HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

PART NO. 02100-60053

POWER SUPPLY

(FOR 2100 COMPUTERS AND 2155A I/O EXTENDER)

POWER SUPPLY DATE CODES COVERED

This manual applies directly to power supplies with date codes 1126, 1140, 1141, 1146, 1148, 1149, 1150, 1215, 1220, 1229, 1240, 1243, 1249, 1250, 1314, 1320, 1322, 1330, and 1345. Documentation pertaining to power supplies with higher date codes will be covered in manual updating supplements.

5951-3038

HEWLETT-PACKARD COMPANY
11000 WOLFE ROAD, CUPERTINO, CALIFORNIA, U.S.A.

PRINTED: APR 1974

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GENERAL INFORMATION

SECTION I

1-1. INTRODUCTION.

1-2. This operating and service manual provides general information, installation instructions, theory of operation, troubleshooting, maintenance instructions, replaceable parts information, and diagrams for the Hewlett-Packard Power Supply, part no. 02100-60053 (figure 1-1). The power supply is designed for use in the HP 2100 Computer and the HP 2155A I/O Extender and is installed in these units during manufacture.

1-3. GENERAL DESCRIPTION.

1-4. The power supply is a modular assembly that can easily be removed from the computer (or extender) for replacement. The method of mounting the power supply in the computer is identical to that in the extender, since the cabinet structure is identical. The computer uses all seven of the dc operating voltages provided by the power supply, and the extender uses all except the +20 and -20 volt (core memory) outputs. All references to the computer in this section, as associated with the power supply, are also applicable to the extender unless otherwise specified.

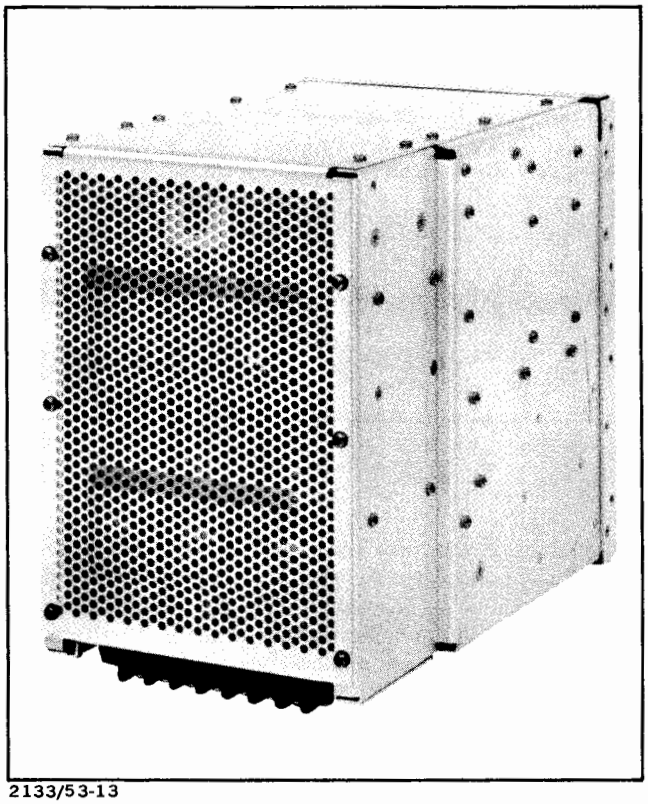

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Figure 1-1. Power Supply, Part No. 02100-60053

1-5. The power supply can operate from either a 115- or optional 230-volt ac power source, by selecting the proper connections at the computer input circuit terminal board. The power supply is controlled by the POWER switch on the front panel of the computer. Power control circuits in the power supply provide power failure detection signals to the computer.

1-6. The power supply assembly is located at the rear of the computer cabinet. Access to the assembly is gained by removing the top and bottom panels of the cabinet. The power supply input line is routed through plenum chamber assembly A26 in the computer. The power supply output voltages are also connected to test points mounted on the back panel of the plenum chamber.

1-7. The power supply assembly, comprised of 12 subassemblies, furnishes the seven regulated dc voltages required by the computer and any I/O interface cards installed in the card cage. All optional units external to the computer cabinet furnish their own ac and dc voltages derived from a separate connection to the primary ac power line.

1-8. SPECIFICATIONS.

1-9. See table 1-1 for specifications of the power supply.

1-10. IDENTIFICATION.

1-11. POWER SUPPLY DATE CODE.

1-12. The power supply date code is marked on the power supply date code label at the rear of the power supply assembly. The date code, consisting of four digits, identifies the electrical configuration of the power supply assembly and is used to indicate design changes. If the date code marked on the label does not agree with the power supply date code on the title page of this manual, refer to the manual change information contained in a supplement accompanying this manual.

1-13. ASSEMBLY PART NUMBERS.

1-14. Four of the electronic assemblies in the power supply are plug-in circuit cards. Card parts location diagrams are shown in figures 7-3 or 7-4, sheets 1 through 4. In each illustration, the location of the card part number is shown, in addition to the identifying numbers and letters of the card pins and the location of all parts by reference designation. Part numbers for parts on these cards are found in tables 7-2 through 7-5 as appropriate.

