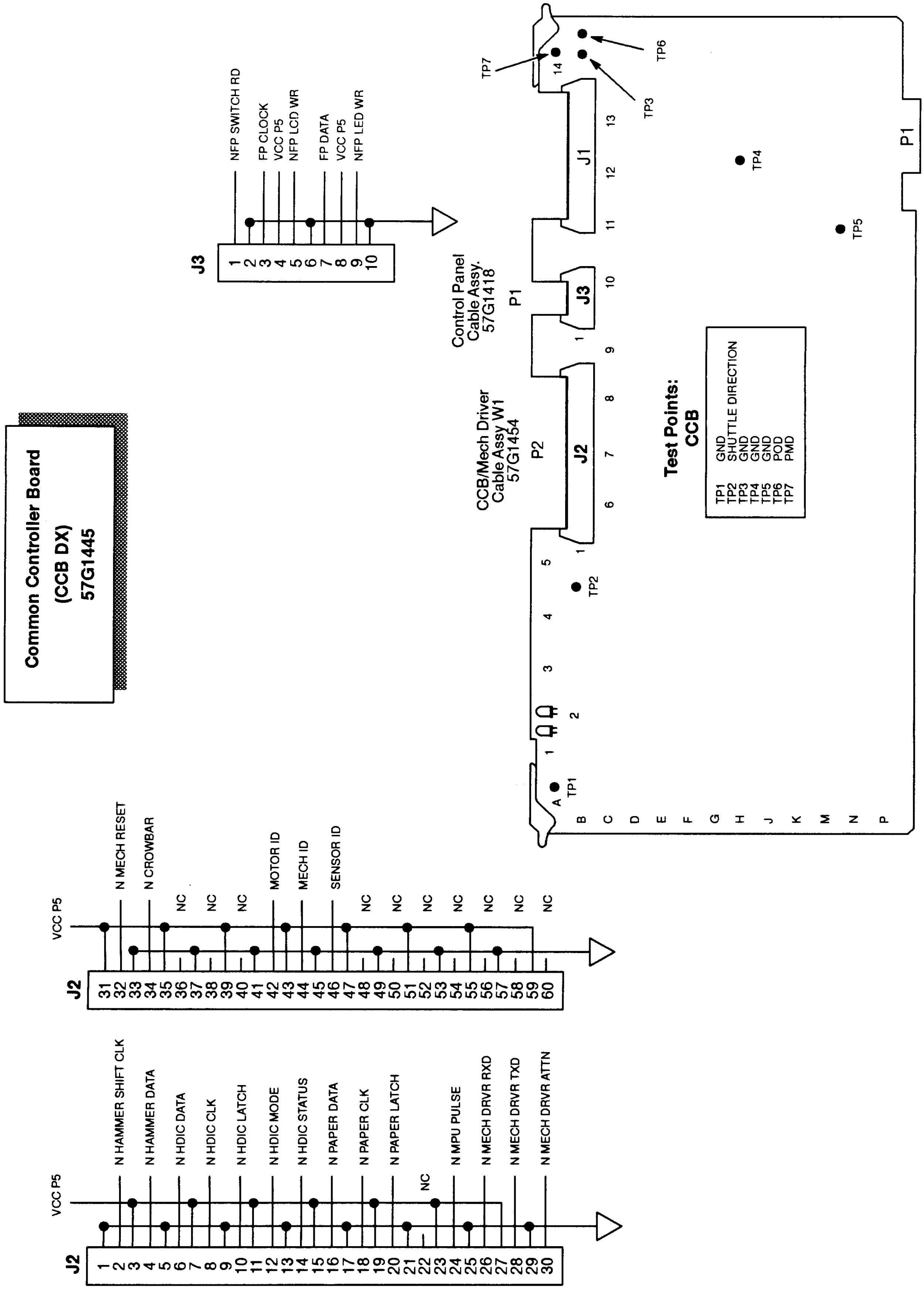
  High Voltage, Power Supply A–30

+5V, Power Supply/Mech A–32
Power, CTPC, 5V A–33
Power, CTPC/IGP–2x0 .... A–17
CCB/Mech. Dr. A–34
50 Cond (CTPC/CCB) A–35
50 Cond (CTPC/IGP) A–36

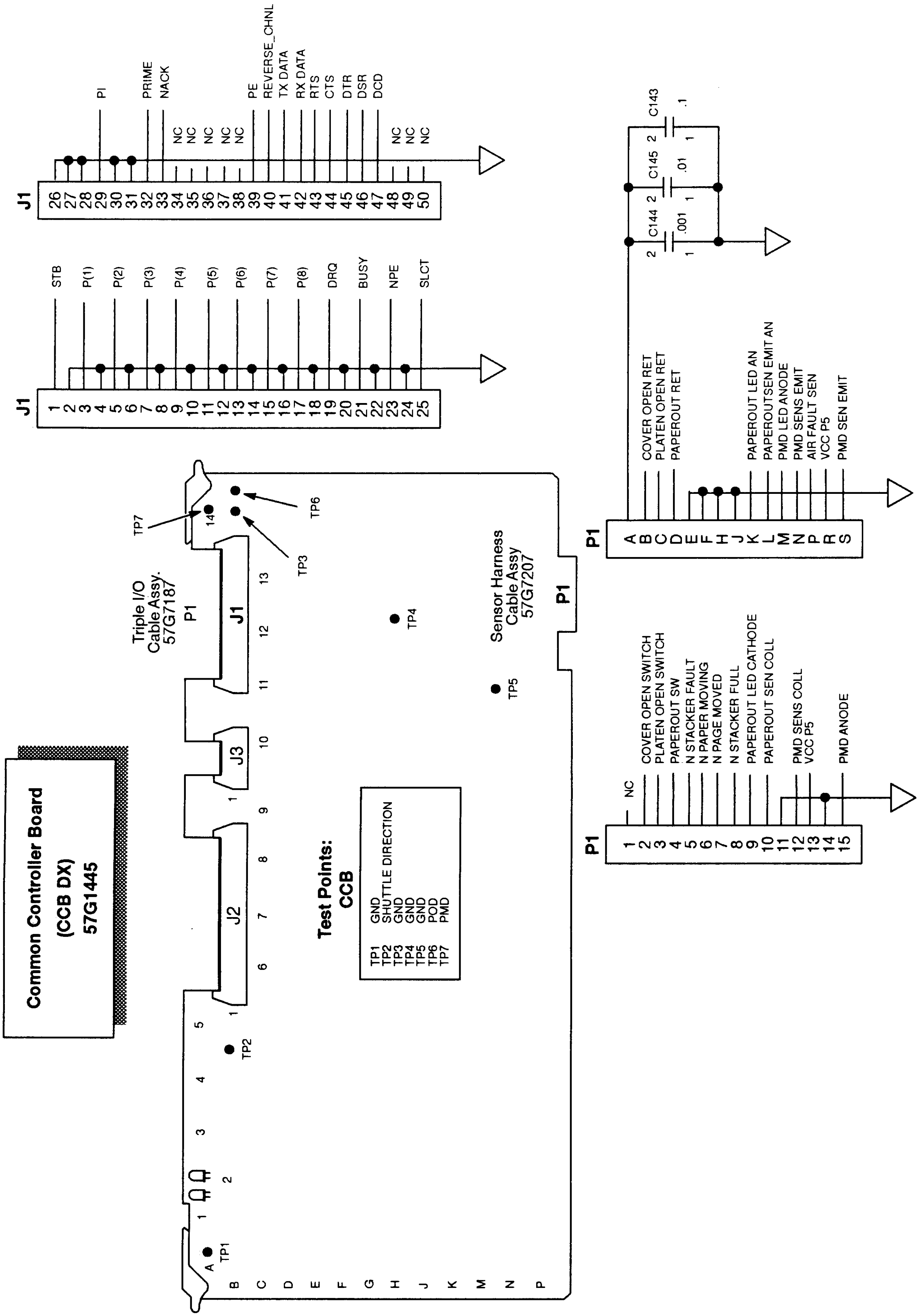

IBM 6412–A00 Interconnection Diagram
I/O Assy Triple 57G7187
Operator Panel 57G1418
Common Controller Board (CCB DX) 57G1445
Cable Assy: CCB / Mech Dr 57G1454
Mechanism Driver PCBA 57G1446
HBL HBR
Cable Assy: +5V Pwr Supply/Mech. Driver 57G7294
Cable Assy: Hmr Dr / Mech Dr 57G7204
Cable Assy: Hmr Dr / Mech Dr 57G7209
Cable Assy: Hmr Dr / Mech Dr 57G7205 (2X)
(4X)
Hammer Bank Left
Hammer Bank Right
Hammer Driver PCBA 57G7189
Cable Assy: Hi V Pwr Supply 57G7210
Main Harness 57G7208
Sensor Harness Assy 57G7207
Cable Assy: Hammer Bank 57G7206
Power Supply 57G7197
48V Fan (Card Cage) 57G1440
48V Fan (Cabinet) 57G1440
Blower Assy 90G6329
NCB(J) NCB(P)
J101 J102 J104 J18 P18
LEFT RIBBON GUIDE 57G7201
LEFT RIBBON MOTOR 57G1577
RIGHT RIBBON MOTOR 57G1577
RIGHT RIBBON GUIDE 57G7202
Ribbon Deck Assy 57G7200
PLATEN MOTOR ASSY 57G1463
PAPER FEED MOTOR 57G1463
PLATEN INTERLOCK 45F4256
PAPER DETECT ASSY 57G1453
SHUTTLE MOTOR 45F4248
MAGNETIC PICK–UP 45F4265
Print Mechanisms
Hammer Bank Assy 57G7211
J19 J43 P43 J46 P46 J33 P33 J30 P30 J45 P45 PLM J32 P32 J41 P41 PMD(J) PMD(P) J34 P34 J40 P40 J35 P35

IBM 6412–CT0 Interconnection Diagram

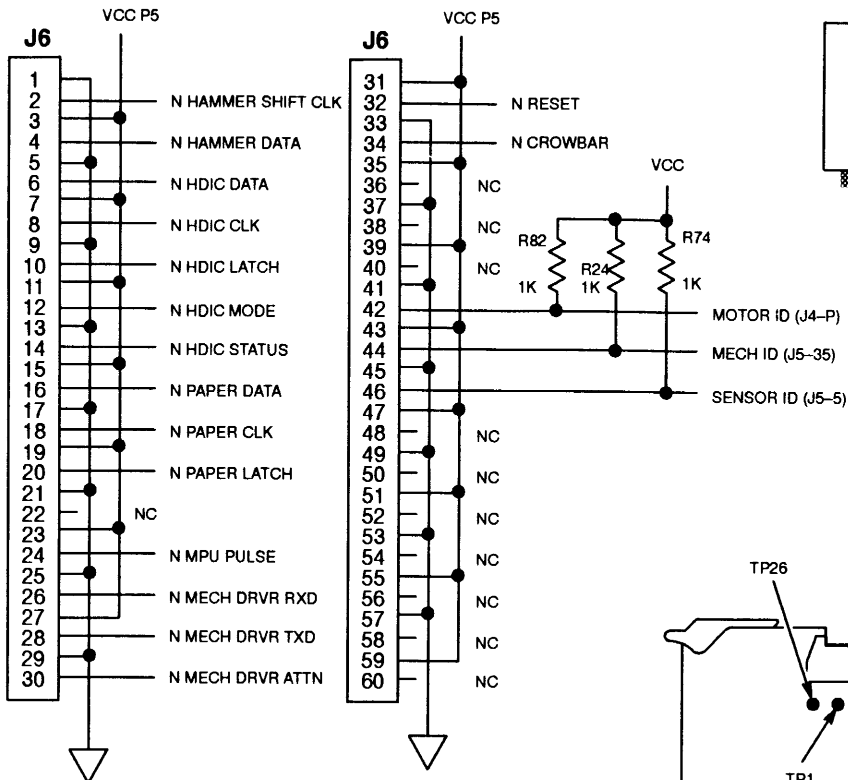




Common Controller Board
(CCB DX)
57G1445
J3
1 NFP SWITCH RD
2
3 FP CLOCK
4 VCC P5
5 NFP LCD WR
6
7 FP DATA
8 VCC P5
9 NFP LED WR
10
Control Panel
Cable Assy.
57G1418
P1
CCB/Mech Driver
Cable Assy W1
57G1454
P2
J1
J2
J3
P1
TP1
TP2
TP3
TP4
TP5
TP6
TP7
Test Points:
CCB
TP1 GND
TP2 SHUTTLE DIRECTION
TP3 GND
TP4 GND
TP5 GND
TP6 POD
TP7 PMD
J2
VCC P5
1
2 N HAMMER SHIFT CLK
3
4 N HAMMER DATA
5
6 N HDIC DATA
7
8 N HDIC CLK
9
10 N HDIC LATCH
11
12 N HDIC MODE
13
14 N HDIC STATUS
15
16 N PAPER DATA
17
18 N PAPER CLK
19
20 N PAPER LATCH
21
22 NC
23
24 N MPU PULSE
25
26 N MECH DRVR RXD
27
28 N MECH DRVR TXD
29
30 N MECH DRVR ATTN
J2
VCC P5
31
32 N MECH RESET
33
34 N CROWBAR
35
36 NC
37
38 NC
39
40 NC
41
42 MOTOR ID
43
44 MECH ID
45
46 SENSOR ID
47
48 NC
49
50 NC
51
52 NC
53
54 NC
55
56 NC
57
58 NC
59
60 NC

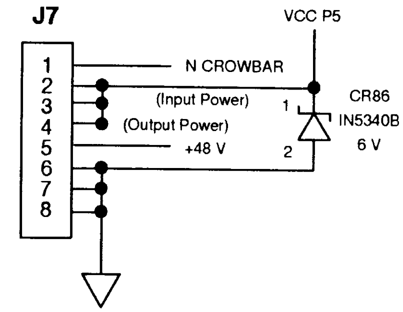


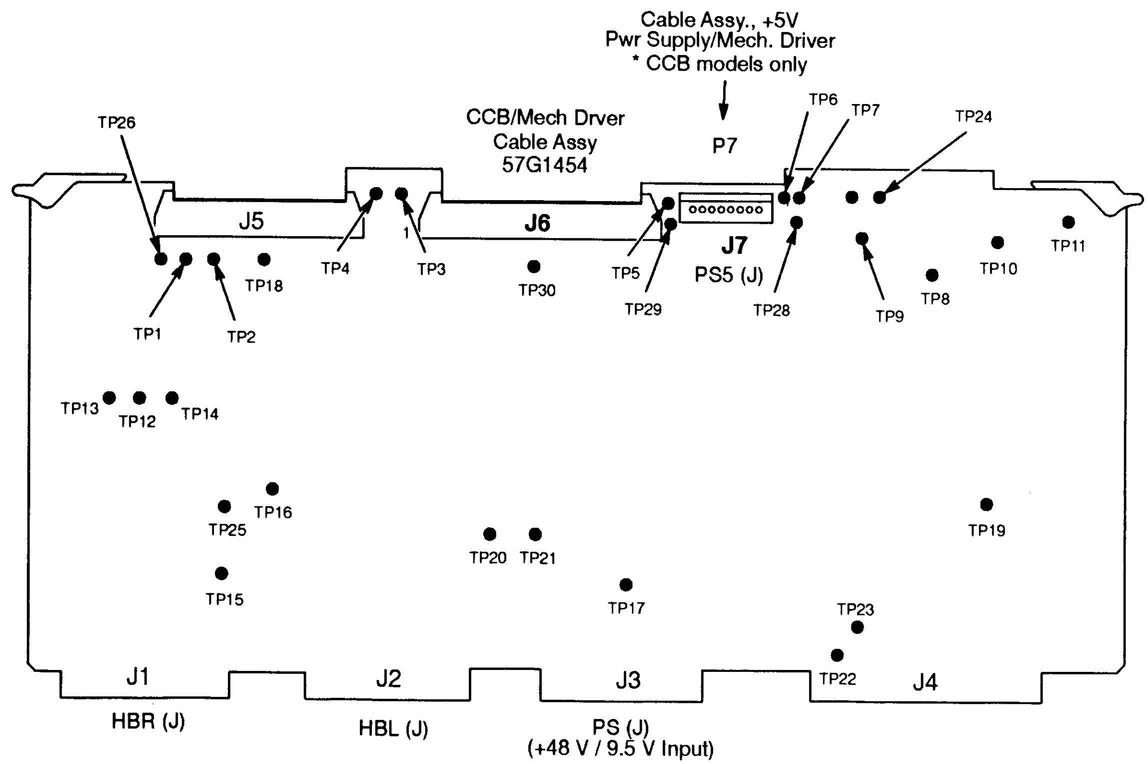
Common Controller Board
(CCB DX)
57G1445
Test Points:
CCB
TP1 GND
TP2 SHUTTLE DIRECTION
TP3 GND
TP4 GND
TP5 GND
TP6 POD
TP7 PMD
Triple I/O
Cable Assy.
57G7187
P1
Sensor Harness
Cable Assy
57G7207
P1
J1
J2
J3
TP1
TP2
TP3
TP4
TP5
TP6
TP7
J1
STB
P(1)
P(2)
P(3)
P(4)
P(5)
P(6)
P(7)
P(8)
DRQ
BUSY
NPE
SLCT
PI
PRIME
NACK
NC
PE
REVERSE_CHNL
TX DATA
RX DATA
RTS
CTS
DTR
DSR
DCD
P1
COVER OPEN RET
PLATEN OPEN RET
PAPEROUT RET
PAPEROUT LED AN
PAPEROUTSEN EMIT AN
PMD LED ANODE
PMD SENS EMIT
AIR FAULT SEN
VCC P5
PMD SEN EMIT
C144
.001
C145
.01
C143
.1
NC
COVER OPEN SWITCH
PLATEN OPEN SWITCH
PAPEROUT SW
N STACKER FAULT
N PAPER MOVING
N PAGE MOVED
N STACKER FULL
PAPEROUT LED CATHODE
PAPEROUT SEN COLL
PMD SENS COLL
VCC P5
PMD ANODE