Table 1-1. Power Supply Specifications

POWER REQUIREMENTS

LINE VOLTAGE:	115V ac ± 10%, single phase, 12A, or 230V ac ± 10%, single phase, 6A
LINE FREQUENCY:	47.5 to 66 Hz (see paragraph 1-31)
POWER CONSUMPTION:	1400 volt-amperes, maximum

POWER CABLE (CONNECTED TO COMPUTER OR EXTENDER)

LENGTH:	10 feet (304, 8 centimeters)
CONNECTOR:	NEMA Type 5-15P (for 115V ac operation), or NEMA Type 6-15P (for 230V ac operation)

DC SUPPLY VOLTAGES AND CURRENTS

+30V, 0.1A
+12V, 5A for 2155A Extender; +12V, 3A for 2100 Computer
+4.85V, 50A
-2V, 23A
-12V, 5A for 2155A Extender; +12V, 3A for 2100 Computer
+20V, 6A
-20V, 0.5A } **For 2100 Computer only**

ENVIRONMENTAL LIMITS

AMBIENT TEMPERATURE RANGE:

Operating:	0° to 55°C (32° to 131°F)
Non-operating:	-40° to 75°C (-40° to 167°F)

RELATIVE HUMIDITY: 50 to 95% at 25° to 40°C (77° to 104°F) without condensation

ALTITUDE:

Operating:	15,000 feet (4572 meters)
Non-operating:	25,000 feet (7620 meters)

VENTILATION

AIR FLOW:	200 cubic feet (5,6634 cubic meters) per minute
HEAT DISSIPATION:	2300 BTUs (579,6 kilocalories) per hour, maximum

WEIGHT AND DIMENSIONS

WEIGHT:	36 pounds (16,344 kilograms)
HEIGHT:	10 inches (254 millimeters)
WIDTH:	7.75 inches (196,85 millimeters)
DEPTH:	12 inches (304,8 millimeters)

1-15. Assemblies other than circuit cards usually are not marked with their part number. Part numbers for these assemblies are found in section VI, where all electronic assemblies are identified by their location in the power supply.

1-16. PRINTED-CIRCUIT CARD REVISION CODES.

1-17. Marked beneath the part number of each printed-circuit card is a revision code (see figure 7-3). The first character of the code is a letter which identifies the etched-foil pattern on the card. The next four digits, referred to as a date code, identify the electrical characteristics of the card with components mounted. The date code is followed by a 1- or 2-digit number which identifies the Hewlett-Packard division which manufactured the assembly. The entire revision code is either stamped on the card with marking ink, or as part of the etched-foil pattern. If both a stamped and an etched code are used, the stamped revision code identifies the card with components mounted, and the etched revision code identifies the card without components.

1-18. MAINTENANCE TOOLS, PARTS, MATERIALS, AND EQUIPMENT.

1-19. TOOLS.

1-20. A standard electronics tool kit will provide the tools required for normal servicing of the power supply. The kit must include a soldering iron designed for removing and installing 14-pin integrated circuits, and a rubber bulb with suction tube for withdrawing molten solder. Also required is a torque wrench, capable of indicating 15 pound-inches, with 3/8-inch, 7/16-inch, 1/2-inch, 9/16-inch and 11/16-inch sockets. The torque wrench is used when replacing stud-type semiconductor devices in the power supply (over-torquing can damage the anodized washers and semiconductor devices).

1-21. PARTS AND MATERIALS.

1-22. Spare parts that may be required for the power supply are listed in section VI of this manual. Part numbers and ordering information are included.

1-23. Materials and chemicals normally used for electronics service work must be available to the serviceman. These must include heat-conductive silicone compound (Wakefield 120-2 Thermal Joint Compound, HP part no. 6040-0239, or equivalent. When ordering this compound, specify a 2-ounce jar.)

1-24. SERVICING EQUIPMENT.

1-25. Equipment required for servicing the power supply consists of a card extender, an operating and service manual, and test equipment.

1-26. CARD EXTENDER. A card extender, part no. 02100-60049, allows circuit cards in the power supply to be extended for troubleshooting. The card extender is part of the 12900A Maintenance Accessory Kit, available at extra cost, which contains special tools and maintenance aids to facilitate maintenance of the computer.

1-27. OPERATING AND SERVICE MANUAL. This manual provides hardware documentation (see paragraph 1-2) for the power supply.

1-28. TEST EQUIPMENT. Equipment recommended for maintenance, troubleshooting, and repair of the power supply is listed in table 1-2.

1-29. POWER SUPPLY CONFIGURATIONS.

1-30. Table 1-3 lists the date codes (see paragraph 1-12) of the power supplies covered by this manual, together with the revision code (see paragraph 1-17) of each printed-circuit card used in the power supply. The power supply date code and card revision codes reflect the configuration as originally manufactured and shipped from the factory. Notes explain changes made to assemblies other than the printed-circuit cards.

1-31. The power fail circuits in the power supply are line-frequency sensitive and must be adjusted to operate at the line frequency available. A label located at the rear of the computer or extender in which the power supply is installed specifies the line frequency for which the power fail circuits were adjusted before shipment from the factory. If the available line frequency is different from that marked on the label, or if a replacement power supply is installed, the power fail circuits will require readjustment (refer to paragraph 5-42).

1-32. Because of field modifications, repairs, board exchange, and other factors that may alter the shipped configurations, the configurations existing in the field may not always agree with the information presented in table 1-3.

1-33. FIELD OFFICE ASSISTANCE.

1-34. Should servicing assistance be required, contact the nearest Hewlett-Packard Sales and Service Office. These offices are listed at the back of this manual.

Table 1-2. Recommended Test Equipment and Servicing Devices

INSTRUMENT	CRITICAL SPECIFICATIONS	RECOMMENDED HP MODEL
Dual-trace oscilloscope	Rise time: ≤10 ns. Vertical deflection: 1 volt/division and 10 volts/division (including attenuator probe, if used). Horizontal sweep speed: 0.1 microsecond/division to 1 second/division.	HP 180A Oscilloscope with 10004A Probe and the following plug-in units. HP 1801A Dual Channel Vertical Amplifier HP 1821A Time Base and Delay Generator
Digital voltmeter	At least 4 digit readout. Minimum input resistance: 10 megohms. Full-scale ranges: 9.999 and 99.99V dc.	HP 3439A Digital Voltmeter with HP 3441A Range Selector.
AC voltmeter	Expanded-scale or digital-readout type, capable of reading ac voltage to ± 1%. Voltage range must be at least 100-115 volts (for a 115-volt input power supply), or 200-230 volts (for a 230-volt input power supply).	HP 3445A AC/DC Range Unit. (Also performs functions of HP 3441A Range Selector listed above. Requires HP 3439A Digital Voltmeter.)
Multimeter	Accuracy: ± 3% of full scale. Full-scale ranges: 100 mV to 300V (dc and ac), 10 ohms center-scale to 10 megohms center-scale.	HP 427A
Power supply	Capable of supplying 0 to 20 volts at 0.75 ampere.	HP 6202B
Logic probe	Indication: logic true >+1.4 volts.	HP 10525A
Metered variable autotransformer	Capable of reducing input line-voltage to 98 volts rms (196 volts for a 230-volt input power supply), and able to furnish the power required (up to 1400 volt-amperes, depending on the load).	None
Centigrade thermometer	General-purpose type, accurate to ±1°C.	HP 0440-0004
High-pressure air source	25-50 psi pressure	None
Vacuum cleaner	Must have flexible hose with small nozzle, vacuum port for hose, and pressure port for hose.	None
IC test clip	None	None

NOTES:

1. The logic probe is optional. Operating voltage for the probe can be obtained from terminals 4 and 5 of TB1 located beneath the power supply.
2. Ambient-temperature and humidity specifications of test equipment must suit the power supply environment.

Table 1-3. Power Supply Configuration

POWER SUPPLY DATE CODE	CARD REVISION CODE					REMARKS
	A1	A2	A3	A4	A5	
1126	1133	1126	1132	1126	1125	
1140	1139	1126	1132	1126	1125	
1141	1140	1140	1132	1126	1139	
1146	1140	1140	1132	1126	1139	
1148	1140	1140	1132	1144	1139	(Note 1)
1149	1140	1140	1147	1144	1139	
1150	1140	1140	1147	1144	1150	
1215	1148	1140	1215	1144	1150	
1220	1148	1140	1215	1144	1150	(Note 2)
1229	1148	1140	1215	1144	1150	(Note 3)
1240	1224	1140	1243	1224	1150	(Note 4)
1243	1224	1140	1243	1224	1150	(Note 5)
1249	1249	1249	1243	1224	1150	
1250	1249	1249	1250	1224	1150	
1314	1249	1249	1250	1224	1150	(Note 6)
1320	1249	1249	1320	1224	1150	
1322	1249	1249	1322	1224	1150	
1330	1249	1330	1322	1224	1330	
1345	1249	1345	1322	1224	1330	

NOTES:
1. Cards A1 through A5 did not change. Part number of A6Q1 and A6Q2 changed to 1884-0219.
2. Cards A1 through A5 did not change. Change made to power supply to bring up to UL, CSA, and IEC standards.
3. Cards A1 through A5 did not change. Change made to A11 ±20 volts Regulator.
4. Part no. of cards A1, A3, and A4 changed to 02100-60108, 02100-60109, and 02100-60110, respectively.
5. Date code 1243 is identical to date code 1240.
6. Cards A1 through A5 did not change. Assembly A7 changed mechanically.

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section presents installation instructions for replacement power supplies. Installation instructions include initial inspection and installation of the power supply. Also described are claims procedures and methods of repacking the power supply for reshipment.

2-3. INSPECTION OF SHIPMENT.

2-4. If external damage to the shipping container is evident, or if the container is water-stained, ask the carrier's agent to be present when the container is opened.

2-5. Unpack the container and examine the power supply for external damage. Look for such things as broken parts, dented corners, bent panels, and scratches. Also check the rigid foam-plastic cushioning material (if used) for signs of deformation which could indicate rough handling in transit.

2-6. If the above examination reveals damage to the power supply, follow the damage-claim procedure described in paragraph 2-8. Retain the shipping containers and packaging materials for examination in the settlement of claims, or for reshipment.