Mechanism Driver Board

57G1446



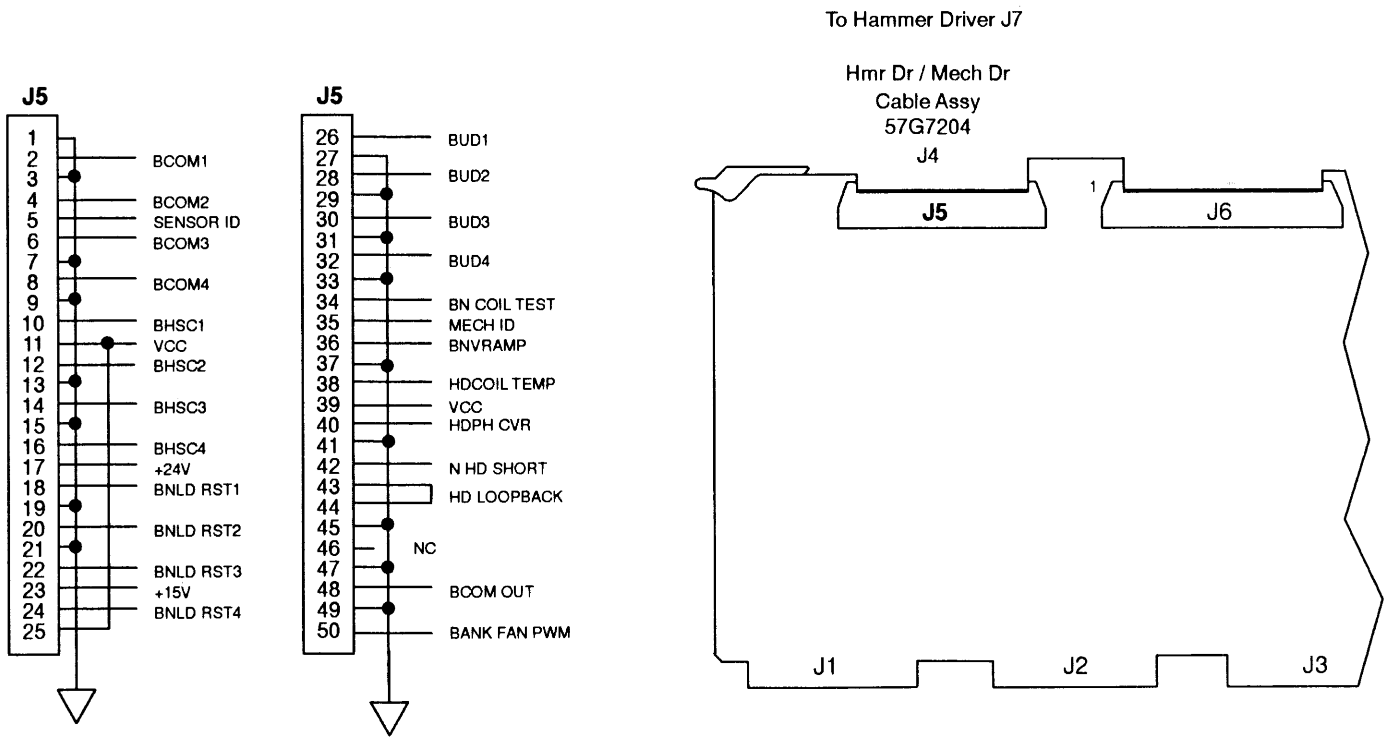


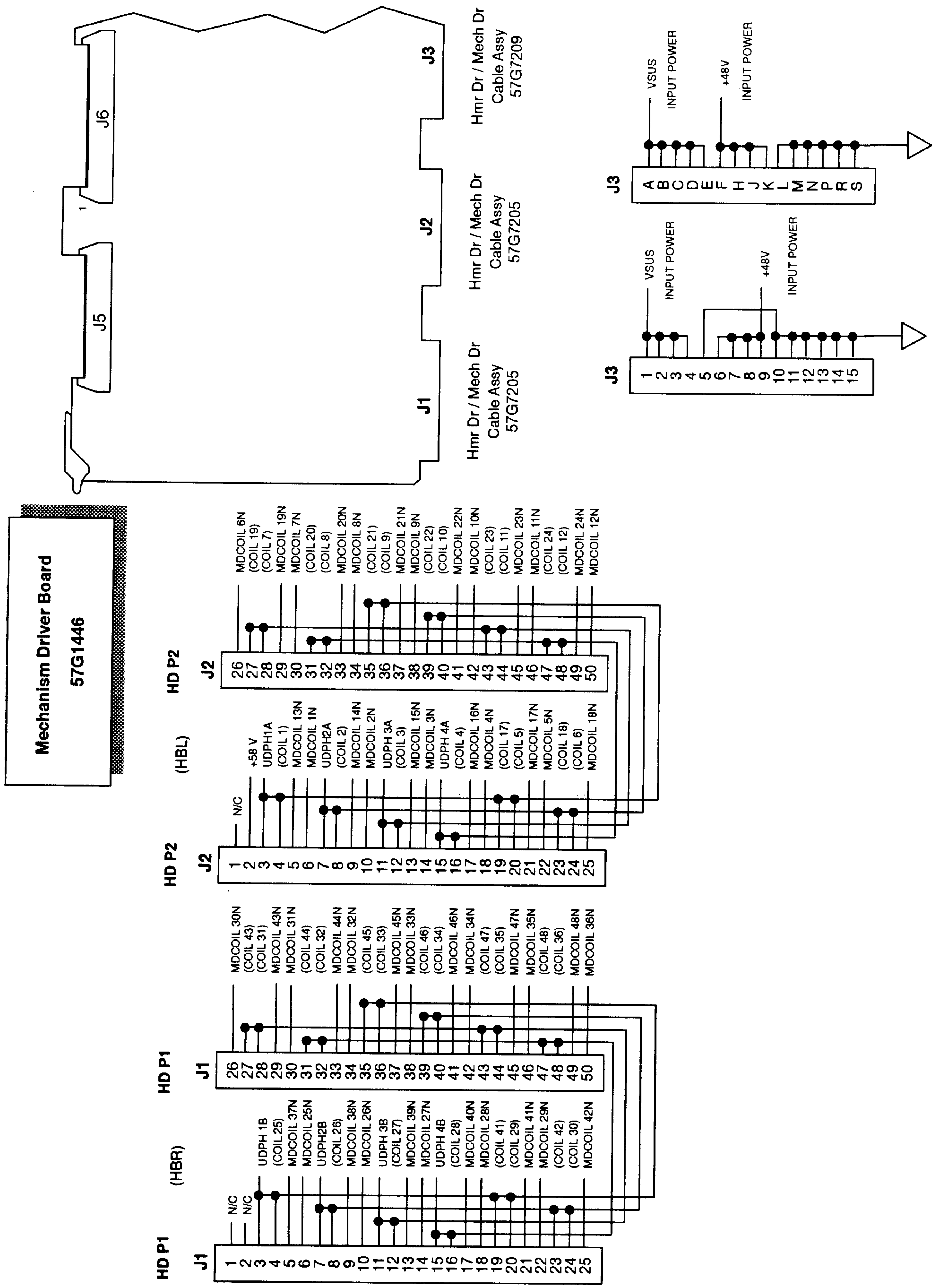
Test Points:
Mech. Driver

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 Board

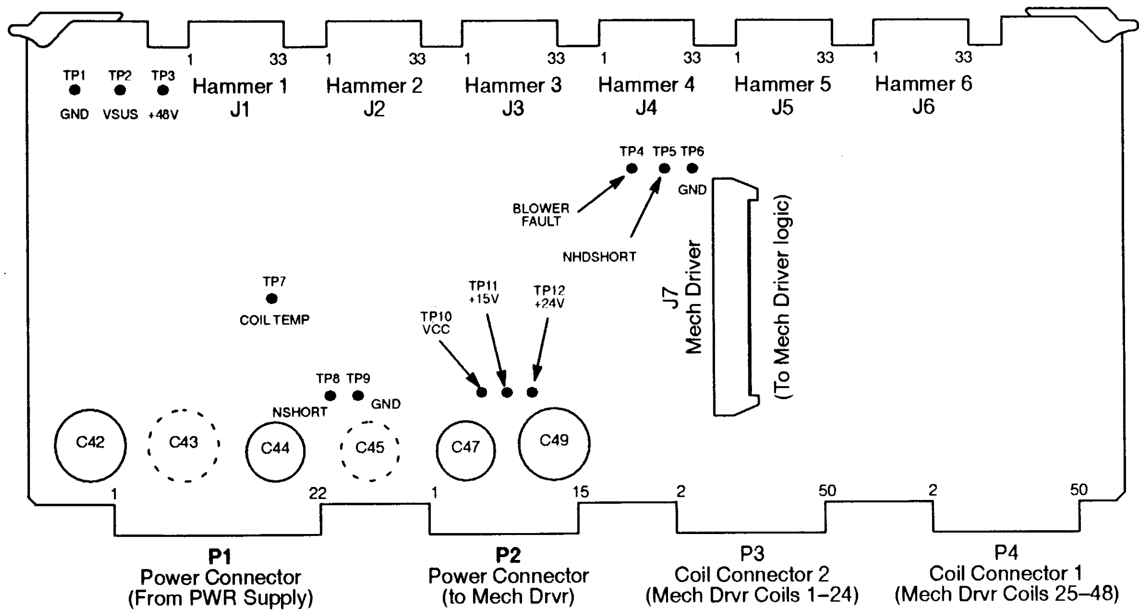
57G1446

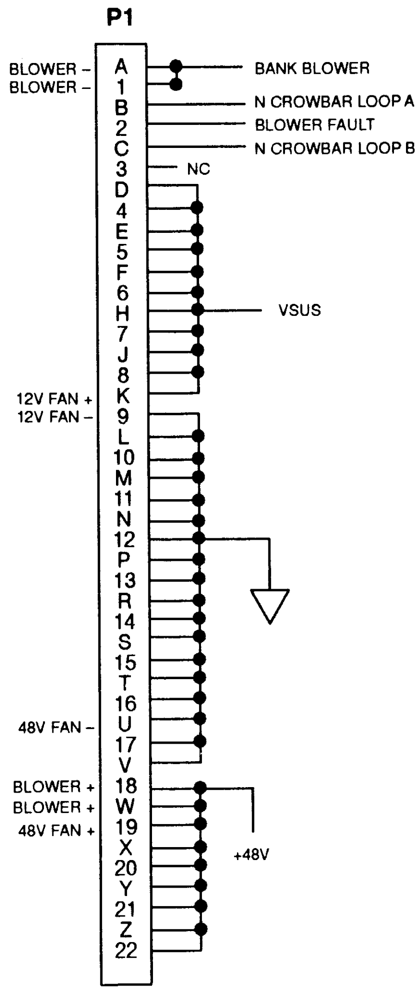


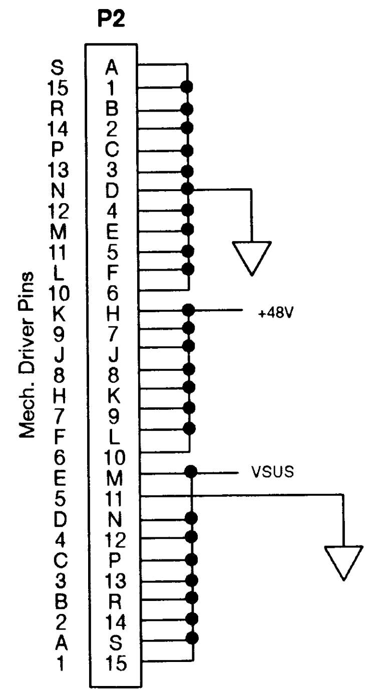

Mechanism Driver Board
57G1446
J6
J5
J1
J2
J3
Hmr Dr / Mech Dr
Cable Assy
57G7205
Hmr Dr / Mech Dr
Cable Assy
57G7205
Hmr Dr / Mech Dr
Cable Assy
57G7209
J3
VSUS
INPUT POWER
+48V
INPUT POWER
A B C D E F H J K L M N P R S
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
HD P1
J1
(HBR)
N/C
N/C
UDPH 1B
(COIL 25)
MDCOIL 37N
MDCOIL 25N
UDPH2B
(COIL 26)
MDCOIL 38N
MDCOIL 26N
UDPH 3B
(COIL 27)
MDCOIL 39N
MDCOIL 27N
UDPH 4B
(COIL 28)
MDCOIL 40N
MDCOIL 28N
(COIL 41)
(COIL 29)
MDCOIL 41N
MDCOIL 29N
(COIL 42)
(COIL 30)
MDCOIL 42N
MDCOIL 30N
(COIL 43)
(COIL 31)
MDCOIL 43N
MDCOIL 31N
(COIL 44)
(COIL 32)
MDCOIL 44N
MDCOIL 32N
(COIL 45)
(COIL 33)
MDCOIL 45N
MDCOIL 33N
(COIL 46)
(COIL 34)
MDCOIL 46N
MDCOIL 34N
(COIL 47)
(COIL 35)
MDCOIL 47N
MDCOIL 35N
(COIL 48)
(COIL 36)
MDCOIL 48N
MDCOIL 36N
HD P2
J2
(HBL)
N/C
+58 V
UDPH1A
(COIL 1)
MDCOIL 13N
MDCOIL 1N
UDPH2A
(COIL 2)
MDCOIL 14N
MDCOIL 2N
UDPH 3A
(COIL 3)
MDCOIL 15N
MDCOIL 3N
UDPH 4A
(COIL 4)
MDCOIL 16N
MDCOIL 4N
(COIL 17)
(COIL 5)
MDCOIL 17N
MDCOIL 5N
(COIL 18)
(COIL 6)
MDCOIL 18N
MDCOIL 6N
(COIL 19)
(COIL 7)
MDCOIL 19N
MDCOIL 7N
(COIL 20)
(COIL 8)
MDCOIL 20N
MDCOIL 8N
(COIL 21)
(COIL 9)
MDCOIL 21N
MDCOIL 9N
(COIL 22)
(COIL 10)
MDCOIL 22N
MDCOIL 10N
(COIL 23)
(COIL 11)
MDCOIL 23N
MDCOIL 11N
(COIL 24)
(COIL 12)
MDCOIL 24N
MDCOIL 12N

Hammer Driver Board

57G7189

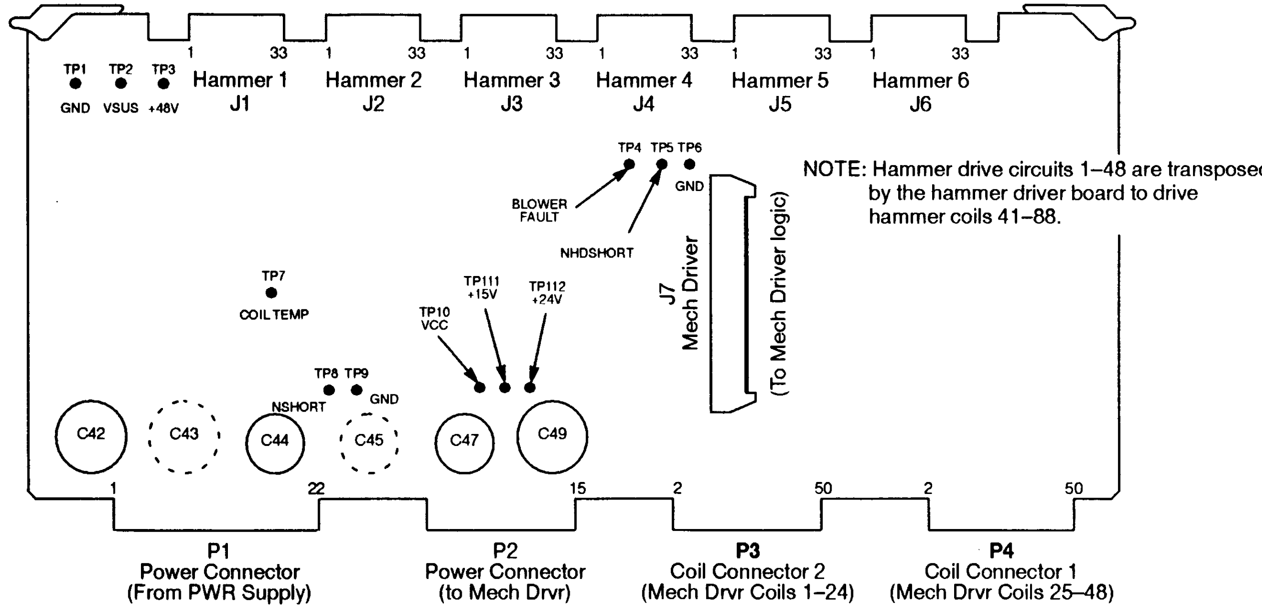






Hammer Driver Board

57G7189



P3
Coil Connector 2

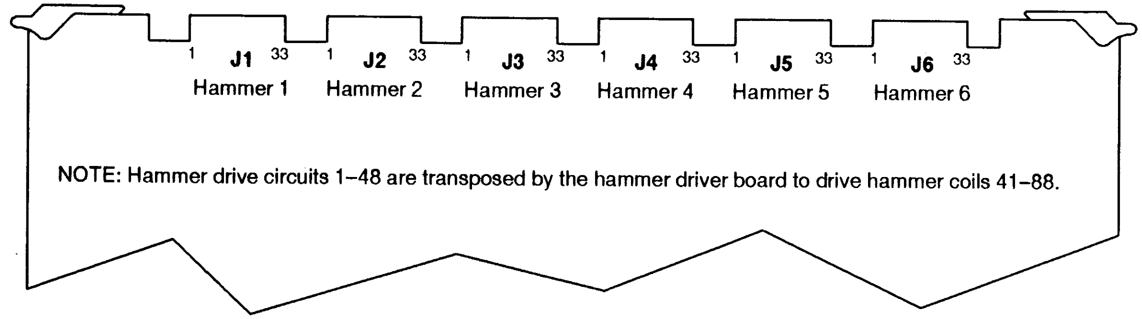
Mech. Driver Pins	Pin	Signal	Mech. Driver Pins	Pin	Signal
50	1	MDCOIL12N	25	26	MDCOIL18N
49	2	MDCOIL24N	24	27	UDPH2C6
48	3	UDPH4C12	23	28	UDPH2C18
47	4	UDPH4C24	22	29	MDCOIL5N
46	5	MDCOIL11N	21	30	MDCOIL17N
45	6	MDCOIL23N	20	31	UDPH1C5
44	7	UDPH3C11	19	32	UDPH1C17
43	8	UDPH3C23	18	33	MDCOIL4N
42	9	MDCOIL10N	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	Pin	Signal	Mech. Driver Pins	Pin	Signal
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 Board

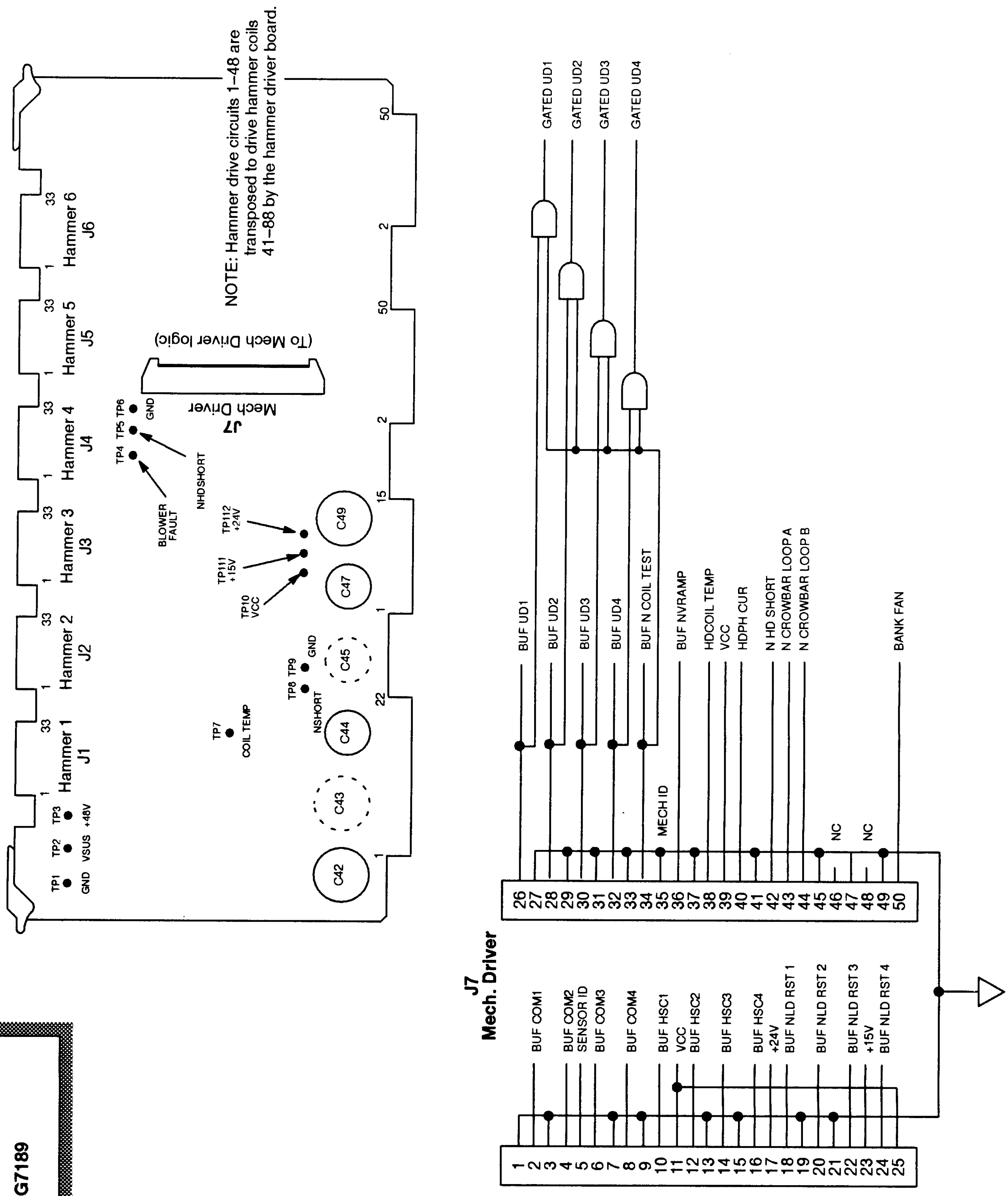
57G7189

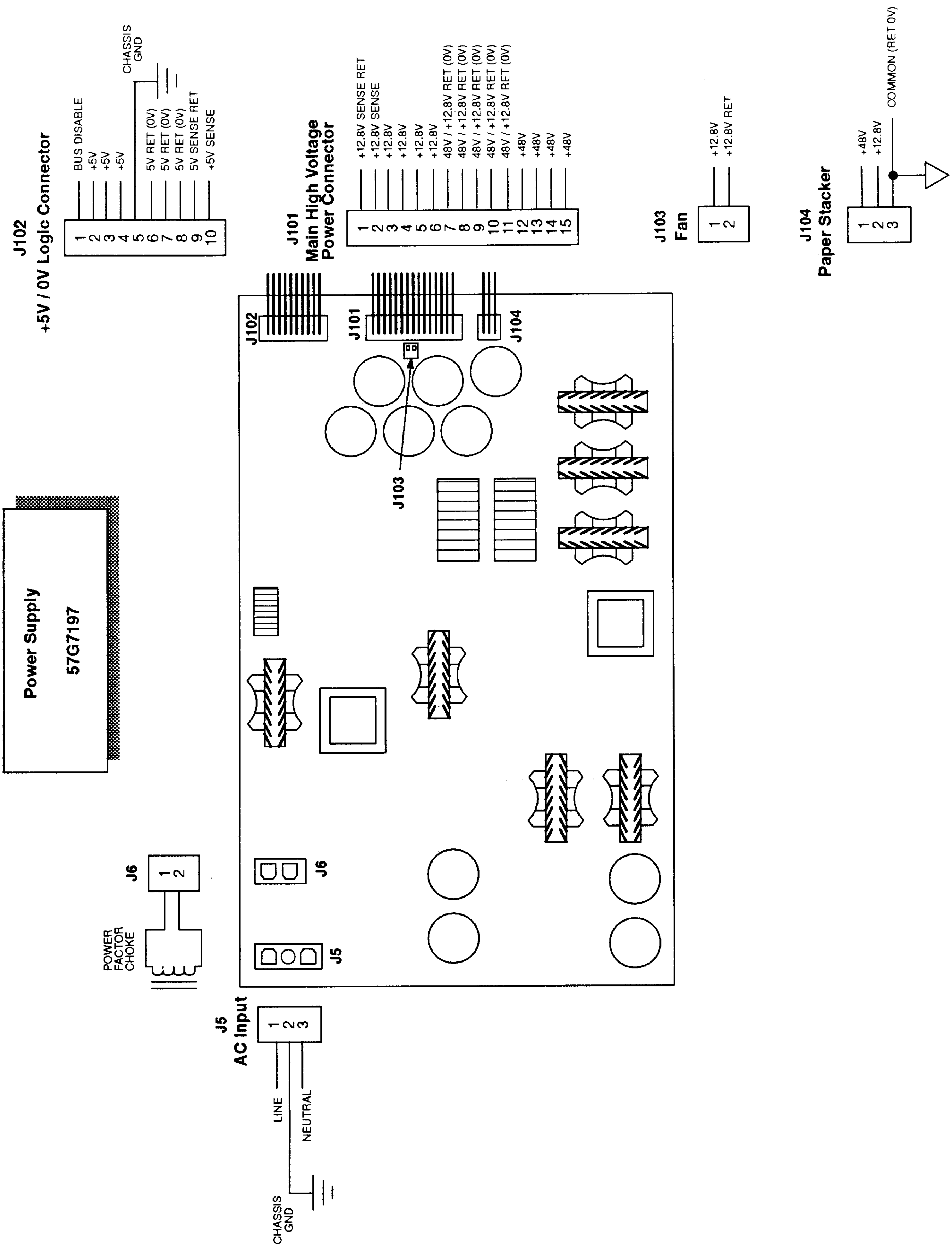


Pin	J1 Hammer1	J2 Hammer2	J3 Hammer3	J4 Hammer4	J5 Hammer5	J6 Hammer6
1–22	NC					
1		HDCOIL7N	HDCOIL23N	HDCOIL40N	MDCOIL16N	MDCOIL33N
2		UDPH3	UDPH3	UDPH4	UDPH4C16	UDPH1D33
3		HDCOIL8N	HDCOIL24N	MDCOIL1N	MDCOIL17N	MDCOIL34N
4		UDPH4	UDPH4	UDPH1C1	UDPH1C17	UDPH2D34
5		HDCOIL9N	HDCOIL25N	MDCOIL2N	MDCOIL18N	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