2-7. Upon completing the inspection for damage in transit, proceed with a physical inventory of the material received, as described in the following paragraphs.

2-8. CLAIMS.

2-9. If the power supply is incomplete or damaged when received and fails to meet specifications, notify the nearest Hewlett-Packard Sales and Service Office. (Sales and Service Offices are listed at the back of this manual.) If damage occurred in transit, notify the carrier also. Hewlett-Packard will arrange for replacement or repair without waiting for settlement of claims against the carrier.

2-10. PACKAGING FOR RESHIPMENT.

2-11. RESHIPMENT USING ORIGINAL PACKAGING.

2-12. The same containers and materials used in factory packing can be used for reshipment of the power supply. Alternatively, containers and packaging materials may be obtained from Hewlett-Packard Sales and Service Offices. If the power supply is being sent to the factory for servicing, attach a tag to the power supply specifying the return address, the type of service required, the model number of the computer (or extender) and power supply date code. Mark the container "FRAGILE" to assure careful handling. In any correspondence, refer to the power supply by date code number (see paragraph 1-12 for a description of the date code number).

2-13. RESHIPMENT USING NEW PACKAGING.

2-14. The following instructions should be followed when packaging the power supply with commercially available materials:

a. Wrap the power supply in heavy paper or sheet plastic. If shipping the power supply back to the factory, first attach a tag to the power supply with the return address and indicate the type of service required, the computer (or extender) model number, and power supply date code.

b. Use a strong shipping container. A double-wall container of 350-pound test material is adequate.

c. Use enough shock absorbing material (3- to 4-inch layer) on all sides of the power supply to provide a firm cushion and to prevent movement inside the container. Use particular care to protect the corners of the units.

d. Seal the shipping container securely, and mark it "FRAGILE".

e. In any correspondence with the factory, refer to the power supply by date code number.

2-15. INSTALLATION.

2-16. Installation instructions apply to installation of the power supply in the 2100 Computer or 2155A Extender. Environmental and power source requirements are described in documentation provided with the computer or extender.

2-17. Prior to installing the power supply, heed the following warning:

WARNING

Be sure that the computer (or extender) ac power cable is disconnected from the ac power source before proceeding. Failure to heed this warning could result in injury or death.

a. Place the computer (or extender) on its side with the side adjacent to the power supply assembly facing up (see figure 2-1).

b. Lift the back of the side frame slightly and carefully insert the power supply assembly from the rear of the computer (or extender).

c. Install the spacer (1) between the back of the side frame and the power supply assembly. Install the four screws (2).

d. Install the screw (3), lock washer (4), and flat washer (5) to secure the forward section of the power supply assembly.

e. Install the four screws (6), split washers (7), and flat washers (8) to secure the power supply assembly rear panel to the rear card cage support.

Note: Prior to connecting the wires in the following steps, refer to the backplane wiring diagram in section III of the computer *Diagrams Manual*, (part no. 02100-90003 for 2100A or part no. 02100-90164 for 2100S), or the *2155A I/O Extender Manual*, part no. 02155-90002, as applicable.

f. Connect the power supply wires to terminal board A26TB2 (9).

g. Connect the backplane wires and bus strips to terminal boards A25TB1 (10) and A25TB2 (11).

h. Install the plenum chamber bottom cover (12).

i. Install the top panel (13), the bottom panel (14), and the side panel (15).

j. Prior to operating the computer (or extender) perform the voltage checks described in paragraph 5-24, and the power fail adjustment described in paragraph 5-42.