Hammer Driver Board

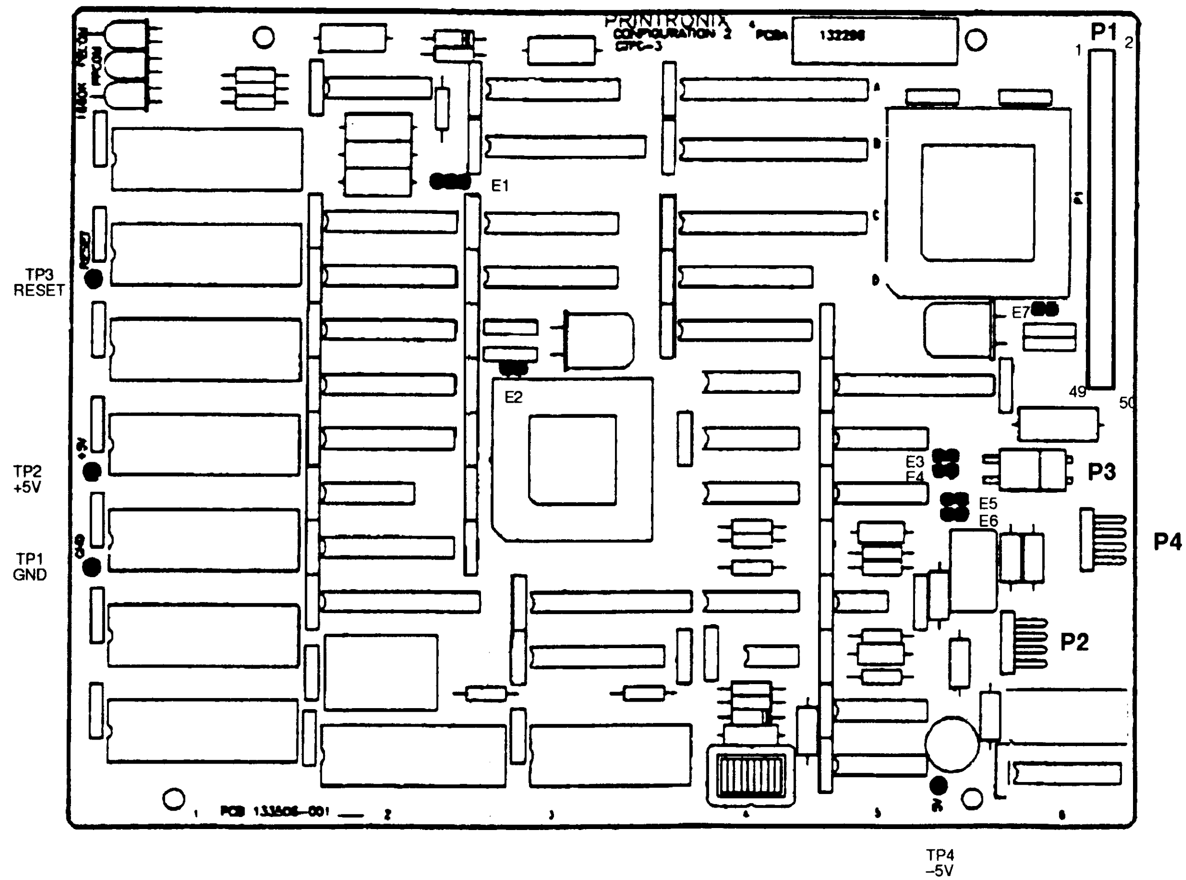
57G7189

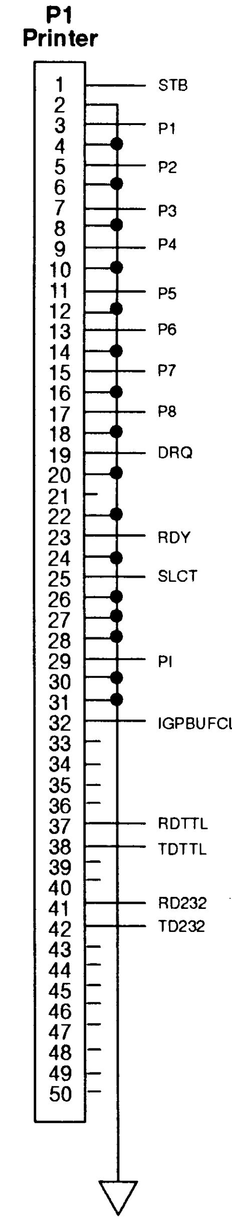




J102
+5V / 0V Logic Connector
1 BUS DISABLE
2 +5V
3 +5V
4 +5V
5
6 5V RET (0V)
7 5V RET (0V)
8 5V RET (0V)
9 5V SENSE RET
10 +5V SENSE
CHASSIS GND
J101
Main High Voltage Power Connector
1 +12.8V SENSE RET
2 +12.8V SENSE
3 +12.8V
4 +12.8V
5 +12.8V
6 +12.8V
7 48V / +12.8V RET (0V)
8 48V / +12.8V RET (0V)
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)
Power Supply
57G7197
J102
J101
J104
J103
J6
J5
J6
1
2
POWER FACTOR CHOKE
J5
AC Input
1 LINE
2
3 NEUTRAL
CHASSIS GND

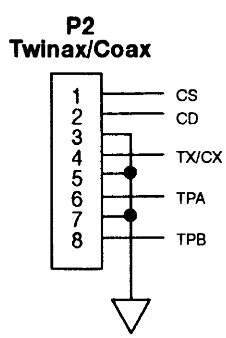
Coax/Twinax Integrated Interface Board (CT) 57G7253

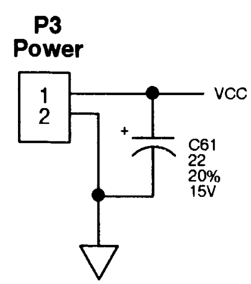


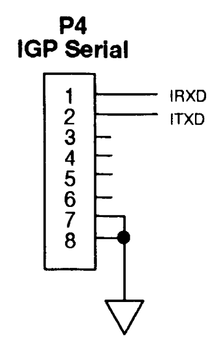


Jumper Table

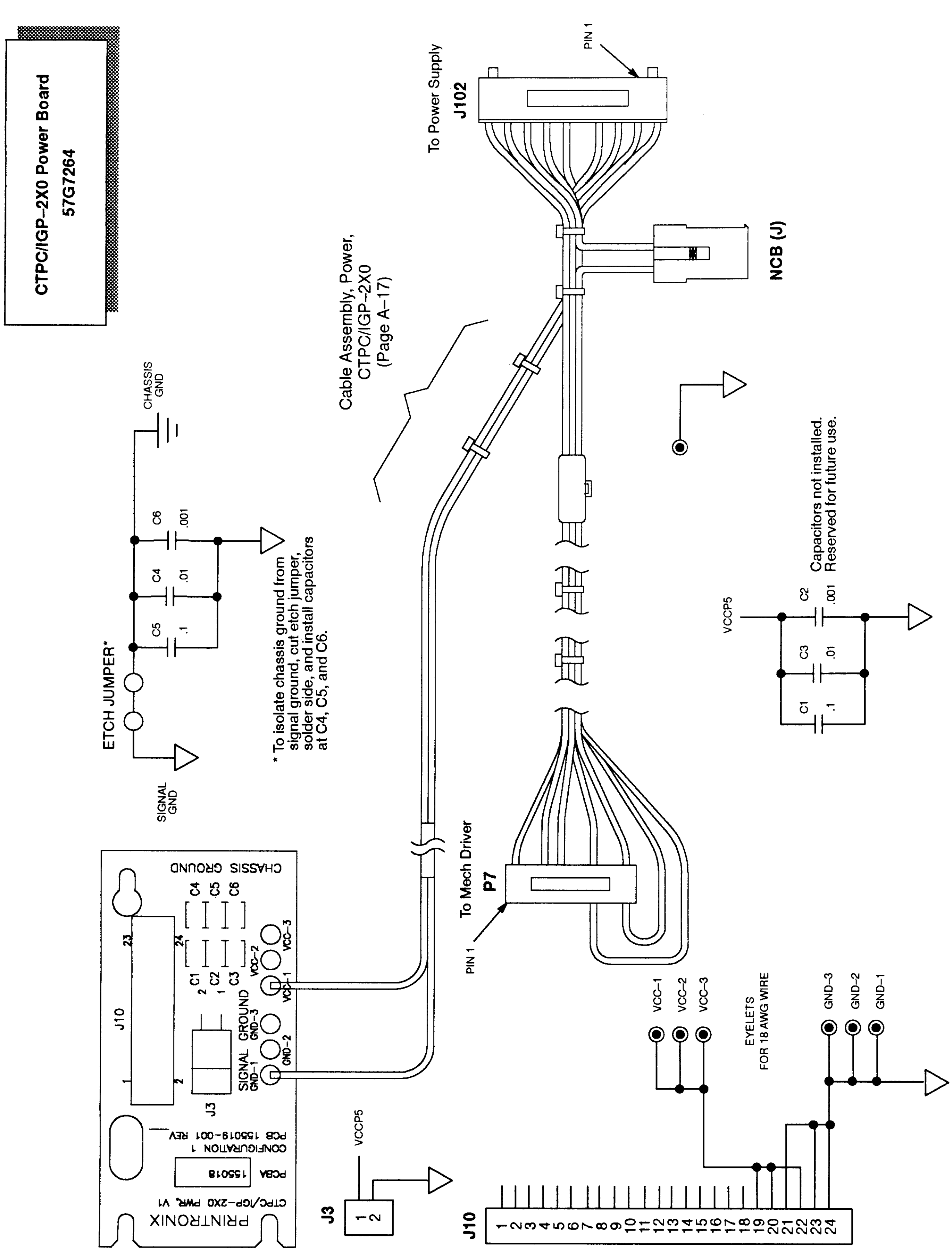
E1	1–2 : P9000 2–3 : P3000 & P6000
E2	80C186 CLOCK ENABLE
E3	RESERVED FOR DIAGNOSTIC SELECTION
E4	RESERVED FOR DIAGNOSTIC SELECTION
E5	RESERVED FOR DIAGNOSTIC SELECTION
E6	RESERVED FOR DIAGNOSTIC SELECTION
E7	8344 CLOCK ENABLE

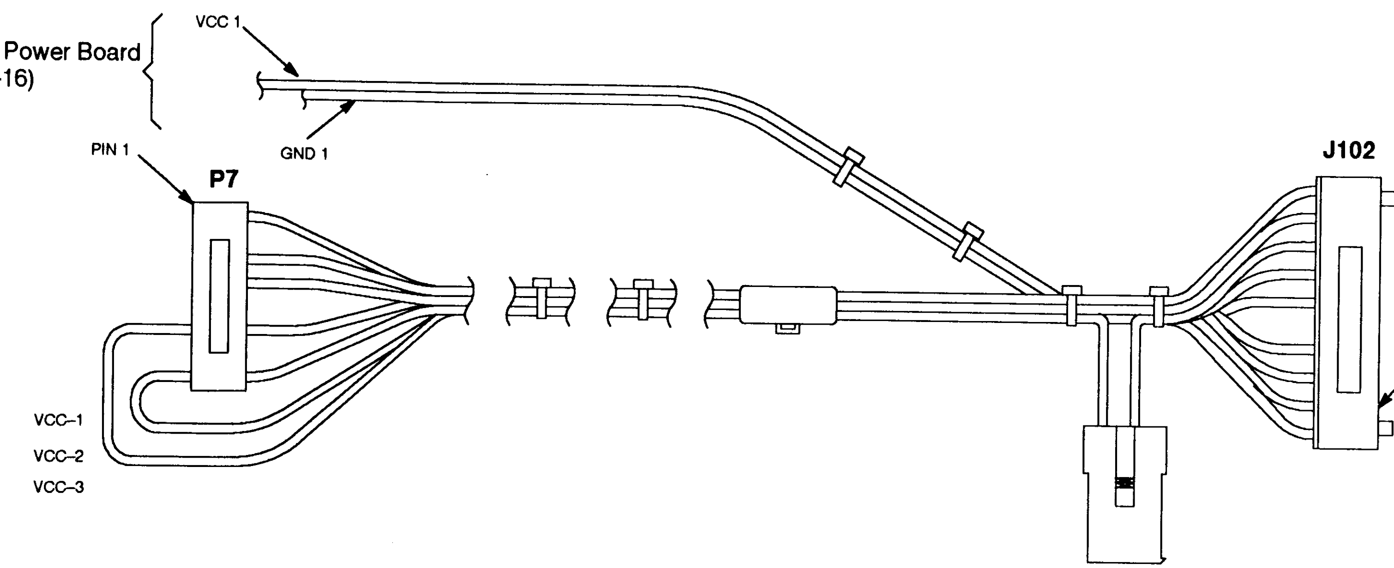


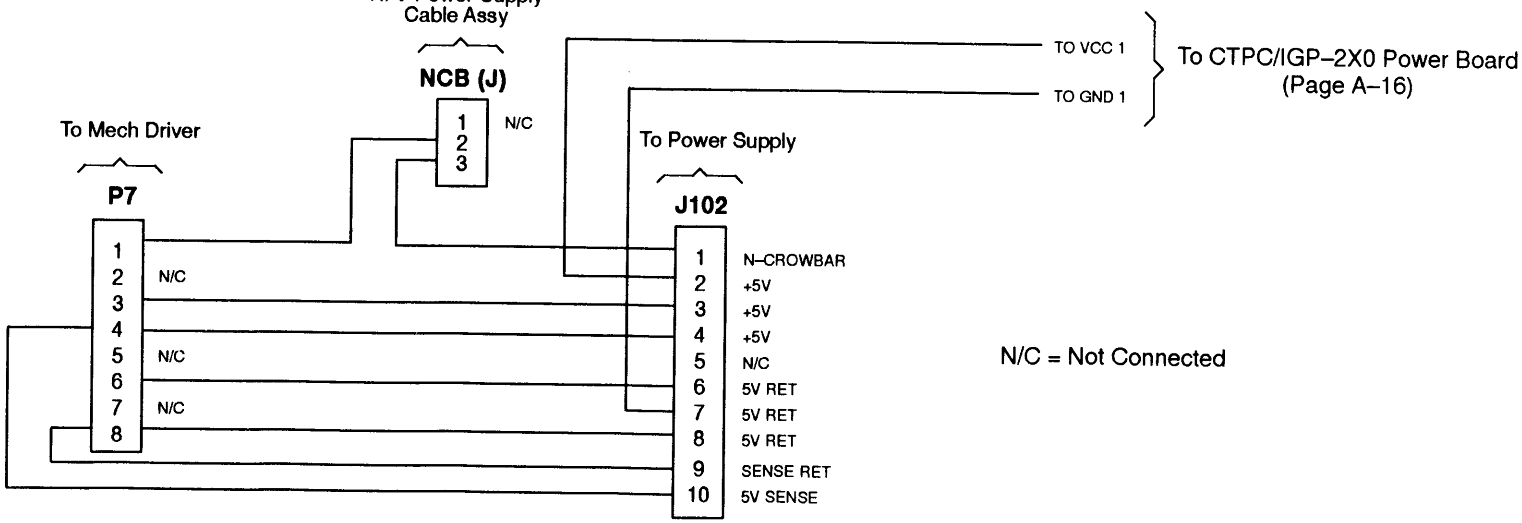




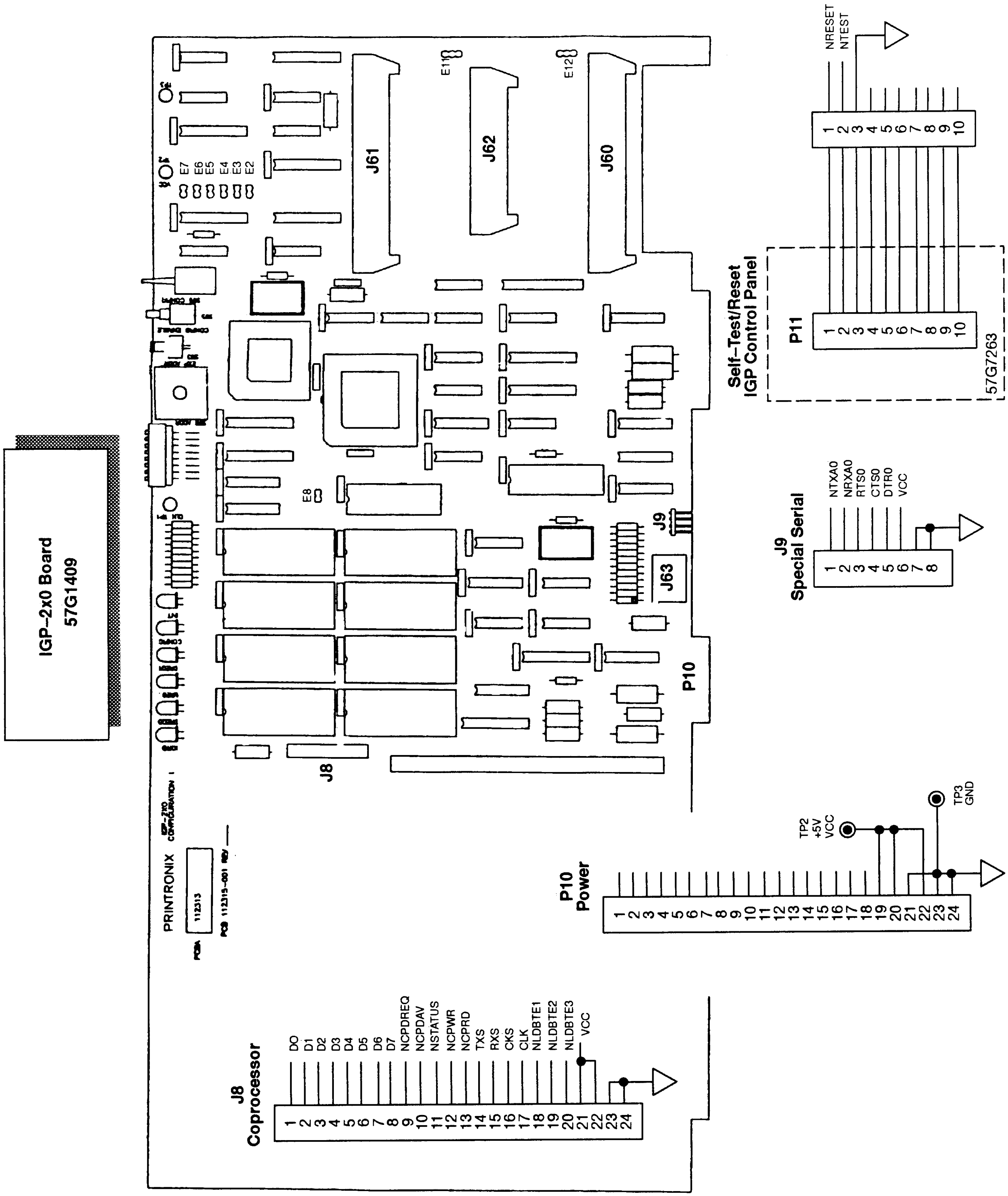
CTPC/IGP–2X0 Power Board 57G7264

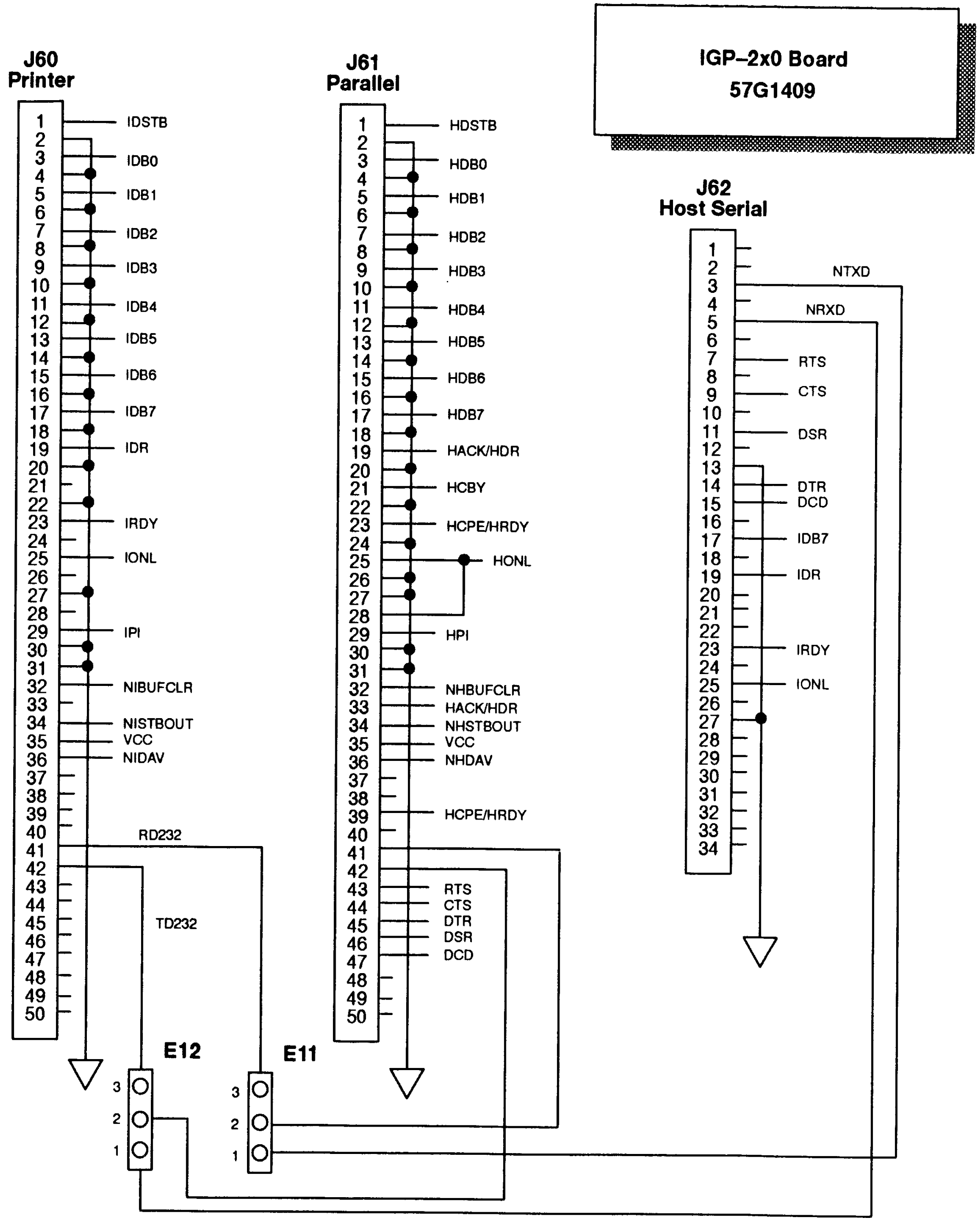


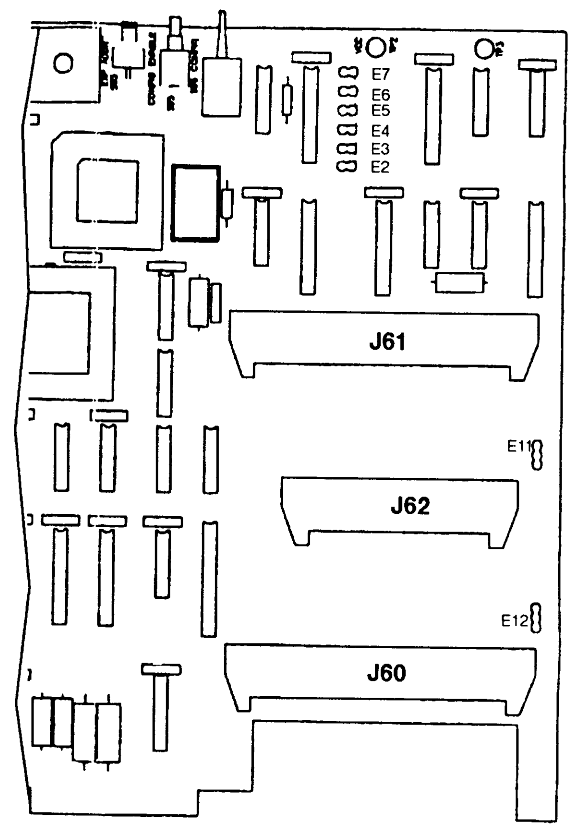




Part No.	Description
Part of 57G7264 (Page A–16)	Cable Assembly, Power, CTPC/IGP–2X0


IGP-2x0 Board
57G1409
J61
J62
J60
E11
E12
E7 E6 E5 E4 E3 E2
E8
J9
J63
J8
P10
PRINTRONIX
PCBA 112313
PCB 112315-001 REV
IGP-2X0 CONFIGURATION 1
NRESET
NTEST
Self-Test/Reset
IGP Control Panel
P11
1 2 3 4 5 6 7 8 9 10
57G7263
J9
Special Serial
NTXA0
NRXA0
RTS0
CTS0
DTR0
VCC
1 2 3 4 5 6 7 8
P10
Power
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
TP2 +5V VCC
TP3 GND
J8
Coprocessor
D0
D1
D2
D3
D4
D5
D6
D7
NCPDREQ
NCPDAV
NSTATUS
NCPWR
NCPRD
TXS
RXS
CKS
CLK
NLDBTE1
NLDBTE2
NLDBTE3
VCC
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