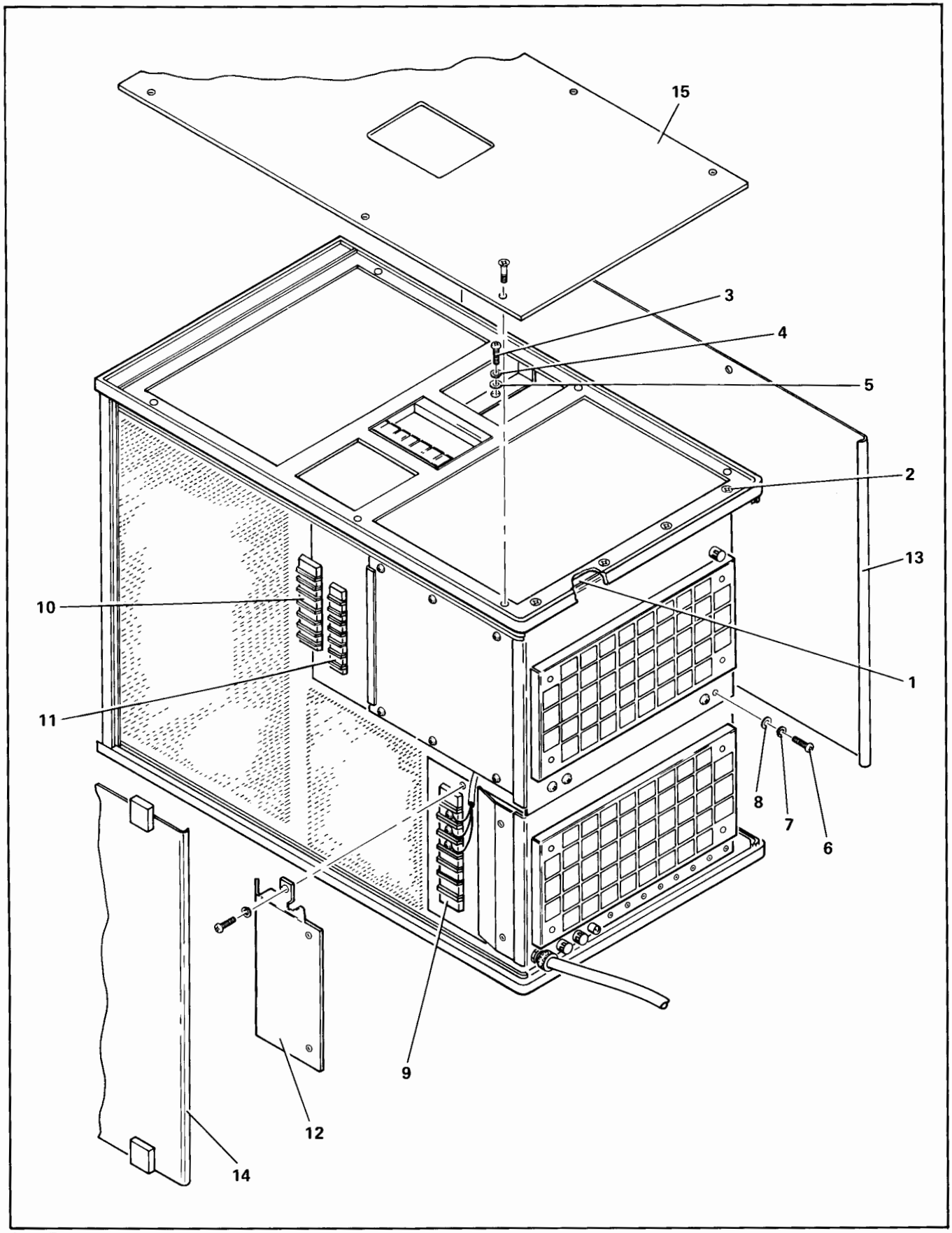

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Figure 2-1. Power Supply, Installation

SECTION III THEORY OF OPERATION

3-1. INTRODUCTION.

3-2. This section describes the operation of the circuits comprising the power supply. The description is divided into three levels. A general description at the block diagram level is presented first, followed by a functional description at the simplified schematic diagram level, then a detailed description of all circuits, emphasizing those that are unique.

3-3. The power supply section operates from a 115-volt (230-volt by changing the positions of jumpers on a terminal board), single-phase, 50- or 60-Hz power source which it converts to regulated dc supply voltages for the operation of the 2100 Computer (or 2155A Extender) in which it is installed. A POWER switch mounted on the front panel of the computer (or extender) controls turn-on and turn-off of the power supply. The power supply provides status signals used for power failure detection for protection of software stored in core memory. Hardware protection for the computer (or extender) is provided by power supply circuits that sense overvoltage, overcurrent, or overtemperature conditions. Protection for circuits in the power supply is provided by various overvoltage circuits, current limit circuits, and fuses.

3-4. BLOCK DIAGRAM DESCRIPTION.

3-5. Figure 3-1 is a block diagram of the power supply. The following paragraphs describe the function of each of the blocks shown in the figure.

3-6. LINE FILTER AND POWER SWITCH.

3-7. The ac line voltage enters the 2100 Computer (or 2155A Extender) through a 12 ampere (6 ampere for 230-volt operation) fuse and an RFI filter located in the plenum chamber assembly. The POWER switch (S1) is located on the front panel of the computer (or extender). With the POWER switch in the ON position, the line voltage is applied to the preregulator circuits and to the preregulator control circuits. The control circuits require much less current than the preregulator and are separately fused for 2 amperes (1 ampere for 230-volt operation).

3-8. PREREGULATOR.

3-9. The preregulator circuit is a full-wave bridge rectifier that converts the input line voltage to a regulated 160 volts dc which is used as the basis for all power supply outputs. The preregulator functions as a conventional controlled rectifier for a 230-volt ac input voltage and functions, in addition, as a voltage doubler for a 115-volt ac input voltage, resulting in the same value of dc output voltage for either 115- or 230-volt ac input. The preregulator circuit is controlled by the preregulator control circuit.

3-10. PREREGULATOR CONTROL.

3-11. The preregulator control circuit monitors the input line voltage to detect phase and amplitude values. This circuit also provides +5, -15, and +15 volts dc for use within the power supply circuits. The control circuit supplies trigger pulses that control the "on" time of the preregulator bridge circuit to maintain proper control of the 160-volt dc output.

3-12. INVERTER.

3-13. The inverter circuits convert the 160-volt dc output of the preregulator circuit to a square-wave ac voltage which is transformer-coupled to the rectifier circuit. The transformer coupling provides isolation for stages following the inverters, as shown in figure 3-1. The operating frequency of the inverters is determined by the inverter driver circuit. The two inverter circuits are identical and operate 90 degrees out of phase with each other.

3-14. INVERTER DRIVERS.