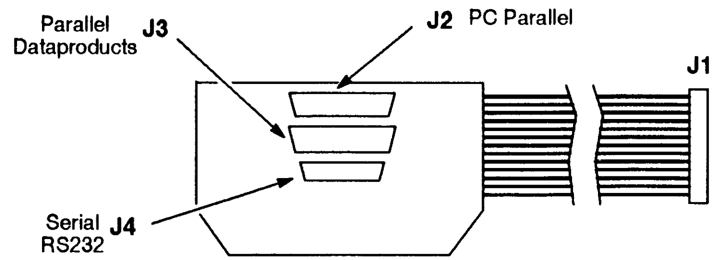




Jumper Table

E2	150NS DELAY ON HOST STROBE LINE
E3	120NS DELAY ON HOST STROBE LINE
E4	90NS DELAY ON HOST STROBE LINE
E5	60NS DELAY ON HOST STROBE LINE
E6	30NS DELAY ON HOST STROBE LINE
E7	0NS DELAY ON HOST STROBE LINE
E8	SELECT HOST SERIAL PORT TO INPUT NEW CONFIGURATION
E11	1–2 : NORMAL RS232 RXD CONNECTION 2–3 : PASS RS232 RXD TO DCU
E12	1–2 : NORMAL RS232 TXD CONNECTION 2–3 : PASS RS232 TXD TO DCU

Multi I/O Interface 57G7187



PC Parallel

J2		J2	
1	DATA STROBE	19	DS RET
2	DB1	20	DB1 RET
3	DB2	21	DB2 RET
4	DB3	22	DB3 RET
5	DB4	23	DB4 RET
6	DB5	24	DB5 RET
7	DB6	25	DB6 RET
8	DB7	26	DB7 RET
9	DB8	27	DB8 RET
10	NACK	28	BUSY RET
11	BUSY	29	PI RET
12	PE	30	NC
13	ONLINE	31	NC
14	GND	32	ONLINE
15	PI	33	NACK RET
16	PE RET	34	NC
17	CHASSIS GND	35	NC
18	NC	36	NC

Parallel Dataproducts

J3		J3	
1	DB3	26	NC
2	DATA STROBE RET	27	NC
3	DB1 RET	28	DB8
4	DB2 RET	29	NC
5	DB3 RET	30	PI
6	DB4 RET	31	NC
7	DB5 RET	32	NC
8	NC	33	NC
9	NC	34	DB5
10	NC	35	DB8 RET
11	NC	36	DB7
12	NC	37	DATA REQUEST RET
13	NC	38	DATA STROBE
14	DB6 RET	39	GND
15	NC	40	READY RET
16	NC	41	DB4
17	NC	42	OL RET
18	DB7 RET	43	DB6
19	DB1	44	PI RET
20	DB2	45	CABLE VER
21	ONLINE	46	
22	READY	47	NC
23	DATA REQUEST	48	NC
24	NC	49	NC
25	NC	50	NC

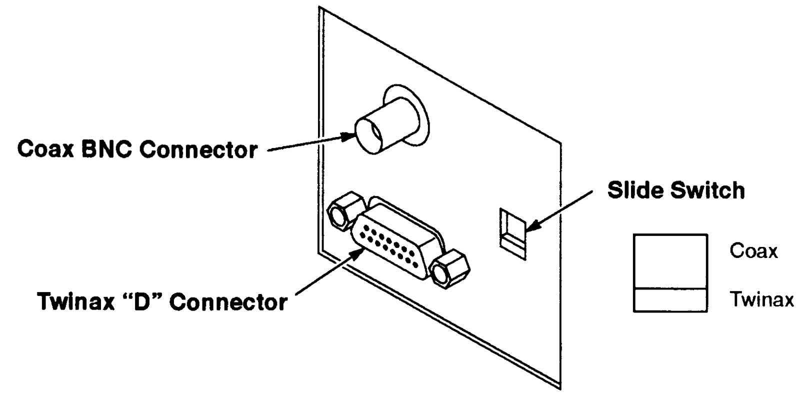
Serial RS232

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

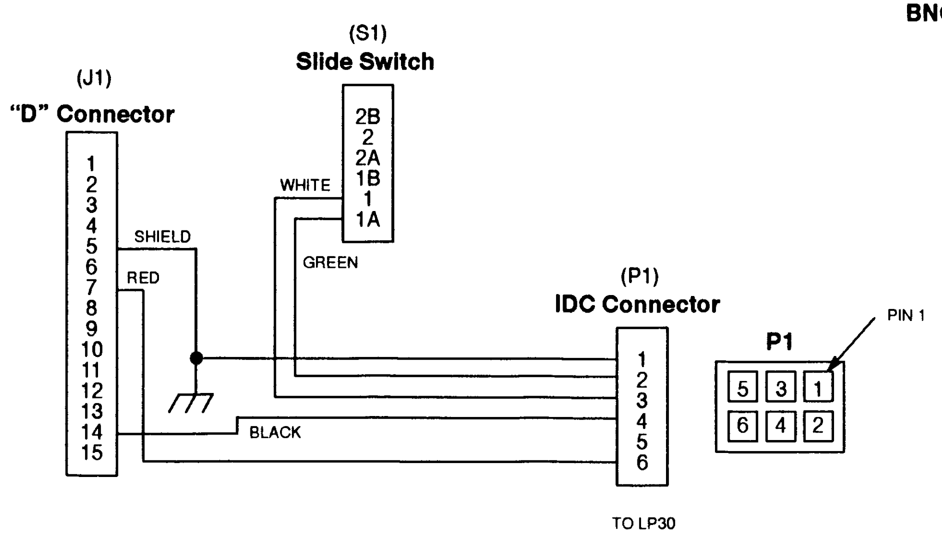
J1

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	DATA REQUEST
20	DATA REQUEST 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	SPARE1
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

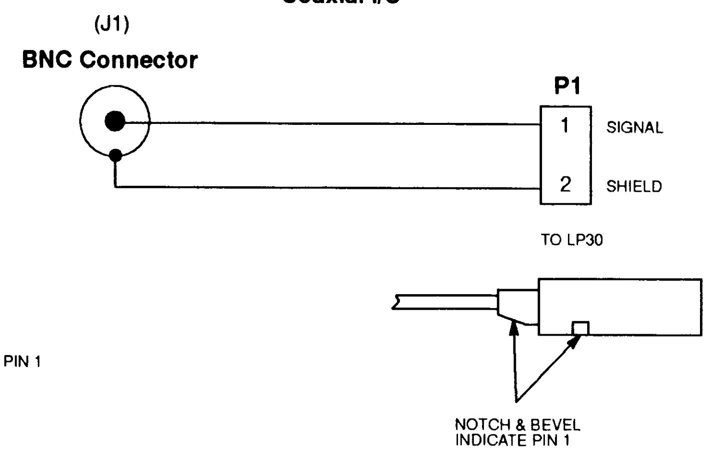
I/O Assembly,
CTPC
57G7181

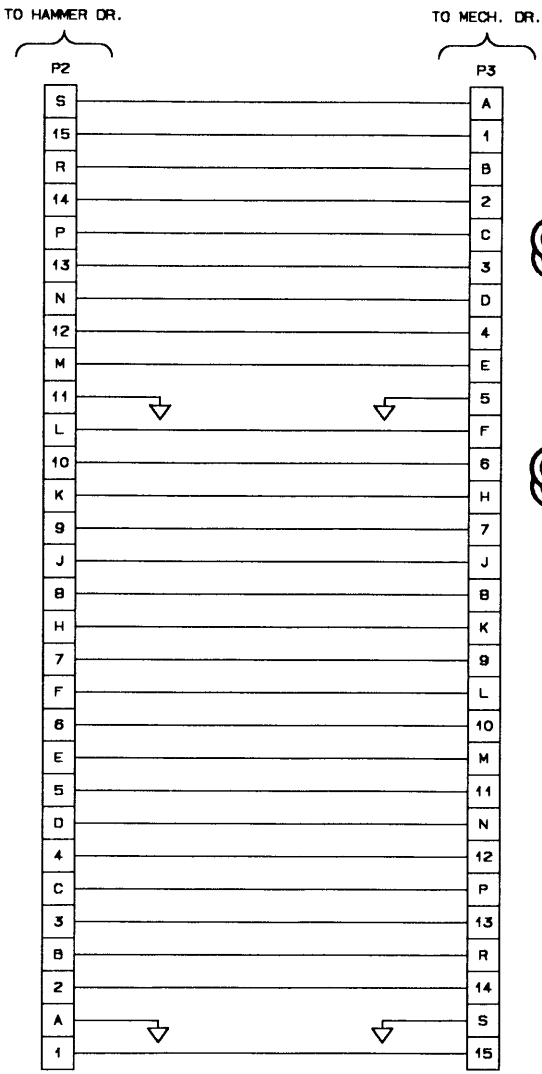


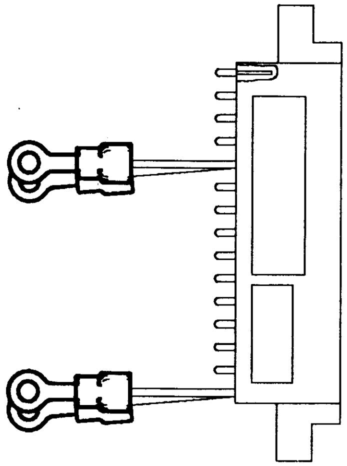
Twinaxial I/O

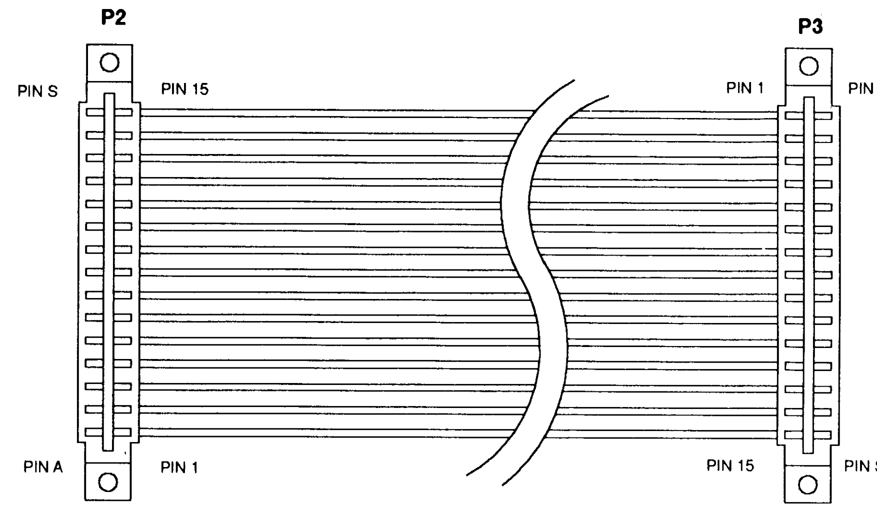


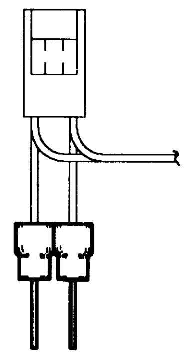
Coaxial I/O



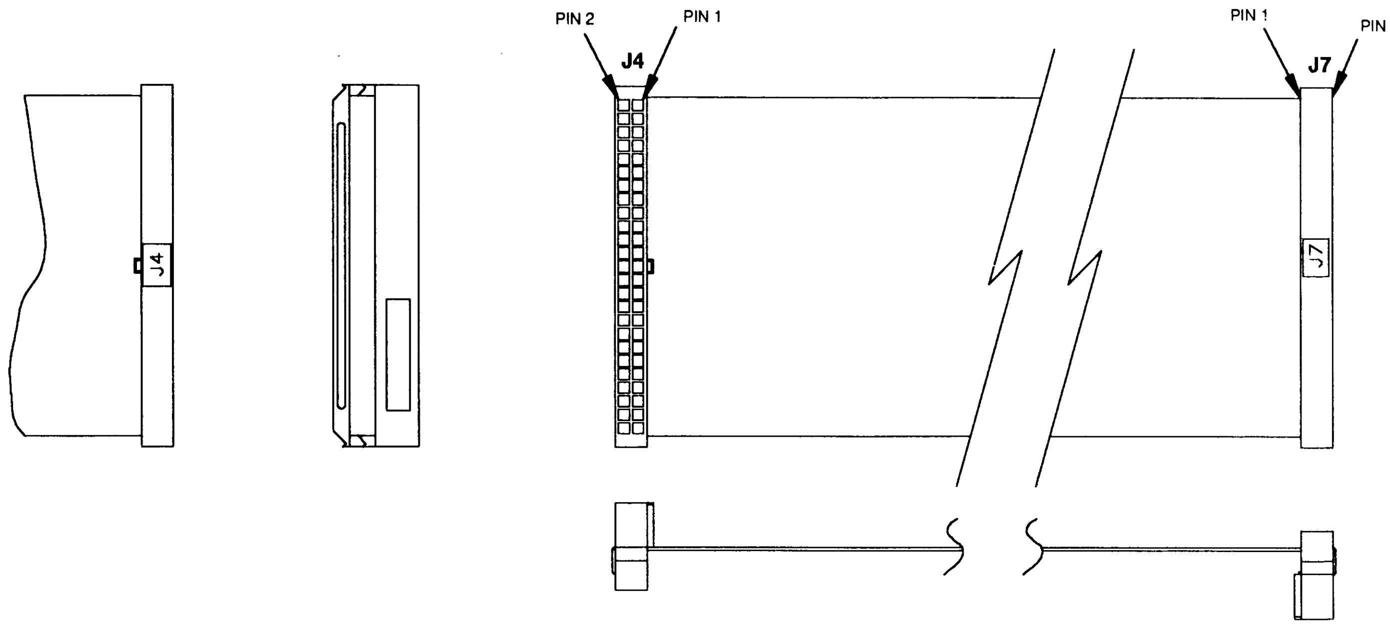




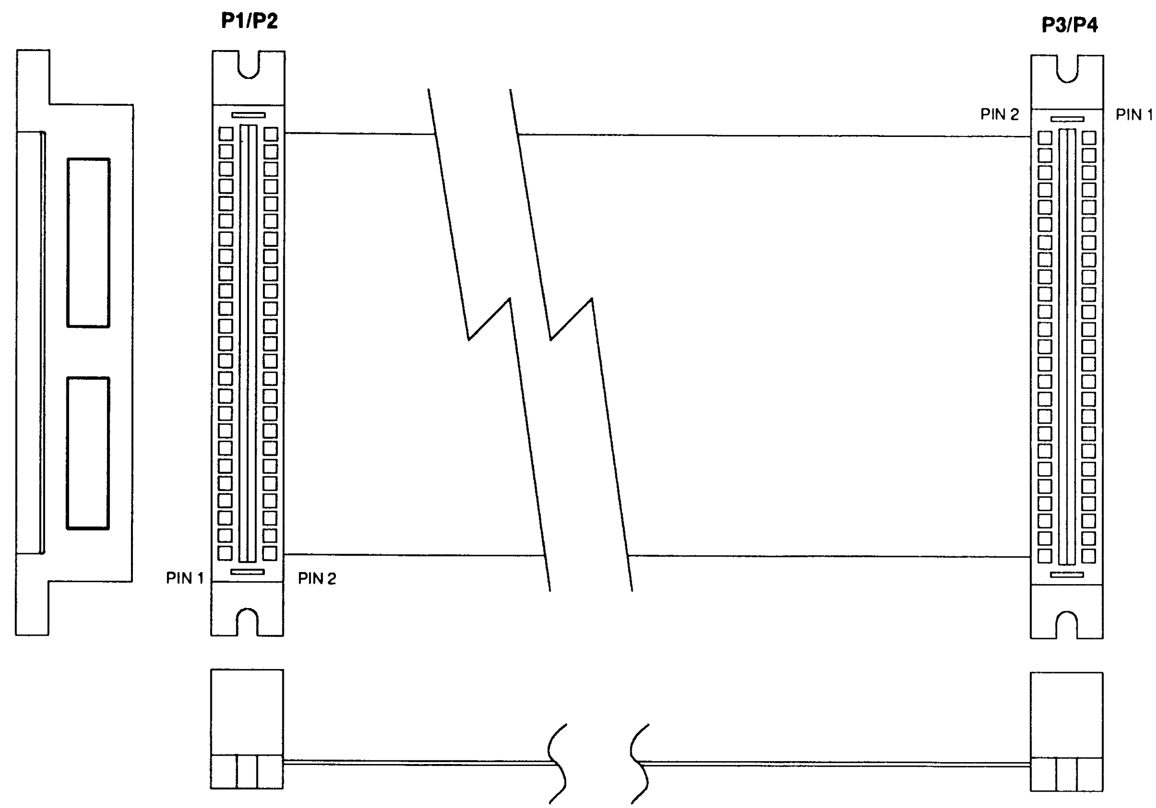




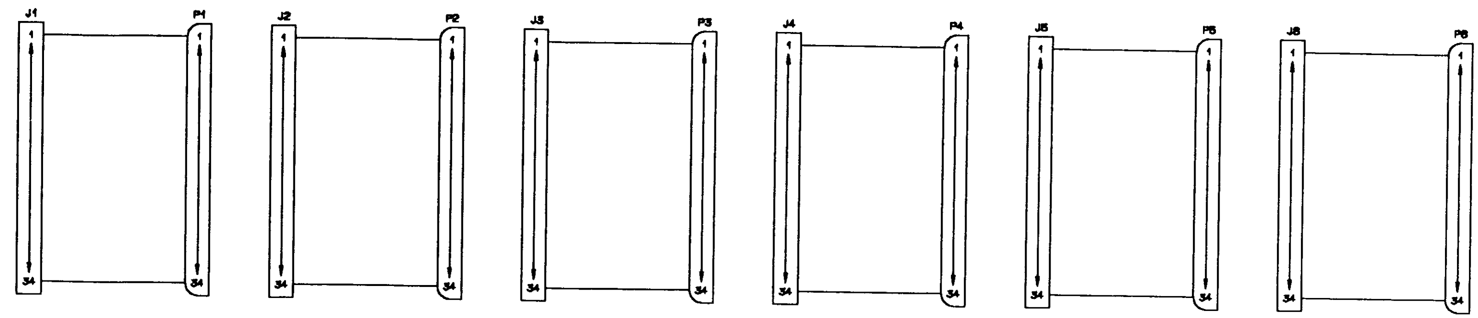
Part No.	Description
57G7209	Cable Assembly, Hmr Dr/Mech Dr 2

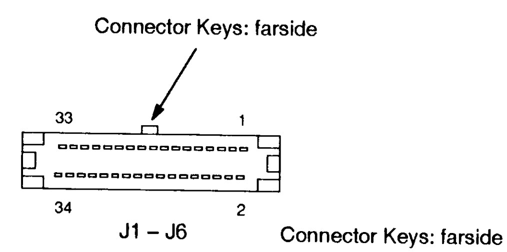


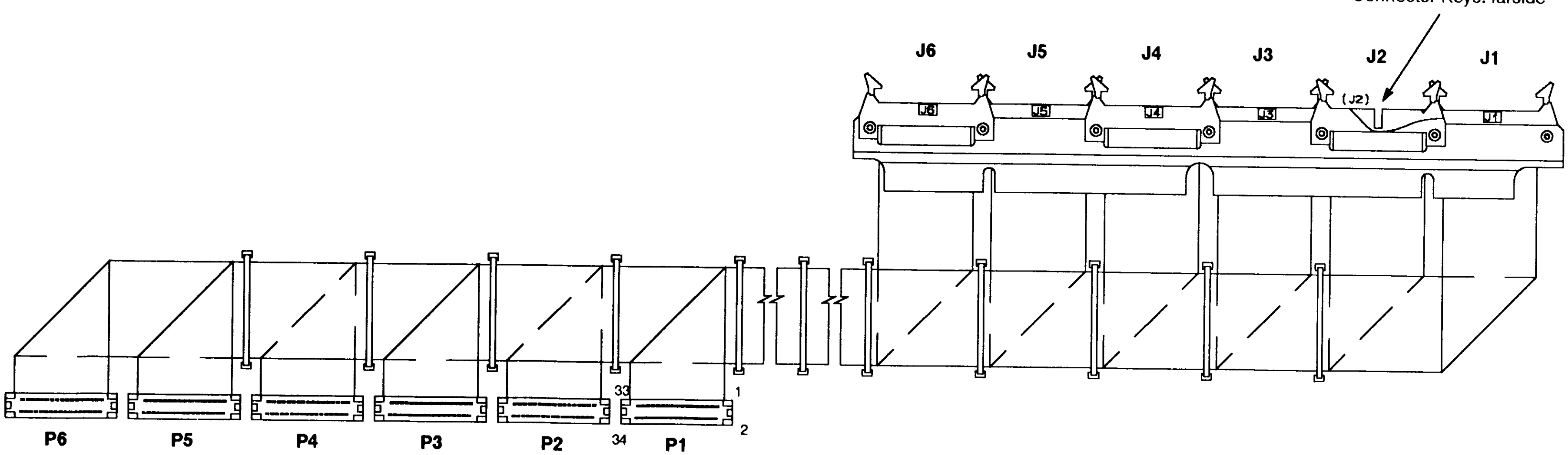
Part No.	Description
57G7204	Cable Assembly, Hmr Dr/Mech Dr

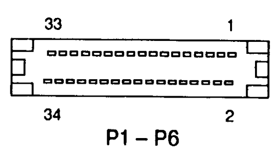


Part No.	Description
57G7205	Cable Assembly, Hmr Dr/Mech Dr 1

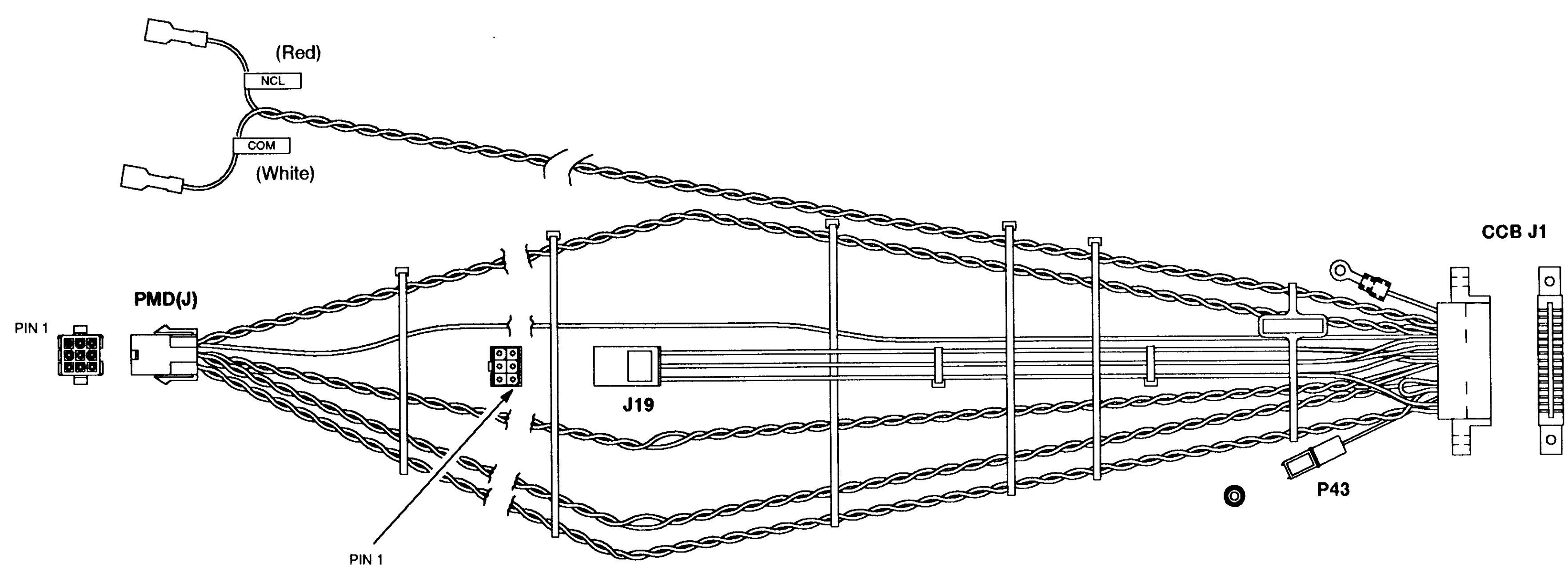








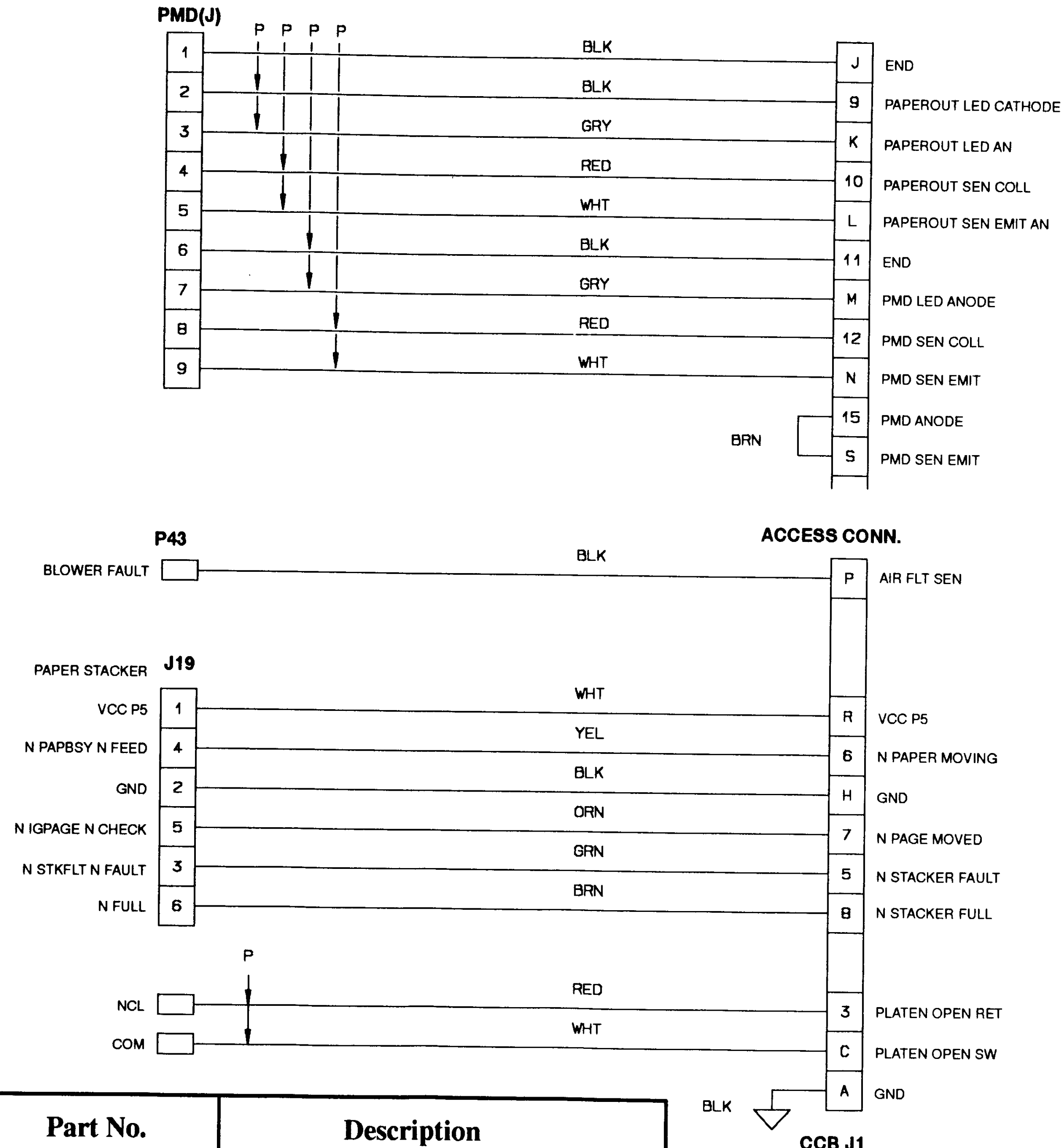
Part No.	Description
57G7206	Cable Assembly, Hammer Bank



Termination Table

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

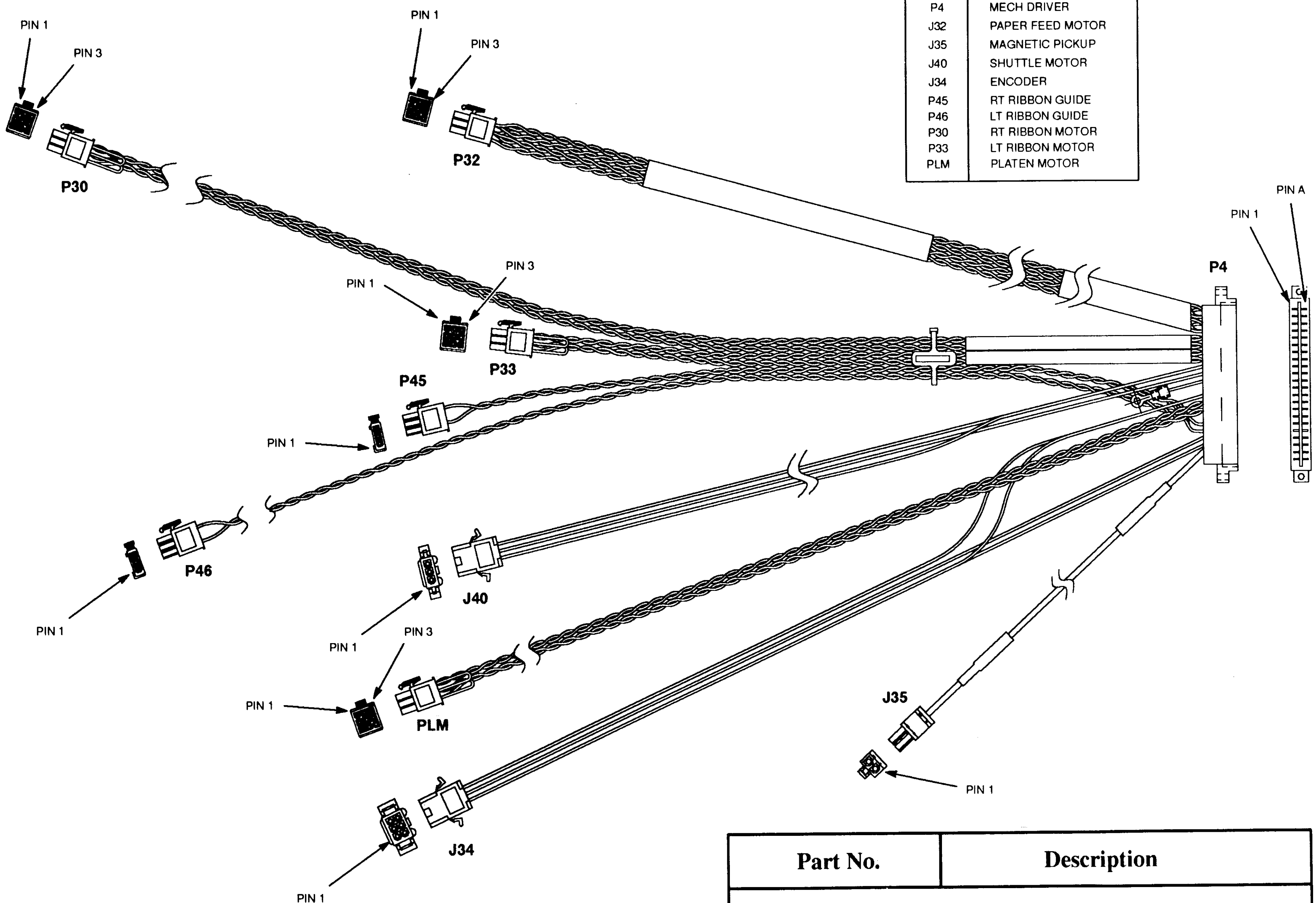
Part No.	Description
57G7207	Sensor Harness Assembly (Continued on next page.)



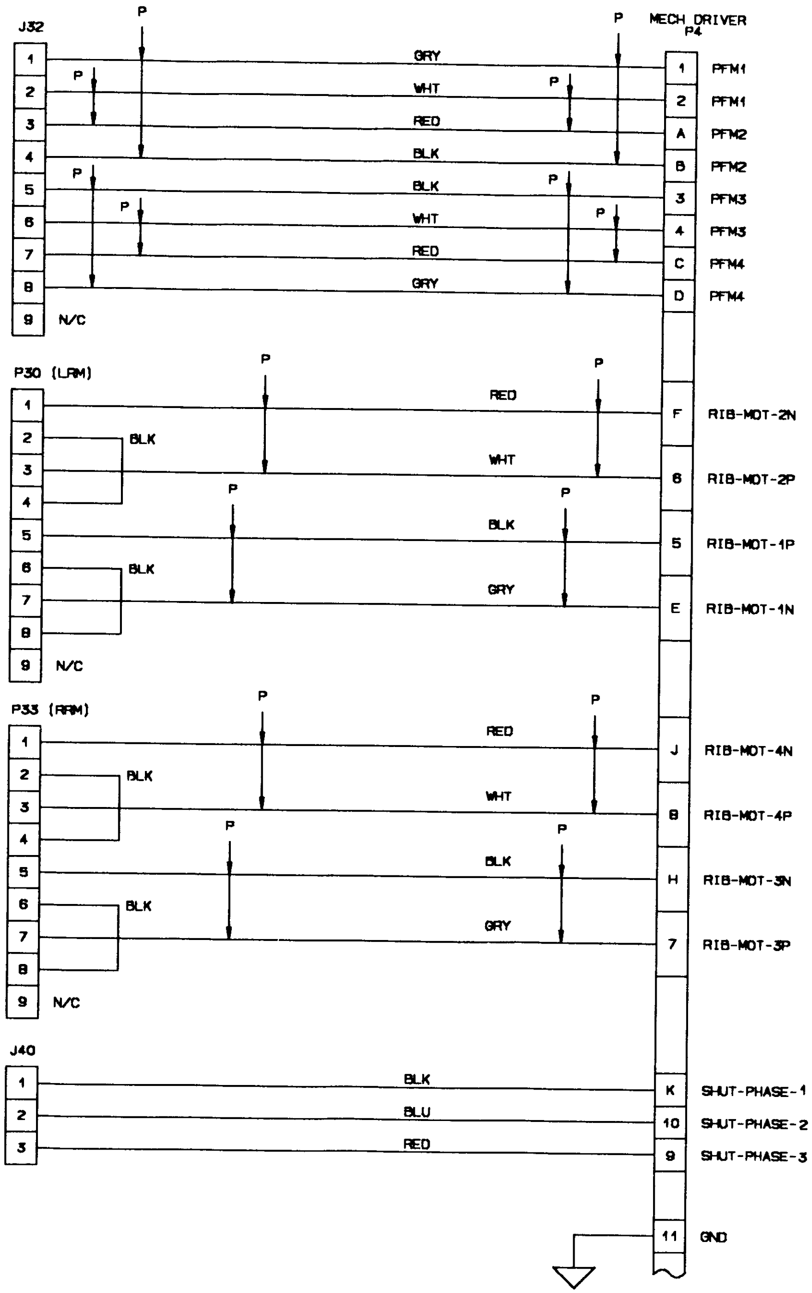
Part No.	Description
57G7207	Sensor Harness Assembly (Continued from previous page.)

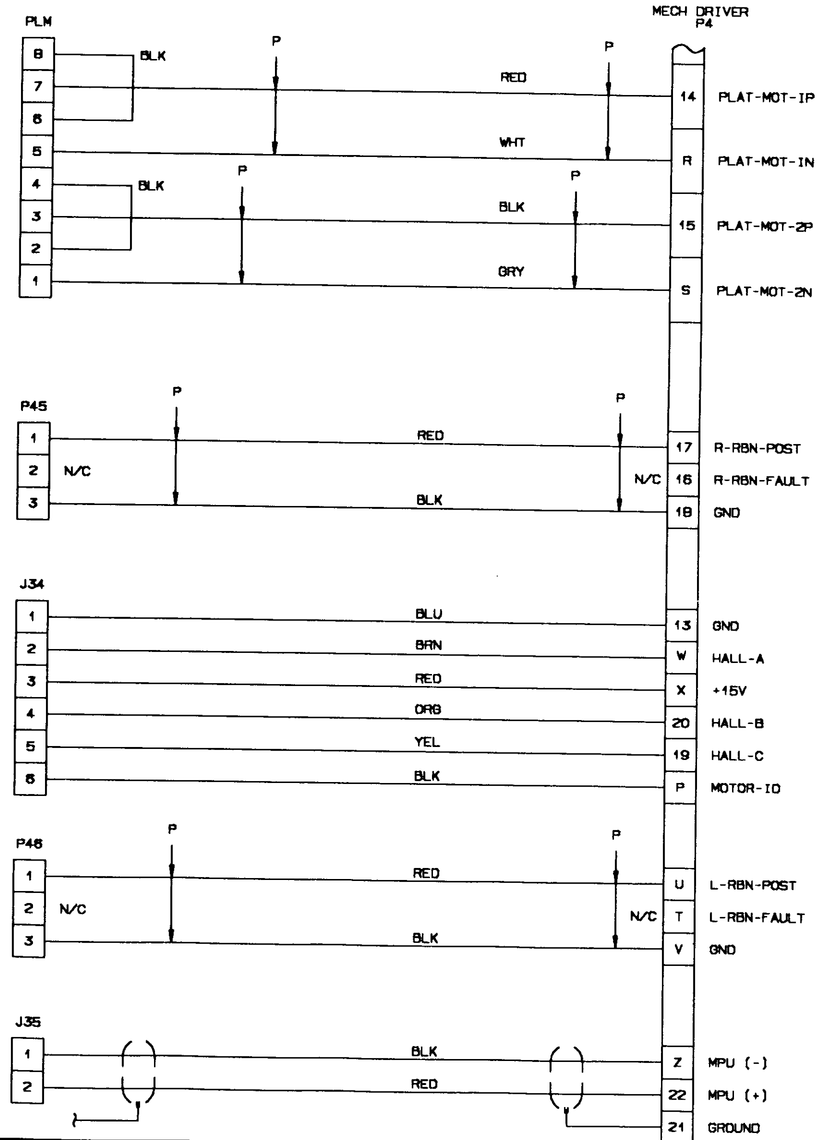
Termination Table

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

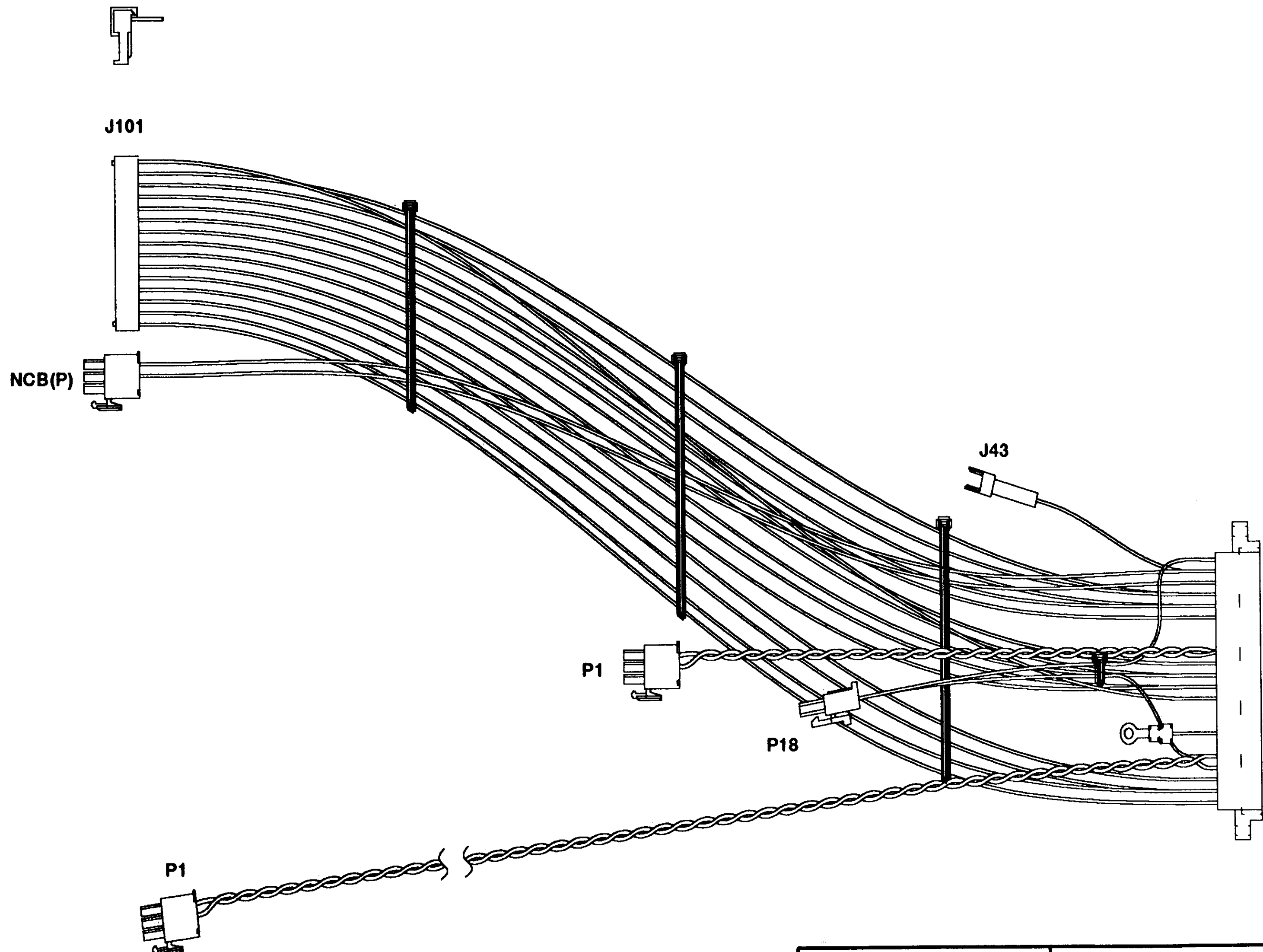


Part No.	Description
57G7208	Wire Harness, Main (Continued on next page.)

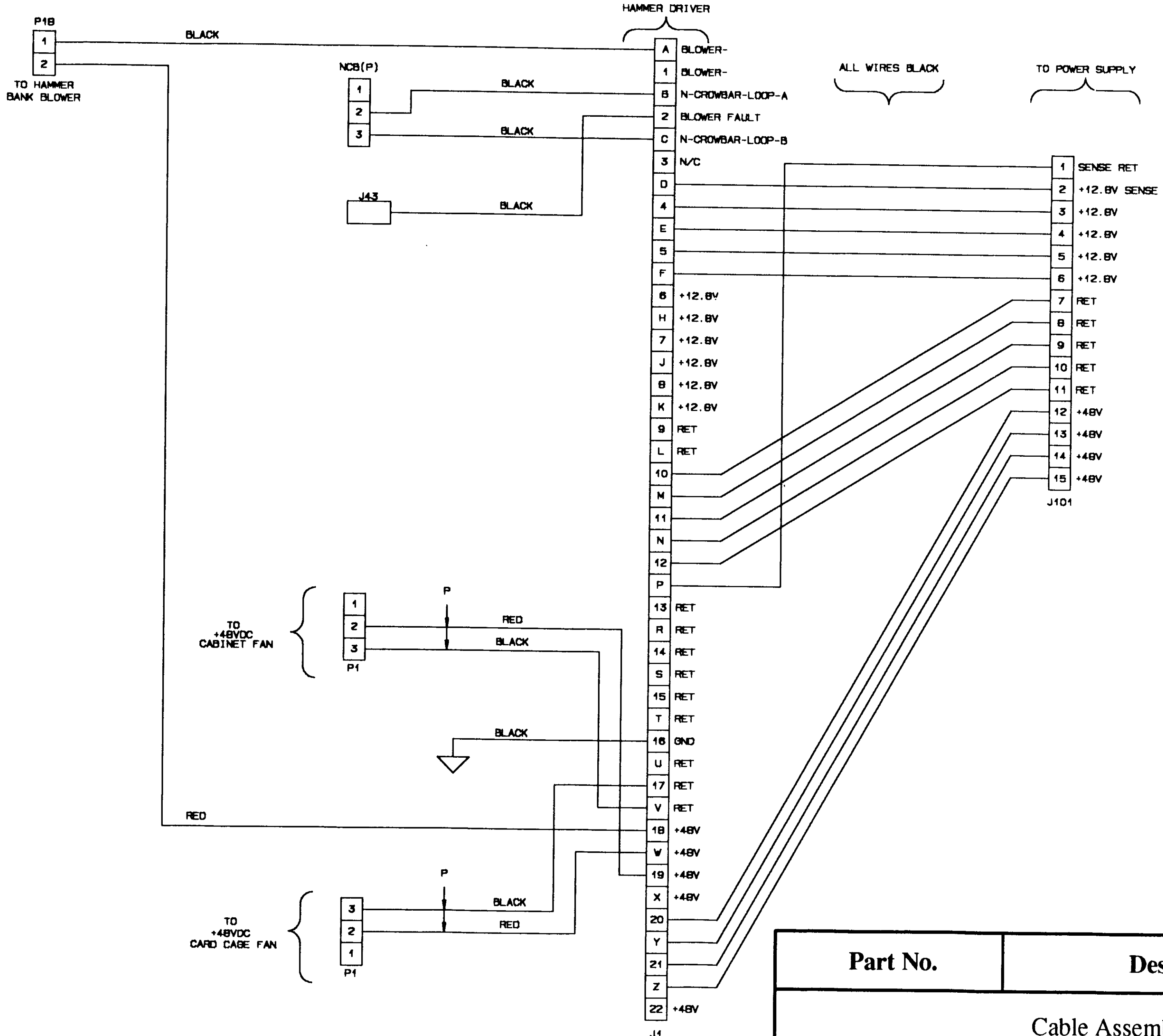




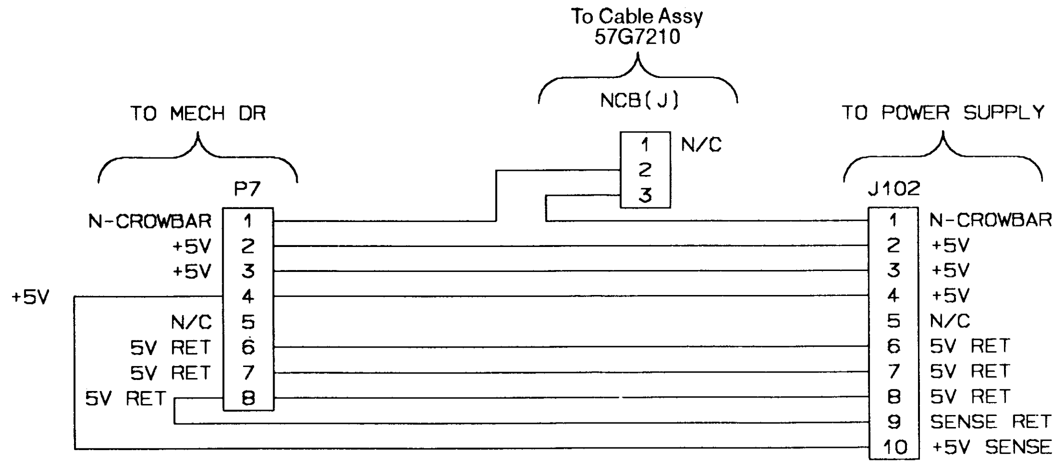
Part No.	Description
57G7208	Wire Harness, Main (Continued from previous page.)