3-15. The inverter driver circuit generates a clock signal that is divided in frequency and time to develop phase 1 and phase 2 drive signals that are applied to the inverter circuits.

3-16. RECTIFIERS.

3-17. The rectifier circuit rectifies the transformer-coupled outputs of the inverter circuits to provide (through output filters) the -2, +12, -12, +30 and +4.85 volts dc output voltages. A +30 and a -30 volt dc output is supplied as input to the +20 and -20 volt dc regulators. The -30 volt output is fed back to the preregulator control circuit to maintain output voltage regulation.

3-18. 20-VOLT REGULATORS.

3-19. The 20-volt dc regulators consist of a +20 and a -20 volt regulator. The +20 volt regulator uses a switching circuit to process the +30 volt output of the rectifier circuit to provide a regulated +20 volts dc. The -20 volt regulator uses a series-shunt circuit to process the -30 volt output of the rectifier circuit to provide a regulated -20 volts dc. The -20 volt regulator is designed to track the +20 volt regulator output so the two outputs maintain equal voltages of opposite polarity.

3-20. CURRENT LIMIT.

3-21. The current limit circuit monitors the dc component of the voltage drop across the resistance of each output filter choke. *A change in current results in a like change in a load current signal which is sent to the load current gain compensation circuit in the preregulator control circuit.* An excessive increase in any output current results in an overcurrent signal that is sent to the protection and control circuit to develop the inhibit preregulator signal. This signal controls the preregulator output to protect the power supply.

3-22. PROTECTION AND CONTROL.

3-23. The protection and control circuits contain overvoltage sensing circuits to provide protection of computer (or extender) hardware and contain undervoltage sensing circuits to provide protection of computer software. The overvoltage comparator circuits monitor all dc voltage outputs in addition to monitoring the thermal switch (overtemperature sense) circuit. If the supply voltage or temperature exceeds a preset level, the protection and control circuits send an inhibit preregulator signal to the preregulator control circuits to turn off the preregulator, drive the crowbar circuit to shunt the 160-volt output and the +4.85, +20, -2, and -20 volt outputs to ground; and turn off the inverter drive signal.

3-24. The undervoltage comparator monitors the +4.85, +20, and -20 volts and the input line voltage. This comparator furnishes the Internal Power Up (IPU) signal to any auxiliary computer (or extender) and the Power Up (PWU) signal to the computer control logic. The IPU signal is connected to other computers (or extenders) in a multicomputer system to inform all computers whenever power of any one computer (or extender) goes down. If the IPU signal drops, the PWU signal also drops to a low logic state and causes the computer to start its shutdown procedure. After power turn-on, the PWU signal inhibits the computer operation until the power supply regulated outputs have maintained acceptable levels for approximately 0.5 second.

3-25. FUNCTIONAL DESCRIPTION.

3-26. As shown in the functional diagram (figure 3-2), the ac input line is connected through fuse F1, RFI filter FL1, and terminal board TB1 to the full-wave phase-controlled bridge rectifier preregulator. The preregulator contains two semiconductor controlled rectifiers (SCR's) and two diodes that rectify and control the voltage sent to the output. The SCR's are turned on by trigger pulses from the preregulator control circuit and turned off (commutated) when the ac input voltage passes through zero. This action sends a portion of the ac input voltage (during each cycle) through the filter circuit and provides the controlled 160-volt dc voltage. The tapped output of choke-transformer T6 results in doubling the ripple frequency to allow smaller filter components. Capacitors A5C17 and A5C18 are connected into the filter circuit (by a jumper on terminal board TB1) as a voltage doubler when operating with 115 volt ac input. Thus, this circuit provides an output of 160 volts dc for either a 115- or 230-volt ac input.

3-27. The crowbar circuit across the 160-volt output is connected through protection and control card A3 to the feedback signals from the other dc outputs. When an overvoltage condition occurs in one of the outputs, the 160-volt crowbar conducts to short-circuit the 160-volt output (through a low resistance) and protect the load circuit. The crowbar circuit is also triggered directly whenever the 160-volt output exceeds 200 volts.

3-28. The ac input line is also connected from terminal board TB1 to cooling fans B1 and B2 in the computer (or extender), to cooling fans B1 and B2 in the power supply, and to transformer T5. The secondary winding of T5 supplies voltage to the +5, -15, and +15 volt dc regulators, which furnish operating voltages internal to the power supply. The secondary of T5 also supplies a sample of the phase and magnitude of the AC input voltage to the line synchronization circuit. This circuit supplies one of the inputs to the firing angle comparator through an integrator circuit which is controlled by a sinusoidal current source *which is in turn controlled by the load current feedback signal (I LOAD).* The other input to the firing angle comparator is from the error amplifier, which senses the -30 volt transformer winding flux that develops a feedback voltage (-30V No. 1). The output of the firing angle comparator controls a trigger pulse generator that furnishes pulses to the preregulator trigger transformer to turn on the SCR's in the phase-controlled preregulator. The SCR's are turned on one at a time (whichever one has a positive anode potential). In this manner, the preregulator is controlled to compensate for any variations in the ac input voltage, the load current, or the dc output voltage, and maintains a closely controlled 160 volts dc.