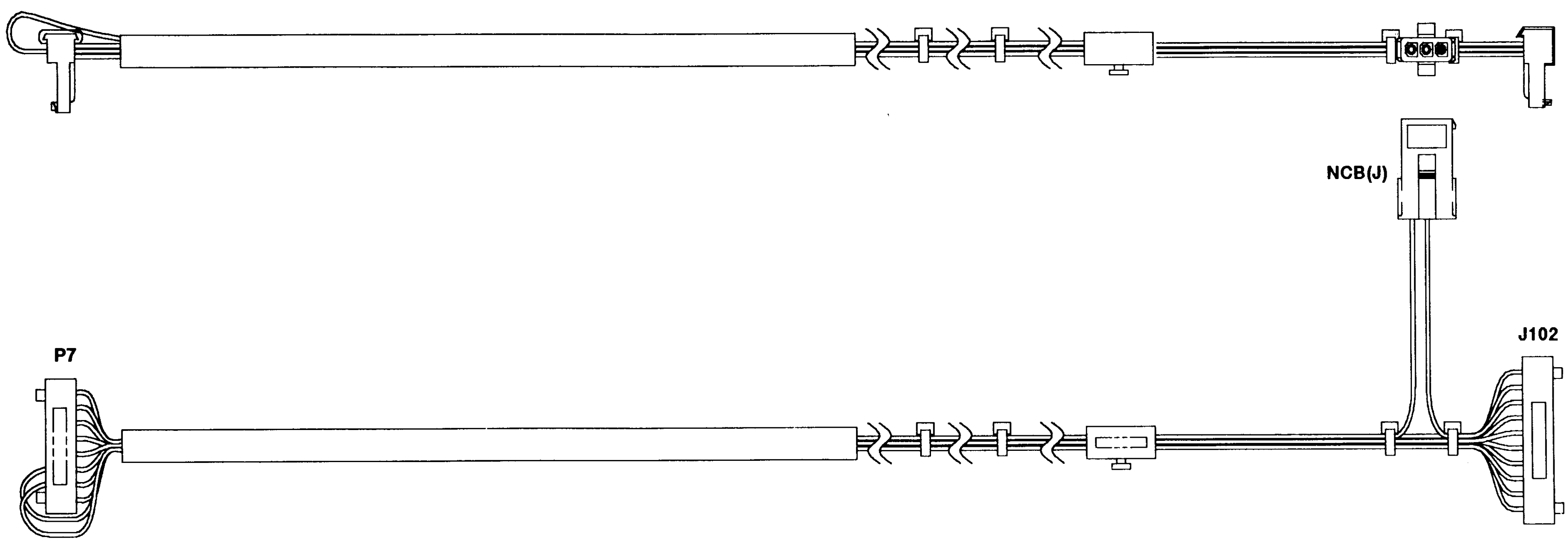


Part No.	Description
57G7210	Cable Assembly, High Voltage, Power Supply (Continued on next page.)

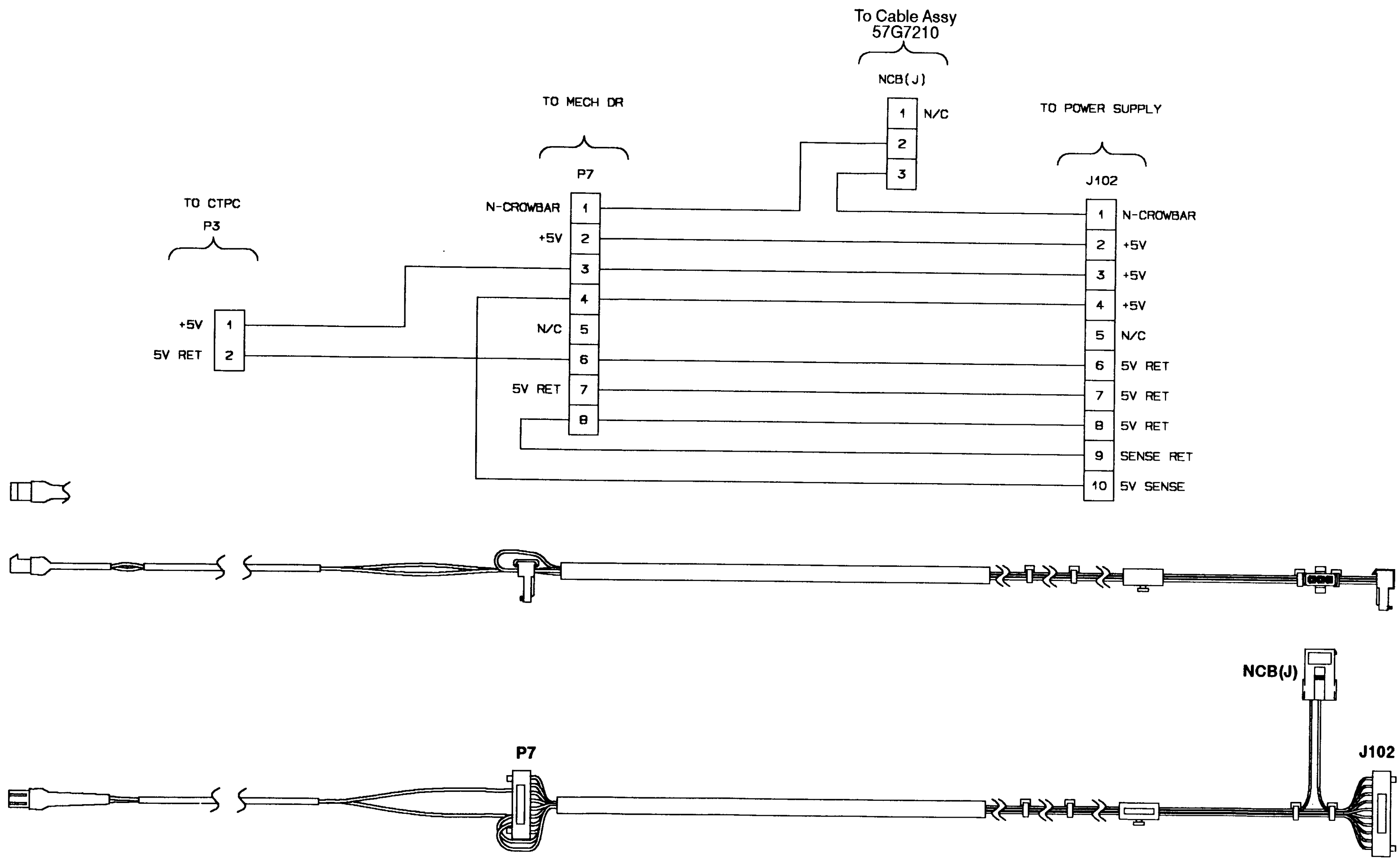


Part No.	Description
57G7210	Cable Assembly, High Voltage, Power Supply (Continued from previous page.)

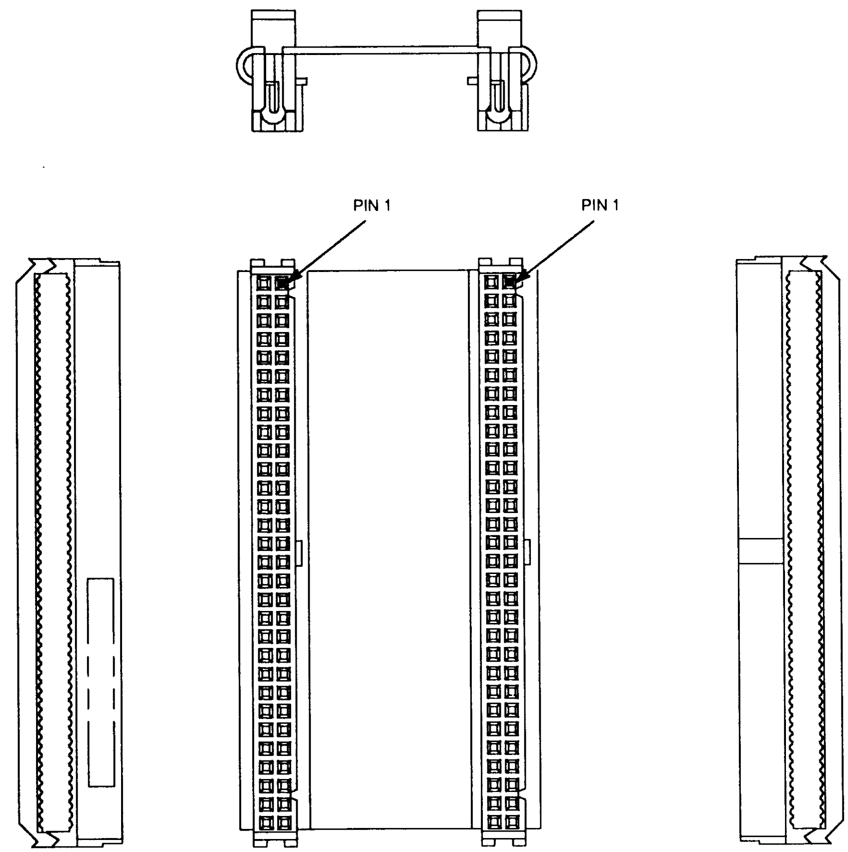




Part No.	Description
57G7294	Cable Assembly, +5 V, Power Supply/ Mech



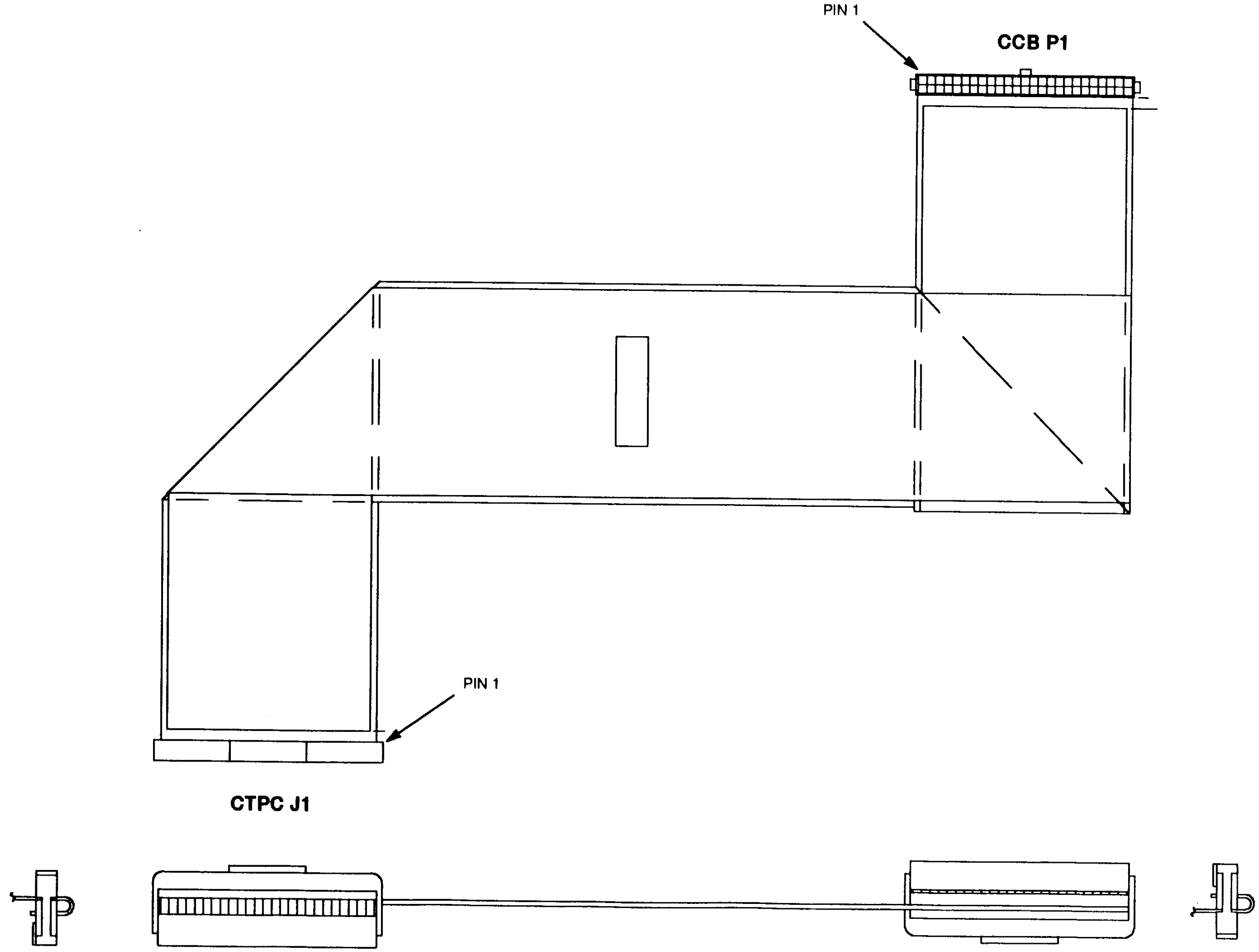
Part No.	Description
57G7295	Cable Assembly, Power, 5V, CTPC



Part No.	Description
57G1454	Cable Assembly, CCB/Mech. Dr.

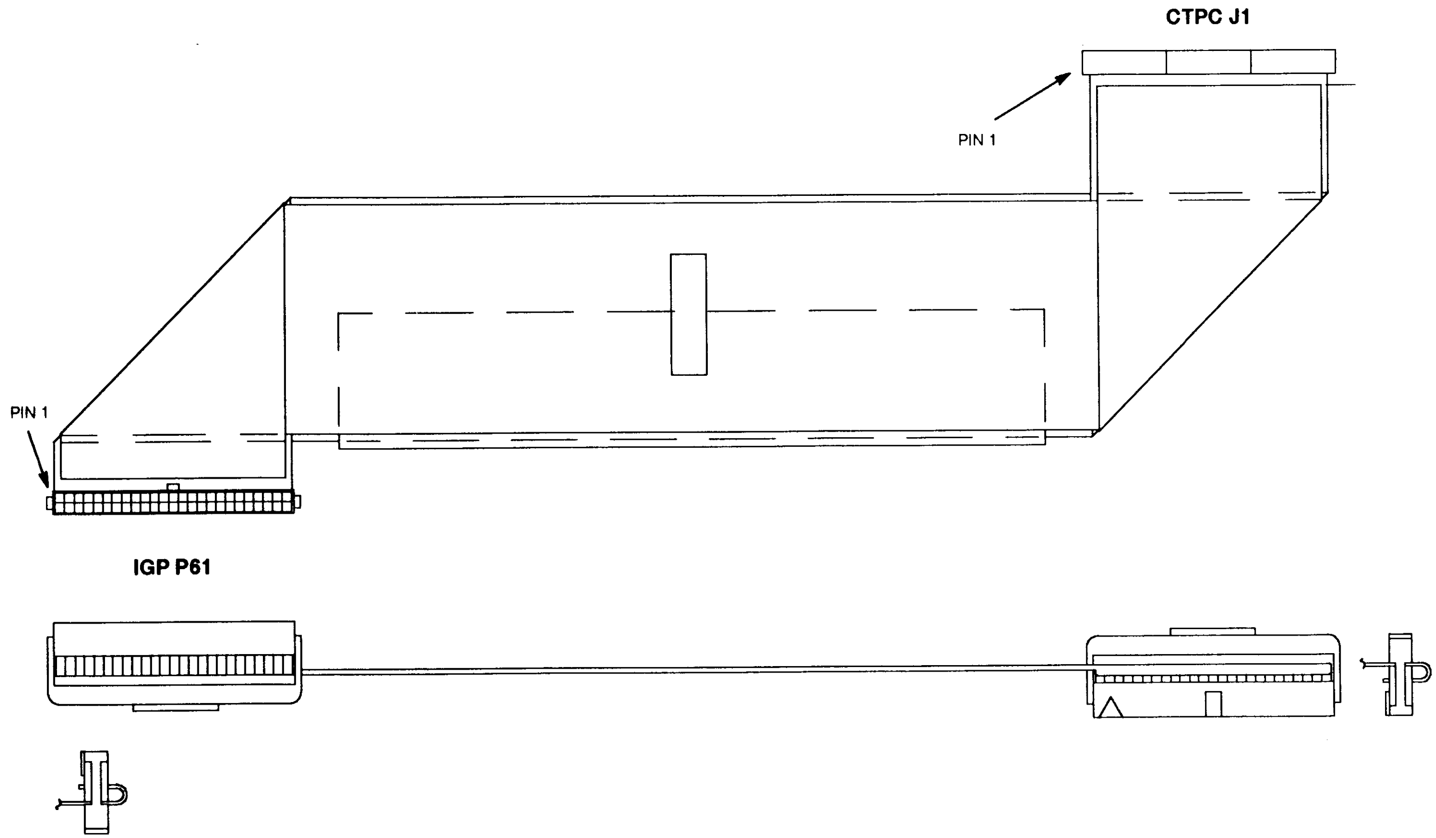
Wire Table

Wire No.	Reference Designator CTPC J1 From:	Reference Designator CCB P1 To:
1	Pin 1	Pin 1
2	Pin 2	Pin 2
3	Pin 3	Pin 3
4	Pin 4	Pin 4
5	Pin 5	Pin 5
6	Pin 6	Pin 6
7	Pin 7	Pin 7
8	Pin 8	Pin 8
9	Pin 9	Pin 9
10	Pin 10	Pin 10
11	Pin 11	Pin 11
12	Pin 12	Pin 12
13	Pin 13	Pin 13
14	Pin 14	Pin 14
15	Pin 15	Pin 15
16	Pin 16	Pin 16
17	Pin 17	Pin 17
18	Pin 18	Pin 18
19	Pin 19	Pin 19
20	Pin 20	Pin 20
21	Pin 21	Pin 21
22	Pin 22	Pin 22
23	Pin 23	Pin 23
24	Pin 24	Pin 24
25	Pin 25	Pin 25
26	Pin 26	Pin 26
27	Pin 27	Pin 27
28	Pin 28	Pin 28
29	Pin 29	Pin 29
30	Pin 30	Pin 30
31	Pin 31	Pin 31
32	Pin 32	Pin 32
33	Pin 33	Pin 33
34	Pin 34	Pin 34
35	Pin 35	Pin 35
36	Pin 36	Pin 36
37	Pin 37	Pin 37
38	Pin 38	Pin 38
39	Pin 39	Pin 39
40	Pin 40	Pin 40
41	Pin 41	Pin 41
42	Pin 42	Pin 42
43	Pin 43	Pin 43
44	Pin 44	Pin 44
45	Pin 45	Pin 45
46	Pin 46	Pin 46
47	Pin 47	Pin 47
48	Pin 48	Pin 48
49	Pin 49	Pin 49
50	Pin 50	Pin 50



Part No.	Description
57G1411	Cable Assembly, 50 Cond (CTPC/CCB)

Part No.	Description
57G1574	Cable Assembly, 50 Cond (CTPC/IGP)



Wire Table

Wire No.	Reference Designator CTPC J1 From:	IGP P61 To:
1	Pin 1	Pin 1
2	Pin 2	Pin 2
3	Pin 3	Pin 3
4	Pin 4	Pin 4
5	Pin 5	Pin 5
6	Pin 6	Pin 6
7	Pin 7	Pin 7
8	Pin 8	Pin 8
9	Pin 9	Pin 9
10	Pin 10	Pin 10
11	Pin 11	Pin 11
12	Pin 12	Pin 12
13	Pin 13	Pin 13
14	Pin 14	Pin 14
15	Pin 15	Pin 15
16	Pin 16	Pin 16
17	Pin 17	Pin 17
18	Pin 18	Pin 18
19	Pin 19	Pin 19
20	Pin 20	Pin 20
21	Pin 21	Pin 21
22	Pin 22	Pin 22
23	Pin 23	Pin 23
24	Pin 24	Pin 24
25	Pin 25	Pin 25
26	Pin 26	Pin 26
27	Pin 27	Pin 27
28	Pin 28	Pin 28
29	Pin 29	Pin 29
30	Pin 30	Pin 30
31	Pin 31	Pin 31
32	Pin 32	Pin 32
33	Pin 33	Pin 33
34	Pin 34	Pin 34
35	Pin 35	Pin 35
36	Pin 36	Pin 36
37	Pin 37	Pin 37
38	Pin 38	Pin 38
39	Pin 39	Pin 39
40	Pin 40	Pin 40
41	Pin 41	Pin 41
42	Pin 42	Pin 42
43	Pin 43	Pin 43
44	Pin 44	Pin 44
45	Pin 45	Pin 45
46	Pin 46	Pin 46
47	Pin 47	Pin 47
48	Pin 48	Pin 48
49	Pin 49	Pin 49
50	Pin 50	Pin 50

B Acronyms and Signal Mnemonics

NOTE: Signal mnemonics with initial letter "N" are negative true, all others are positive true. For example, a signal called SIG is positive (high) true. NSIG or N_SIG or N–SIG indicates negative (low) true.