3-29. The 160-volt dc output is connected to the inverter bridge circuits through fuses A5F1 and A5F2. Each of the two bridge circuits consists of four transistor switches that are turned on and off by transformer-coupled pulses from the inverter driver circuit. This switching action develops ac square-wave pulses which are transformer-coupled to the rectifier circuits to supply the dc output voltages. As shown in figure 3-2, the inverter driver receives clock signals from a multivibrator that are supplied in two different phases (1 and 2) which are displaced from each other by 90 degrees. This results in the inverter bridges being operated 90 degrees out-of-phase with each other to supply ac square-wave output pulses that overlap as shown in figure 3-7. When the pulses are combined in the full-wave rectifiers, the low-ripple dc outputs are obtained by use of small output filter components.

Note: Information shown in italics on this page pertains only when A1 Preregulator Control Card, part no. 02100-60046, and A4 Current Limit Card, part no. 02100-60061, are installed in the power supply.

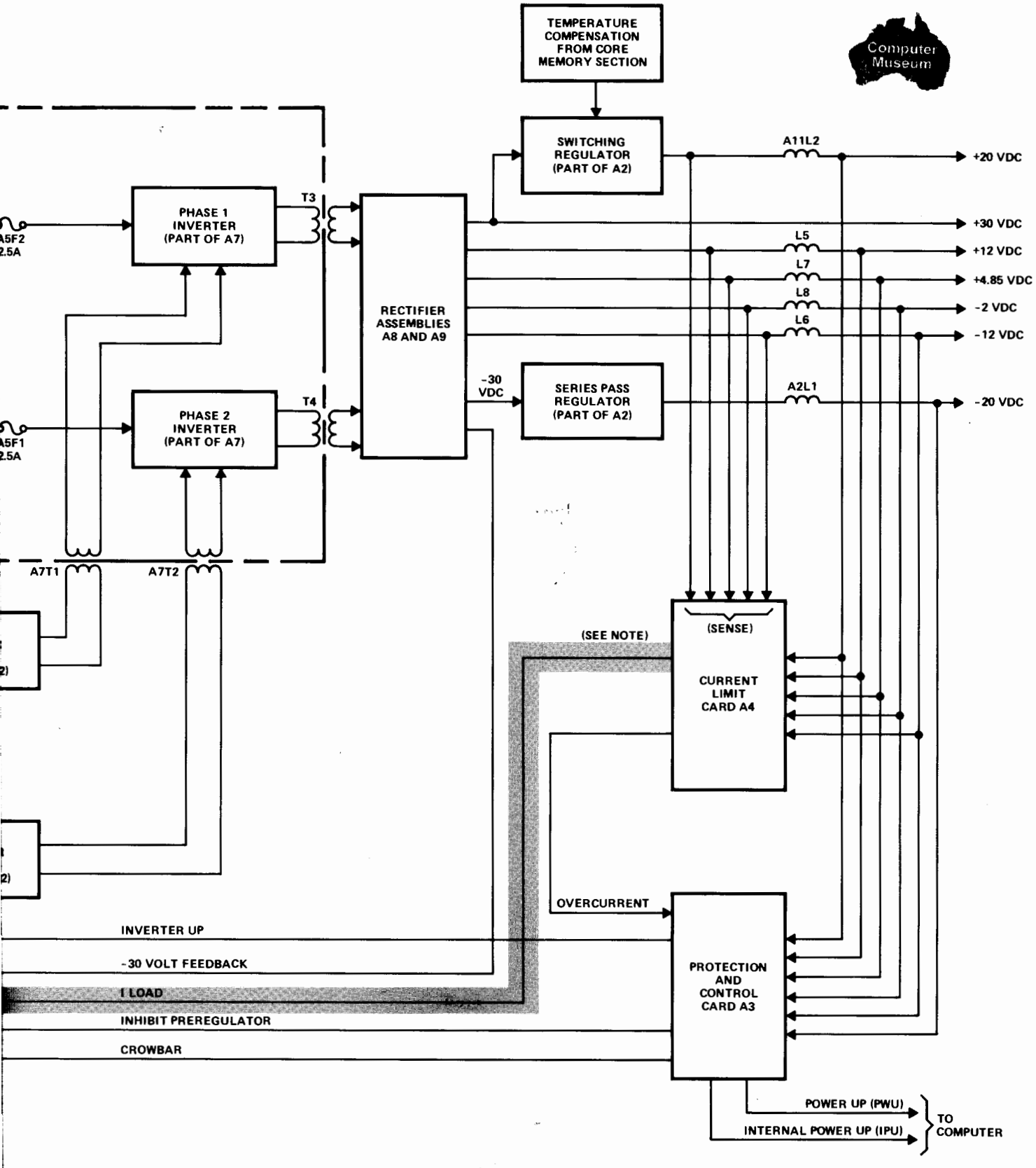
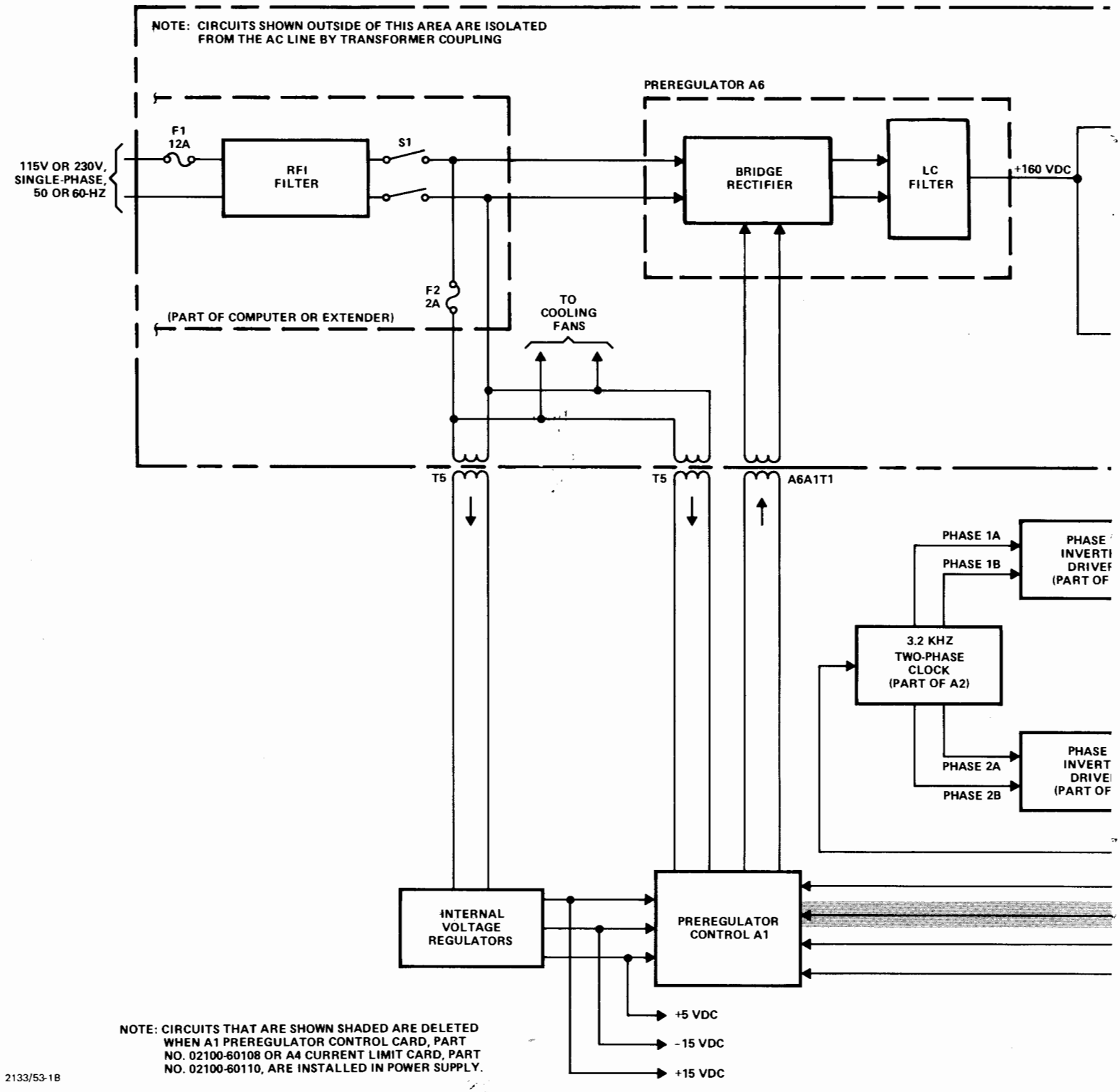