ACRONYM/ MNEMONIC	DEFINITION
ACK	Acknowledge
AN	Anode
ASIC	Application–Specific Integrated Circuit
ATTN	Attention
BPS	Bits per second
CA	Cathode
CC	Card Cage
CCB	Common Controller Board
CCF	Card Cage Fan
CHNG	Change
CLK	Clock
CO	Cover Open
COLL	Collector
CONTLR	Controller
CPI	Characters Per Inch
CT	Same as CTPC
CTPC	Coax/Twinax Integrated Interface
CTS	Clear to Send
DCD	Data Carrier Detect

DIAG	Diagnostic
DIFF	Differential
DMA	Direct Memory Access
DP	Data Processing, DataProducts
DPMC	Dot Plucker Memory Controller
DPU	Data Processing Unit
DRAM	Dynamic Random–Access Memory
DRVR	Driver
DSR	Data Set Ready
DTR	Data Terminal Ready
EMIT	Emitter
EPROM	Electrically Programmable Read–Only Memory
ERR	Error
EX	Exhaust, Extra
EXF	Exhaust Fan
FD	Feed
FLT	Fault
FP	Front Panel (Operator Panel)
FTIC	Fire Timer Integrated Circuit
GND	Ground
HB	Hammer Bank
HBF	Hammer Bank Fan
HD	Hammer Driver
HDIC	Hammer Driver Integrated Circuit
IC	Integrated Circuit
ID	Identification
INT	Interrupt
(J)	Jack connector
L	Left
LCD	Liquid Crystal Display

LED	Light Emitting Diode
LPI	Lines Per Inch
MCH	Mechanism
MH	Mounting Hole, Main Harness
MOT	Motor
MPU	Magnetic Pick Up
N	Negative True
N–	Negative True
N_	Negative True
NC	Not Connected
NVRAM	NonVolatile Random–Access Memory
P5	+ 5 V dc
(P)	Pin connector
P(1), P(2), etc.	Parallel data 1, data 2, etc.
PAL	Programmable Array Logic
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
PE	Printer Error or Paper Empty
PER	Peripheral Device
PFC	Paper Feed Controller
PFM	Paper Feed Motor
PI	Paper Instruction
PLAT	Platen
PLM	Platen Motor
PMD	Paper Motion Detect
PO	Paper Out
PPR	Paper
PROM	Programmable Read–Only Memory
PS	Power Supply
PS5	Power Supply + 5 Volt
R	Right
RBN	Ribbon
RD	Read

RET .... Return

RG .... Ribbon Guide

RM .... Ribbon Motor

RPF .... Reverse Paper Feed

RQ .... Request

RSP .... Ribbon and Shuttle Processor

RST .... Reset

RTPU .... Real–Time Processing Unit

RTS .... Request to Send

RXD .... Receive Detect

SCS .... SNA Character Stream

SEC .... Security (Key)

SEL .... Select

SEN .... Sense, Sensor

SHH .... Shuttle Hall (Effect)

SHM .... Shuttle Motor

SHUT .... Shuttle

SLCT .... Select (On–line)

SNA .... Systems Network Architecture

SRAM .... Static Random–Access Memory

SW .... Switch

TXD .... Transmit Detect

UART .... Universal Asynchronous Receiver/Transmitter

UDPH .... Upper Drive Phase

USART .... Universal Synchronous/Asynchronous Receiver/Transmitter

V_{CC} .... 5 Volts DC

V_{DD} .... Voltage at Drain

V_{SS} .... Voltage at Source

WR .... Write

XMT .... Transmit

C PROM Locations

Contents

Coax/Twinax Integrated Interface (CTPC) Board C–2
Common Controller Board (CCB DX) C–3
IGP–2X0 Board C–4
Mechanism Driver Board C–5

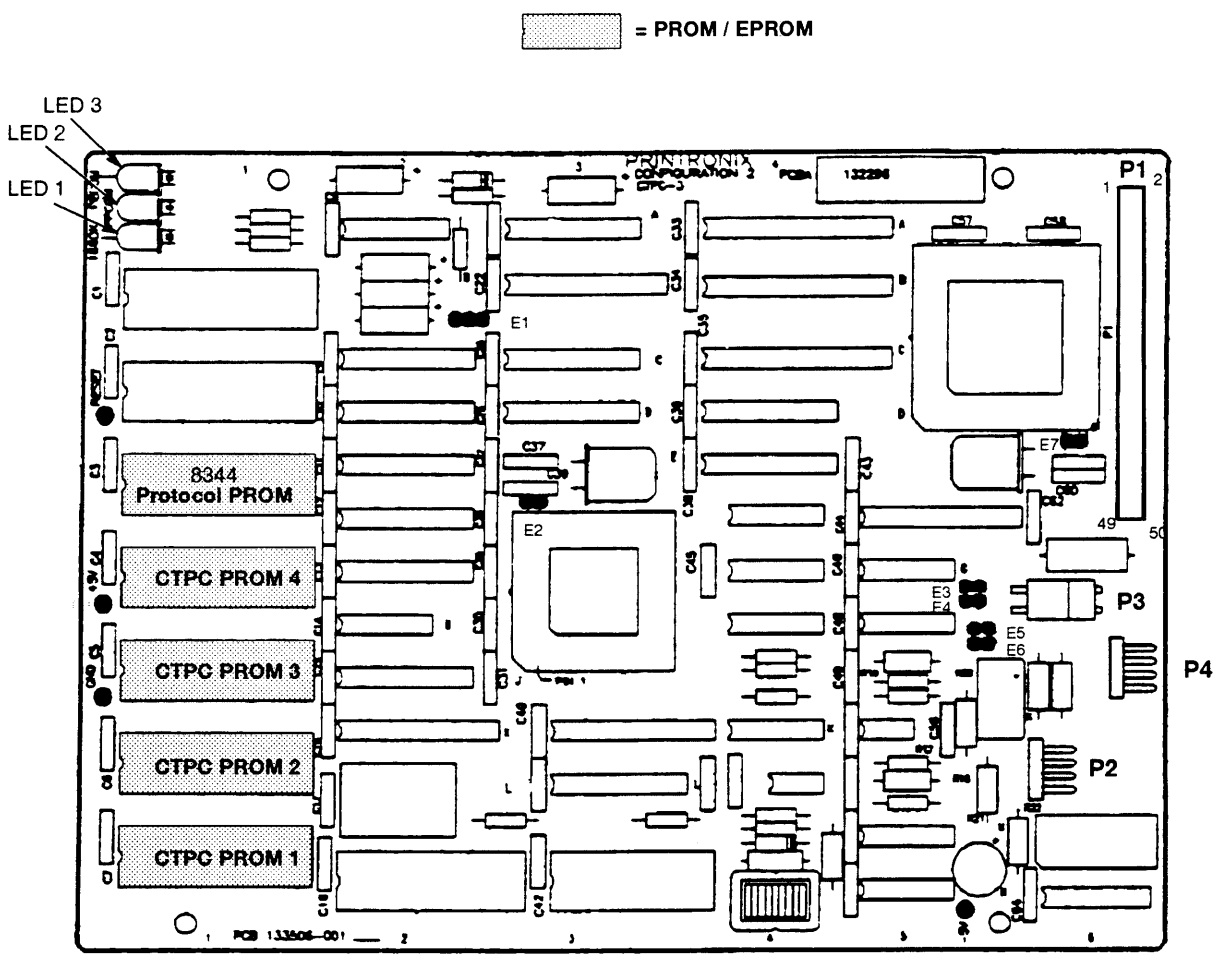


Figure C–1. Coax/Twinax Integrated Interface (CTPC) Board

PROM Kit, CT0: 57G7179
PROM Kit, A00: 57G7255

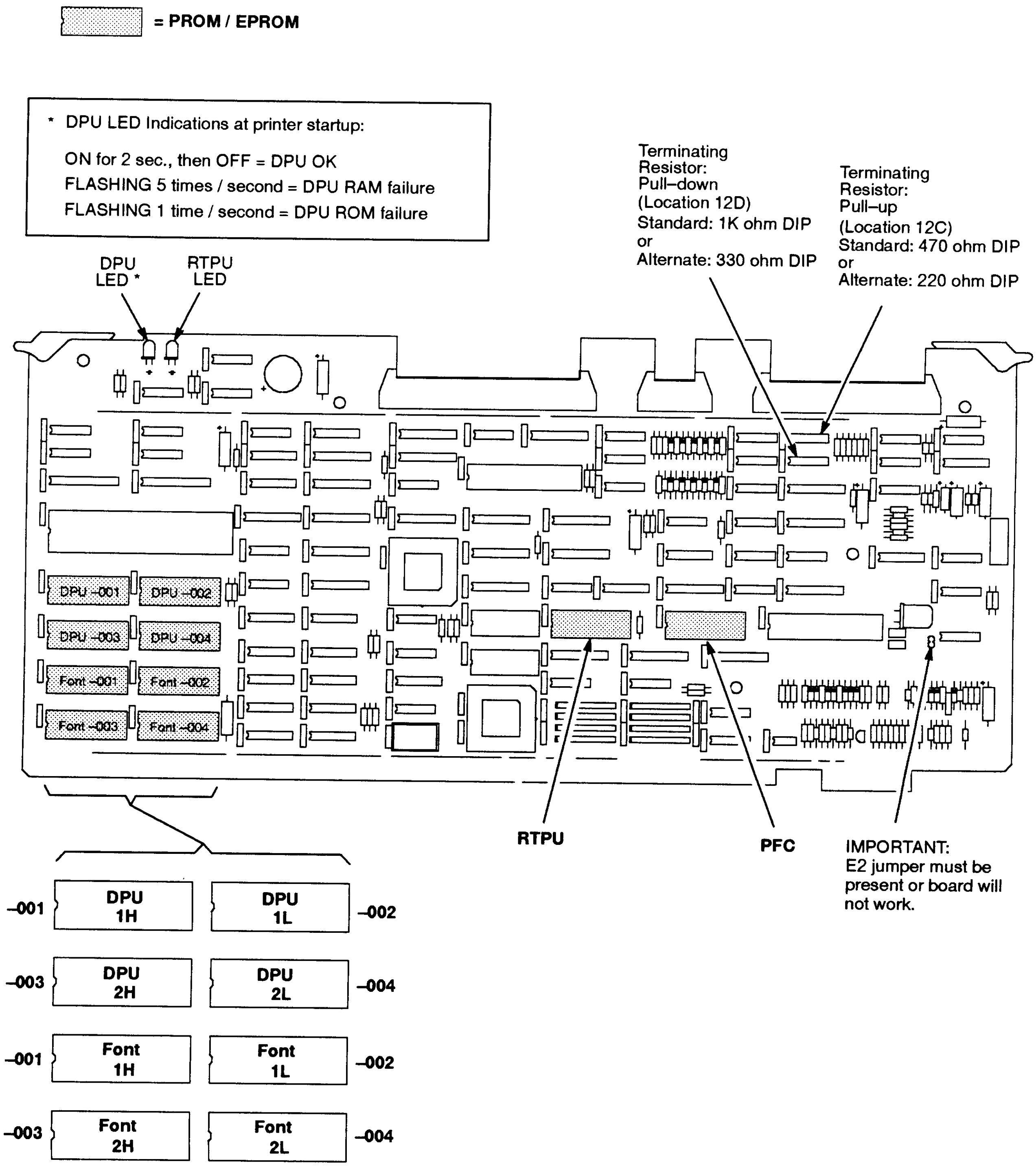


Figure C–2. Common Controller Board (CCB DX)

Field Kit:
IGP–200: 57G3833
IGP–210 (Code V): 57G3834

PROM Kit:
IGP–200: 57G3777
IGP–210 (Code V): 57G3778

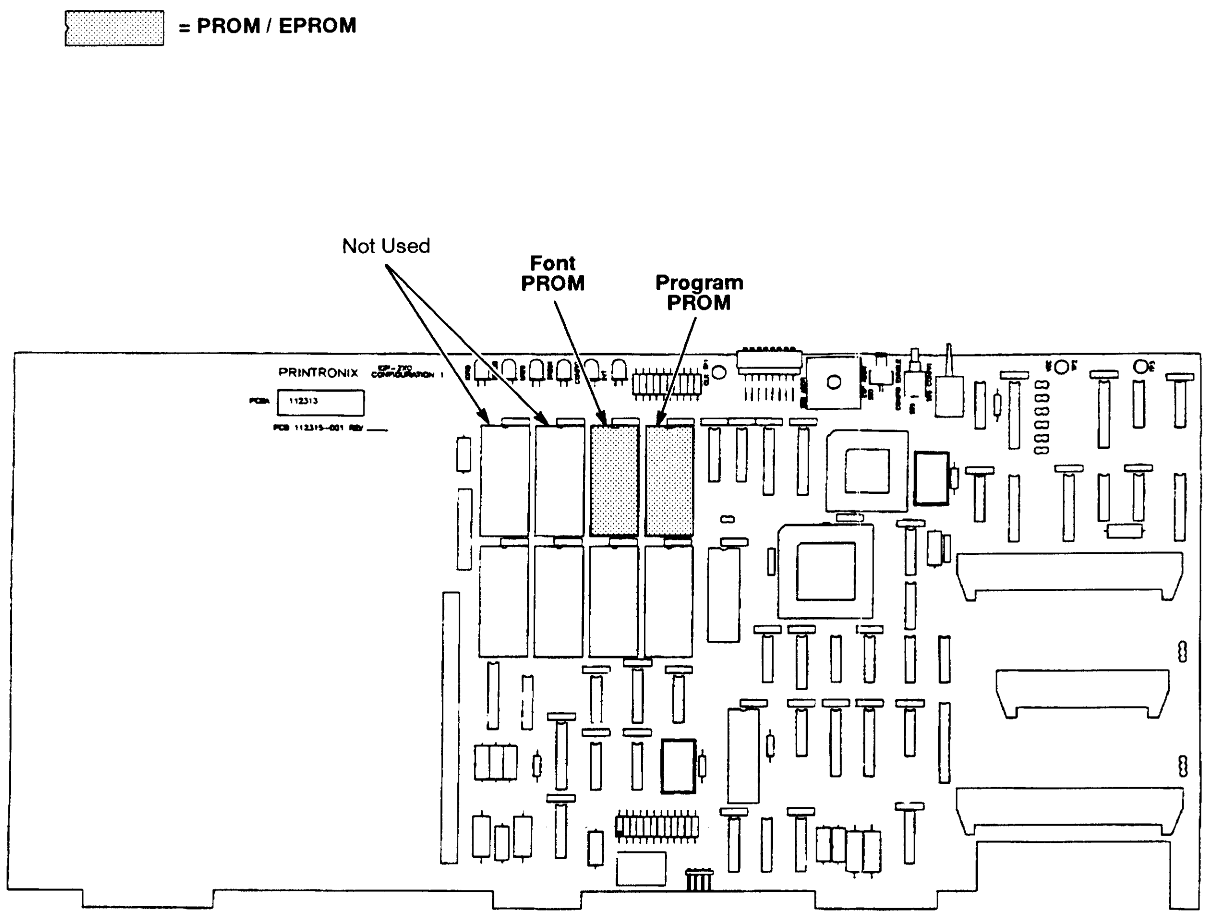


Figure C–3. IGP–2X0 Board

= PROM / EPROM

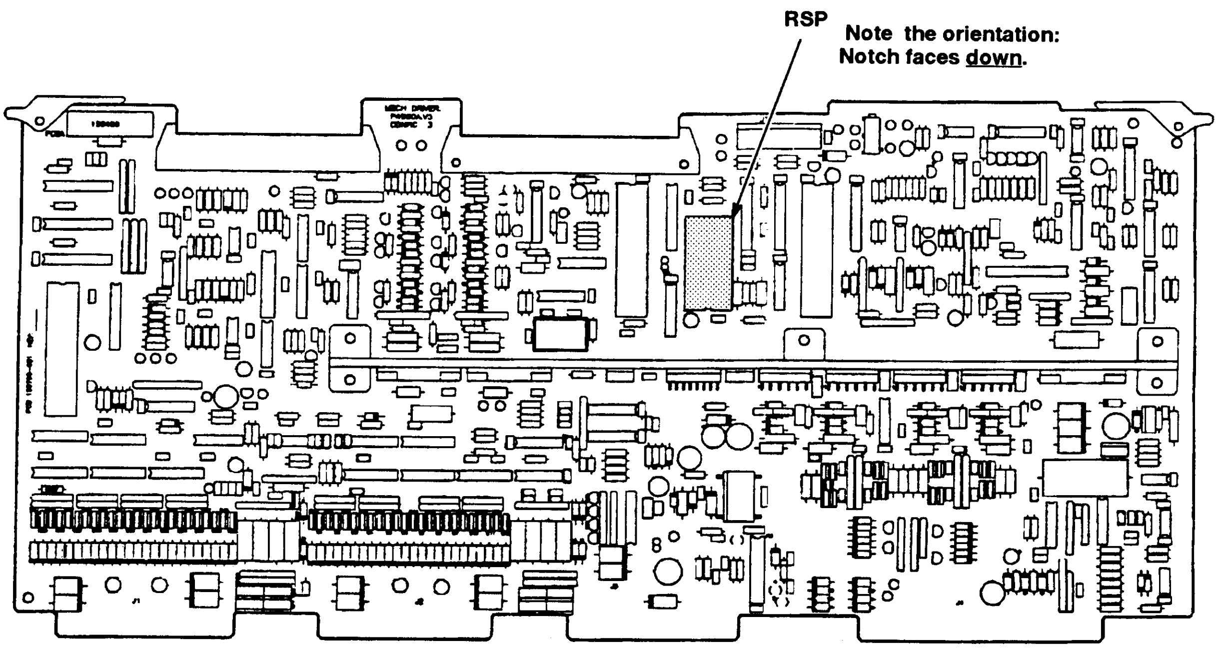


Figure C–4. Mechanism Driver Board

D Printer Specifications

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Paper Specifications D–2

Paper D–2

Labels D–2

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Data Input Rate D–5

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Ribbon Specifications

NOTE: Use only the ribbons listed below:

IBM General Purpose Ribbon	Part No. 1040995
IBM High Contrast Ribbon	Part No. 1040998

Paper Specifications

Paper

Type:	Edge–perforated, fan–fold, 3 to 16 inches (7.62 to 40.64 cm) wide, 1 to 12 inches (2.54 to 30.48 cm) long
Thickness:	Single–part: 15 to 100 pound (6.80 to 45.36 kg) stock; Multi–part: 1– to 6–part forms, upper plies 12 lbs [5.44 kg] maximum
Sheet Thickness:	0.025 inch (0.0635 cm) maximum
Drive:	Adjustable tractors, 8–pin engagement
Slew Rate:	20 in/sec (50.8 cm/sec) maximum

Labels

On Backing:	One–part, continuous, perforated, fan–folded bac form. Labels must be placed at least 1/6 inch (0.42 cm) from the fan–fold perforation. Backing adhesive must not be squeezed out during printing.
Sheet Size:	3 to 16 inches (7.62 to 40.64 cm) wide, including the two standard perforated tractor feed strips. A maximum sheet length of 12 inches (30.48 cm) between top and bottom perforations.
Thickness:	Not to exceed 0.025 inch (0.064 cm) (including backing sheet)

Printer Dimensions

Height:	42 inches (105.9 cm)
Width:	34 inches (86.4 cm)
Depth:	29 inches (72.4 cm)
Weight:	330 pounds (150 kg) (Unpacked)

Environmental Characteristics

Temperature

Operating	41° to 104° F (5° to 40° C) up to 5000 feet (1524 meters) 41° to 90° F (5° to 32° C) up to 8000 feet (2438 meters)
Storage	–40° to 158° F (– 40° to 70° C)

Relative Humidity

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

Interfaces

IBM 6412–A00 (ASCII)

Type:	Two resident parallel, one resident serial
Logic Levels:	TTL/EIA–232D
Data Format:	ASCII
Compatibility:	PC Parallel, EIA–232D, Dataproducts
Transfer Rates:	Up to 200K bytes on parallel interfaces Up to 19200 baud on serial interface

IBM 6412–CT0 (Coax/Twinax SCS)

Type:	Coaxial/Twinaxial Integrated Interface (CT)
Data Format:	EBCDIC

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)

PC Parallel	Up to 200,000 characters per second
RS–232	Up to 19,200 Baud
Dataproducts	Up to 500,000 characters per second

Radio Frequency Interference (RFI)

Radio Frequency Interference tested/certified to RFI standards FCC 15.B Class A; VDE 0871 Class B; CSA C108.8–M1983 Class A.

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 D–1 charts typical printing rates for the IBM 6412 printer. 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 D–1. Printing Rates

Print Dimensions			Performance		
Dot Density (DPI) NOTE 1	Characters per Inch (CPI)	Dot Matrix NOTE 2	Uppercase Only	Descenders & Underline	Plot Mode
			Lines Per Minute	Lines Per Minute	Inches Per Minute
Near Letter Quality (NLQ) 90 (180) X 96	10 12 15	7 (13) X 9 + 3 6 (11) X 9 + 3 5 (9) X 9 + 3	480	370	50
Data Processing (DP) 60 (120) X 72	10 12 13.3 15 17.1	5 (9) X 7 + 2 4 (7) X 7 + 2 4 (7) X 7 + 2 3 (5) X 7 + 2 3 (5) X 7 + 2	900	720	100
Fast Draft 60 (120) X 48	10 12 13.3	5 (9) X 5 + 1 4 (7) X 5 + 1 4 (7) X 5 + 1	1200	1030	150

NOTE 1 A (B) X C, where: A is maximum horizontal dot density
B is horizontal placement resolution
C is vertical dot density

NOTE 2 D (E) X F + G, where: D is maximum number of dots that may be placed on
E horizontal dot positions
F is number of vertical dots for uppercase symbols
G is number of dots available for descenders

Duty Cycle

The IBM 6412 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 *Setup Guide*.

E Power Cords

Part No.	Units	Description
57G7261	1	Power Cord, 110V 6 Feet Non–Lock, U.S., Canada
46F2112	1	Power Cord, 220V 6 Feet Non–Lock, U.S., Canada
57G7260	1	Power Cord, 110V 8 Feet Non–Lock, U.S., Canada, Brazil, Cayman Islands, Costa Rica, Dominican Republic, El Salvador, Guatemala, Mexico, Liberia, Panama, Saudi Arabia, Phillipines, Honduras, Peru, Columbia, Nicaragua, Bermuda, Bahamas, Barbados, Bolivia, Guyana, Ecuador, Haiti, Jamaica, Venezuela, Netherlands, Antilles, Trinidad, Suriname, Taiwan, Tobago, Saint Lucia, Indonesia
1838573	1	Power Cord, 220V 12 Feet Non–Lock, U.S., Canada, Honduras, Nicaragua, Peru, Phillipines, Saint Lucia, Taiwan, Thailand, Tobago, Panama
73F4932	1	Power Cord, 220V 12 Feet Watertight, U.S., Canada
13F9941	1	Power Cord, 12 Feet, Argentina, Australia, Colombia, New Guinea, New Zealand, Paraguay, Samoa, Uraguay
13F9979	1	Power Cord, 9 Feet, Afghanistan, Algeria, Angola, Austria, Belgium, Benin Republic/Dahomey, Bulgaria, Burundi, Cameroon, Chad, Congo/Brazzaville, Central Africa Empire, Czechoslovakia, East Germany, Egypt, Finland, France, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Korea, Lebanon, Luxembourg, Mali, Madagascar, Mauritania, Monaco, Morocco, Mozambique, Netherlands, Norway, Poland, Portugal, Rhodesia, Romania, Spain, Sudan, Sweden, Syria, Togo, Tunisia, Turkey, Upper Volta, USSR, West Germany, Yugoslavia, Zaire
13F9997	1	Power Cord, 9 Feet, Denmark
14F0015	1	Power Cord, 9 Feet, Bangladesh, Burma, Pakistan, South Africa, Sri Lanka
14F0033	1	Power Cord, 9 Feet, Bahrain, Brunei, Channel Islands, PRC, Cyprus, Hong Kong, India, Iraq, Ireland, Kenya, Kuwait, Malaysia, Malta, Nepal, Nigeria, Oman, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Arab Emirates, U.K., Zambia
14F0051	1	Power Cord, 9 Feet, Switzerland, Liechtenstein
14F0069	1	Power Cord, 9 Feet, Chile, Ethiopia, Italy, Libya
14F0087	1	Power Cord, 9 Feet, Israel
1332167	1	Power Cord, 12 Feet, Japan
57G7262	1	Power Cord, No Plug
38F8254	1	Twinax Pigtail (Not a power cord)

F 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 and Force

Multiply	By	To Obtain
pound–inch	0.11298	newton–meter (N•m)
pound–foot	1.3558	newton–meter (N•m)
newton–meter (N•m)	8.8511	pound–inch
newton–meter (N•m)	0.7376	pound–foot
pound	4.4482	Newton (N)
Newton (N)	0.22481	pound

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)

G Safety Inspection Guide

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Power Cable G–7
Power On/Off Verification G–8
Print Interlock Service Check G–8
Safety Label Check G–8

Safety Inspections

The IBM 6412 printer incorporates safety items installed to protect customers, operators, and service personnel from injury. Use this inspection guide as an aid in identifying possible unsafe conditions in the printer.

Perform the inspection steps outlined in this guide before the normal inspection for Maintenance Agreement Qualification, or any time you are instructed to make a safety inspection.

If you find any unsafe conditions, determine the severity of the hazard and whether or not you can continue the inspection without first correcting the problem.

NOTE: The correction of any unsafe condition is the customer's responsibility.

Preparation

You must have completed the "Electrical Safety Training Course for IBM Customer Engineers" (self–study course 77170 or existing level) to do the Safety Inspection.

Have the following items available:

1. *Electrical Safety for IBM Customer Engineers*, Order No. S229–8124.
2. A Fluke** meter (P/N 8496278) or similar device for resistance and voltage measurements.
3. An ECOS** Electrical Safety Tester (P/N 6339695) in the United States or a similar safety tester in other countries.

For each safety check on the following pages, do the steps in the order presented. Do not omit any steps.

Prepare the Printer for Inspection

DANGER

Always disconnect the AC power cord from the power source before performing any maintenance procedure. Failure to remove power could result in injury to you or damage to equipment. If you must apply power during maintenance, you will be instructed to so in the maintenance procedure.

1. Have the operator take the printer off–line.
2. Power off the printer.
3. Unplug the printer power cord from the customer's outlet.

Inspect Mechanical Parts

Top Cover and Doors

1. Inspect the top cover:
   a. Open the top cover. Make sure the gas spring assembly holds the cover in the open position.
   b. Lower the top cover. Make sure the operator panel is centered in the opening of the cover.
   c. Make sure the window is not cracked or broken.
   d. Make sure the seal around the top cover is not cracked or broken.
   e. Make sure the ESD (electrostatic discharge) fingers are not loose or damaged. Make sure they touch the contact strips on the frame when the cover is closed.
   f. Make sure there are no exposed or sharp edges.
   g. Make sure the wireform paper path is undamaged.
2. Inspect the front and rear cabinet doors:
   a. Make sure the seals and magnetic strips are not loose or damaged.

b. Make sure the restraining cable is attached and unbroken.

c. Make sure there are no exposed or sharp edges.

3. Open the rear cabinet door and inspect the lower rear paper path:

   a. Make sure the access panel permitting access to the I/O plate and power supply is installed.

   b. Make sure the paper stacker tray assembly is in place and undamaged.

Print Mechanism

1. Open the printer top cover.

2. Make sure the upper paper guide assembly and the wire form paper guide assembly are correctly installed and undamaged. (See page 7–32 and 7–30.)

Inspect Electrical Parts

Safety Ground Path

NOTE: Ground paths are summarized in Figure G–2.

1. Make sure the printer power cord is unplugged.

2. Remove the paper stacker assembly (page 7–32).

3. Remove seven screws and the access panel. (Refer to Figure 7–22, page 7–75.)

4. Make sure the green/yellow wire from the power supply is undamaged and is firmly attached to the ground stud on the floor of cabinet, as shown in Figure G–1.

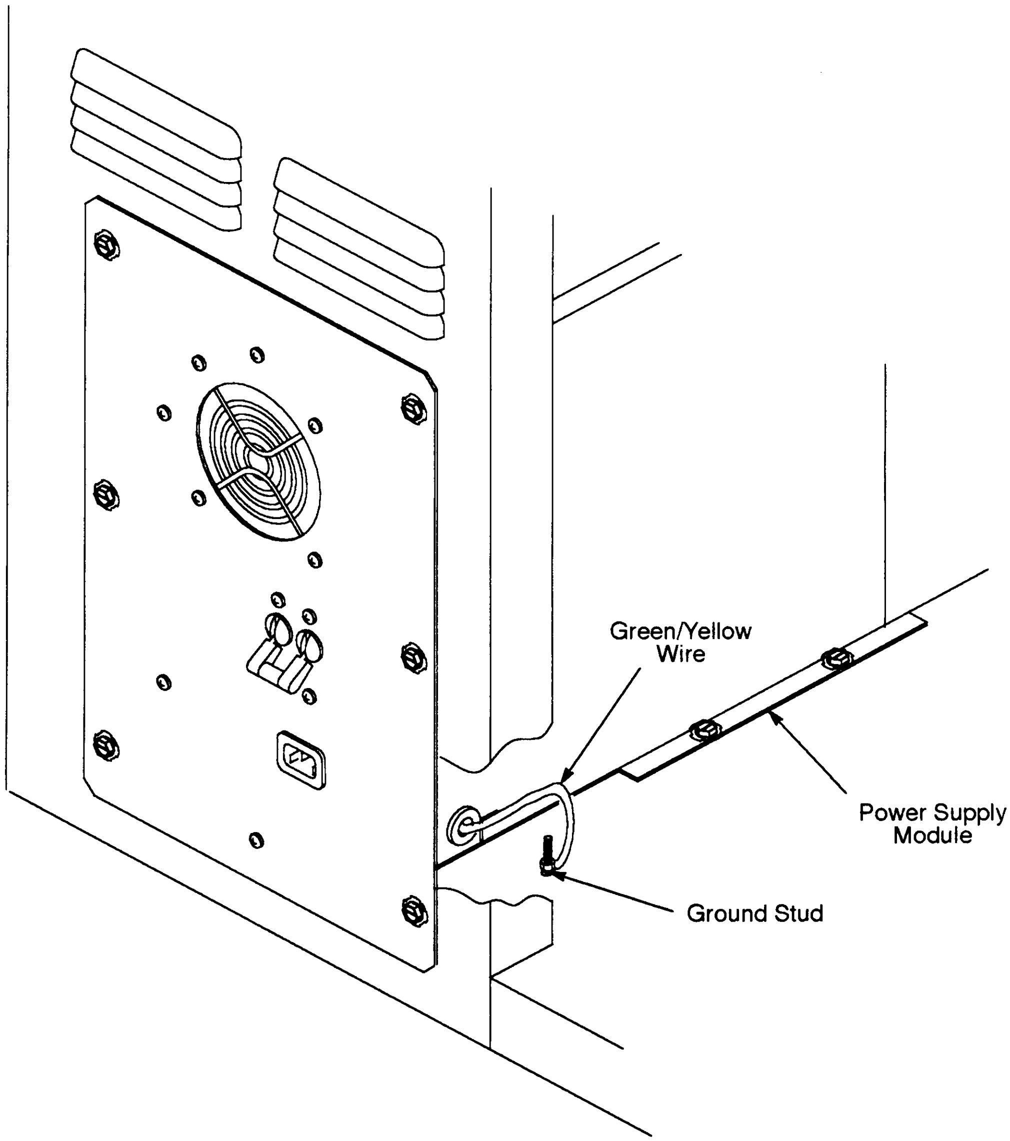


Figure G–1. Power Supply Ground Stud

5. Set a Fluke meter (P/N 8496278) or similar device to the lowest resistance scale. Measure the resistance between the power cable ground pin and the printer frame: safety ground circuits should measure 0.1 Ohm or less.

6. Install seven screws and the access panel. (Refer to Figure 7–22, page 7–75.)

7. Install the paper stacker assembly (page 7–32).

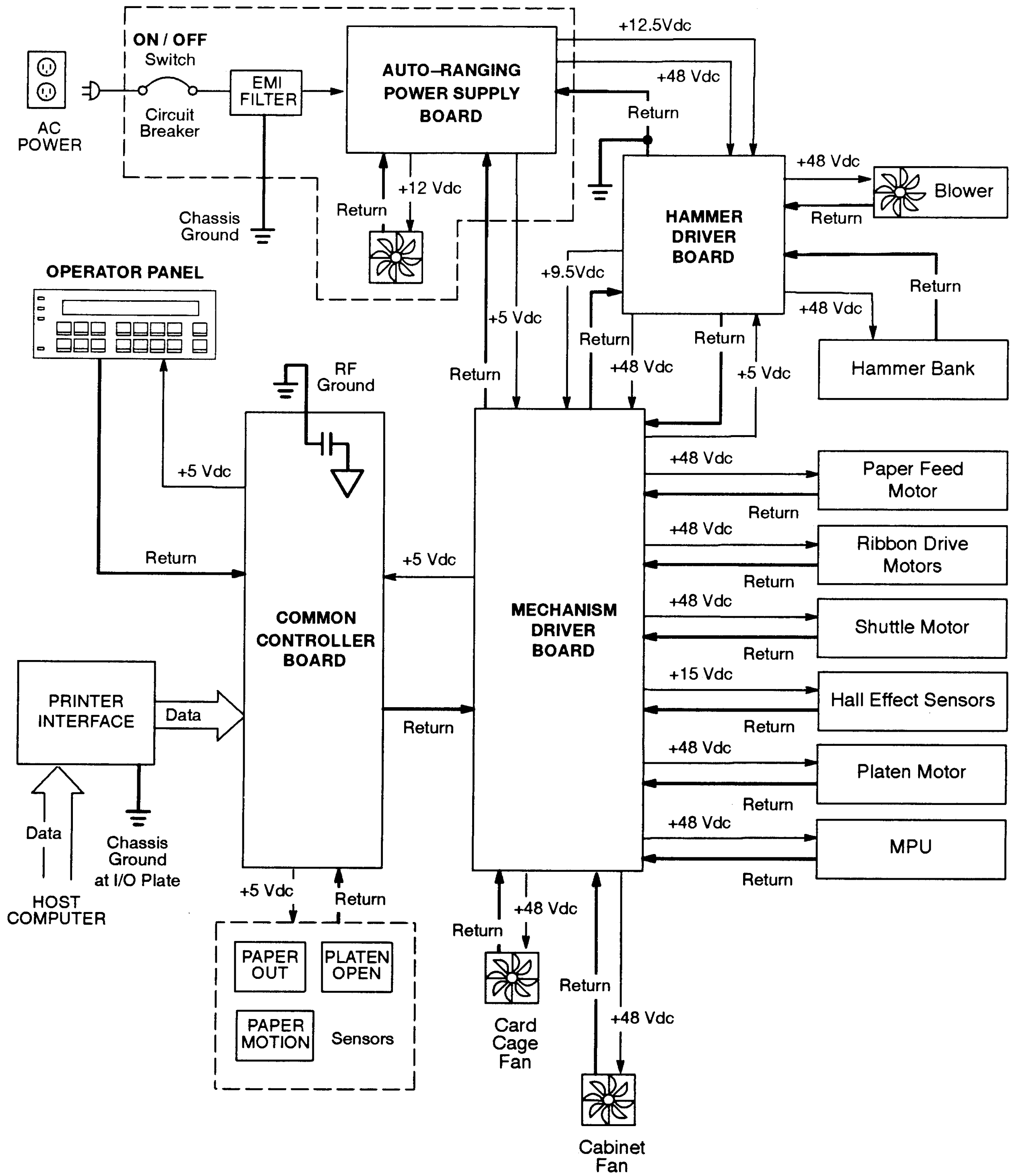


Figure G–2. Ground Path Diagram

Customer Power Source Service Check

Use an ECOS Electrical Safety Tester (P/N 6339695) in the United States or a similar safety tester in other countries.

NOTE: The ECOS tester will trip ground fault detector protected outlets. This is a good test of the ground fault detector. Reset the outlet as needed.

Plug the ECOS meter into the customer's outlet. Follow the instructions supplied with the meter to test for the following:

1. Wiring errors
2. Low voltage
3. Neutral to ground short
4. Ground path impedance
5. Neutral impedance

NOTE: The customer is responsible for correcting problems with the power source. Inform the IBM Installation Planning Representative (IPR) of any problems with the customer's power source.

Each branch circuit must be grounded for safety and correct operation of the printer. This ground must be connected either to the electrical service ground or to a suitable building ground. The printer power cable has a green or green/yellow insulated grounding conductor. This is *not* a neutral.

Power Cable

1. Make sure the power cable is not damaged.
2. Make sure the power plug is the correct type.

Power On/Off Verification

1. Make sure all covers are installed.
2. Plug the power cable into the customer's power outlet.
3. Power on the printer and watch the LCD.
4. Verify that the power–on diagnostic tests and initialization routines are successful.
5. The IBM 6412–A00 should cycle automatically to the NOT READY mode.
   The IBM 6412–CT0 should cycle automatically to the READY mode.
6. Power off the printer. Verify that the LCD goes completely blank and all fans stop.

Print Interlock Service Check

1. Power on the printer.
2. Open the printer top cover.
3. Open the platen release lever.
   The LCD should display a Platen Open message. (On the IBM 6412–A00, the audible alarm should sound if it is enabled.)
4. On the IBM 6412–A00, press **Stop**. The audible alarm should stop.
5. Close the platen release lever.
   On the IBM 6412–A00, the fault message should clear automatically.
   On the IBM 6412–CT0, press **Stop**. The fault message should clear.

Safety Label Check

1. Power off the printer.
2. Open the printer top cover.
3. Remove the cam cover. (See Figure 7–9, page 7–49.)
4. Verify that the safety label (P/N 19G0637) is attached to the base support.

H Hammer and Coil Wire Data

Hammer Coils 1–40 (Hammer Driver Board) H–2

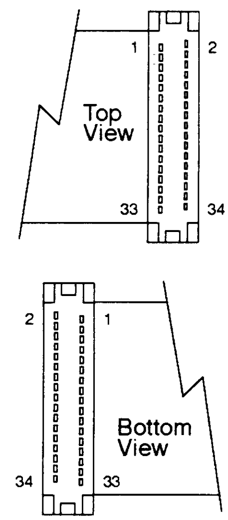
Hammer Coils 41–88 (Mechanism Driver Board) H–3

Hammer Coils 1–40 (Hammer Driver Board Drivers)

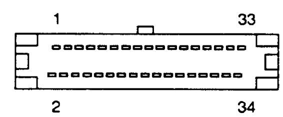
Print Position (column)	Hammer/ Coil	Hammer Bank Cable Assembly	
		Coil Connector	Hammer Driver Connector
1, 2	1	J1 – 23 (wht), 24 (red)	P1 – 23, 24
2, 3	2	J1 – 25 (wht), 26 (red)	P1 – 25, 26
4, 5	3	J1 – 27 (wht), 28 (red)	P1 – 27, 28
5, 6	4	J1 – 29 (wht), 30 (red)	P1 – 29, 30
7, 8	5	J1 – 31 (wht), 32 (red)	P1 – 31, 32
8, 9	6	J1 – 33 (wht), 34 (red)	P1 – 33, 34
10, 11	7	J2 – 1 (wht), 2 (red)	P2 – 1, 2
11, 12	8	J2 – 3 (wht), 4 (red)	P2 – 3, 4
13, 14	9	J2 – 5 (wht), 6 (red)	P2 – 5, 6
14, 15	10	J2 – 7 (wht), 8 (red)	P2 – 7, 8
16, 17	11	J2 – 9 (wht), 10 (red)	P2 – 9, 10
17, 18	12	J2 – 11 (wht), 12 (red)	P2 – 11, 12
19, 20	13	J2 – 13 (wht), 14 (red)	P2 – 13, 14
20, 21	14	J2 – 15 (wht), 16 (red)	P2 – 15, 16
22, 23	15	J2 – 17 (wht), 18 (red)	P2 – 17, 18
23, 24	16	J2 – 19 (wht), 20 (red)	P2 – 19, 20
25, 26	17	J2 – 21 (wht), 22 (red)	P2 – 21, 22
26, 27	18	J2 – 23 (wht), 24 (red)	P2 – 23, 24
28, 29	19	J2 – 25 (wht), 26 (red)	P2 – 25, 26
29, 30	20	J2 – 27 (wht), 28 (red)	P2 – 27, 28
31, 32	21	J2 – 29 (wht), 30 (red)	P2 – 29, 30
32, 33	22	J2 – 31 (wht), 32 (red)	P2 – 31, 32
34, 35	23	J3 – 1 (wht), 2 (red)	P3 – 1, 2
35, 36	24	J3 – 3 (wht), 4 (red)	P3 – 3, 4
37, 38	25	J3 – 5 (wht), 6 (red)	P3 – 5, 6
38, 39	26	J3 – 7 (wht), 8 (red)	P3 – 7, 8
40, 41	27	J3 – 9 (wht), 10 (red)	P3 – 9, 10
41, 42	28	J3 – 11 (wht), 12 (red)	P3 – 11, 12
43, 44	29	J3 – 13 (wht), 14 (red)	P3 – 13, 14
44, 45	30	J3 – 15 (wht), 16 (red)	P3 – 15, 16
46, 47	31	J3 – 17 (wht), 18 (red)	P3 – 17, 18
47, 48	32	J3 – 19 (wht), 20 (red)	P3 – 19, 20
49, 50	33	J3 – 21 (wht), 22 (red)	P3 – 21, 22
50, 51	34	J3 – 23 (wht), 24 (red)	P3 – 23, 24
52, 53	35	J3 – 25 (wht), 26 (red)	P3 – 25, 26
53, 54	36	J3 – 27 (wht), 28 (red)	P3 – 27, 28
55, 56	37	J3 – 29 (wht), 30 (red)	P3 – 29, 30
56, 57	38	J3 – 31 (wht), 32 (red)	P3 – 31, 32
58, 59	39	J3 – 33 (wht), 34 (red)	P3 – 33, 34
59, 60	40	J4 – 1 (wht), 2 (red)	P4 – 1, 2

NOTE:
Print positions shown underlined denote half character positions.

Hammer Drive Connectors P1 – P6



Coil Connectors J1–J6



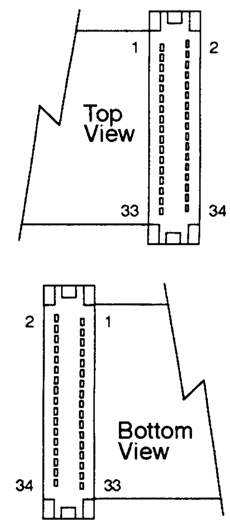
Odd pins — white wires
Even pins — red wires

Hammer Coils 41–88 (Mechanism Driver Board Drivers)

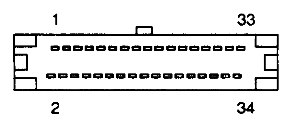
Print Position (column)	Hammer/ Coil	Hammer Bank Cable Assembly: Coil Connector	Hammer Bank Cable Assembly: Hammer Driver Connector
61, 62	41	J4 – 3 (wht), 4 (red)	P4 – 3, 4
62, 63	42	J4 – 5 (wht), 6 (red)	P4 – 5, 6
64, 65	43	J4 – 7 (wht), 8 (red)	P4 – 7, 8
65, 66	44	J4 – 9 (wht), 10 (red)	P4 – 9, 10
67, 68	45	J4 – 11 (wht), 12 (red)	P4 – 11, 12
68, 69	46	J4 – 13 (wht), 14 (red)	P4 – 13, 14
70, 71	47	J4 – 15 (wht), 16 (red)	P4 – 15, 16
71, 72	48	J4 – 17 (wht), 18 (red)	P4 – 17, 18
73, 74	49	J4 – 19 (wht), 20 (red)	P4 – 19, 20
74, 75	50	J4 – 21 (wht), 22 (red)	P4 – 21, 22
76, 77	51	J4 – 23 (wht), 24 (red)	P4 – 23, 24
77, 78	52	J4 – 25 (wht), 26 (red)	P4 – 25, 26
79, 80	53	J4 – 27 (wht), 28 (red)	P4 – 27, 28
80, 81	54	J4 – 29 (wht), 30 (red)	P4 – 29, 30
82, 83	55	J4 – 31 (wht), 32 (red)	P4 – 31, 32
83, 84	56	J5 – 1 (wht), 2 (red)	P5 – 1, 2
85, 86	57	J5 – 3 (wht), 4 (red)	P5 – 3, 4
86, 87	58	J5 – 5 (wht), 6 (red)	P5 – 5, 6
88, 89	59	J5 – 7 (wht), 8 (red)	P5 – 7, 8
89, 90	60	J5 – 9 (wht), 10 (red)	P5 – 9, 10
91, 92	61	J5 – 11 (wht), 12 (red)	P5 – 11, 12
92, 93	62	J5 – 13 (wht), 14 (red)	P5 – 13, 14
94, 95	63	J5 – 15 (wht), 16 (red)	P5 – 15, 16
95, 96	64	J5 – 17 (wht), 18 (red)	P5 – 17, 18
97, 98	65	J5 – 19 (wht), 20 (red)	P5 – 19, 20
98, 99	66	J5 – 21 (wht), 22 (red)	P5 – 21, 22
100, 101	67	J5 – 23 (wht), 24 (red)	P5 – 23, 24
101, 102	68	J5 – 25 (wht), 26 (red)	P5 – 25, 26
103, 104	69	J5 – 27 (wht), 28 (red)	P5 – 27, 28
104, 105	70	J5 – 29 (wht), 30 (red)	P5 – 29, 30
106, 107	71	J5 – 31 (wht), 32 (red)	P5 – 31, 32
107, 108	72	J5 – 33 (wht), 34 (red)	P5 – 33, 34
109, 110	73	J6 – 1 (wht), 2 (red)	P6 – 1, 2
110, 111	74	J6 – 3 (wht), 4 (red)	P6 – 3, 4
112, 113	75	J6 – 5 (wht), 6 (red)	P6 – 5, 6
113, 114	76	J6 – 7 (wht), 8 (red)	P6 – 7, 8
115, 116	77	J6 – 9 (wht), 10 (red)	P6 – 9, 10
116, 117	78	J6 – 11 (wht), 12 (red)	P6 – 11, 12
118, 119	79	J6 – 13 (wht), 14 (red)	P6 – 13, 14
119, 120	80	J6 – 15 (wht), 16 (red)	P6 – 15, 16
121, 122	81	J6 – 17 (wht), 18 (red)	P6 – 17, 18
122, 123	82	J6 – 19 (wht), 20 (red)	P6 – 19, 20
124, 125	83	J6 – 21 (wht), 22 (red)	P6 – 21, 22
125, 126	84	J6 – 23 (wht), 24 (red)	P6 – 23, 24
127, 128	85	J6 – 25 (wht), 26 (red)	P6 – 25, 26
128, 129	86	J6 – 27 (wht), 28 (red)	P6 – 27, 28
130, 131	87	J6 – 29 (wht), 30 (red)	P6 – 29, 30
131, 132	88	J6 – 31 (wht), 32 (red)	P6 – 31, 32

NOTE:
Print positions shown underlined denote half character positions.

Hammer Drive Connectors P1 – P6



Coil Connectors J1–J6



Odd pins — white wires
Even pins — red wires

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