Figure 3-1. Power Supply, Block Diagram



NOTE: CIRCUITS THAT ARE SHOWN SHADED ARE DELETED WHEN A1 PREREGULATOR CONTROL CARD, PART NO. 02100-60108 OR A4 CURRENT LIMIT CARD, PART NO. 02100-60110, ARE INSTALLED IN POWER SUPPLY.

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3-30. The +30 and -30 volt rectified outputs are used to supply the +20 and -20 volt regulators. The additional regulation is required for the 20-volt supplies due to the load (core memory) which has large fluctuations in current demand and requires a high degree of voltage regulation. Since the proper operating voltage for the core memory varies with temperature, the 20-volt supplies are temperature compensated to always supply the optimum voltage. The two different types of 20-volt supplies are described in the following paragraphs.

3-31. The +20 volt supply is a switching-type voltage regulator, with the output voltage level determined by the duty cycle (ratio of "on" time to "off" time) of a switching transistor. The duty cycle is controlled by a feedback signal from the output voltage connected through a resistive divider to one input of an error (operational) amplifier. This input is also connected to the temperature sense resistor in the computer. The other input to the error amplifier is a +15 volt reference voltage. The error amplifier generates an error signal proportional to the difference between its two inputs. This error signal is applied to a comparator circuit. The other input to the comparator is a 20-kHz triangular waveform generated by an oscillator. The output of the comparator is a series of rectangular-shaped pulses, with the width determined by the amplitude of the error signal input. These rectangular-shaped pulses are connected through a driver stage to the switching transistor to control the duty cycle and regulate the +20 volt output.

3-32. The -20 volt supply is a combination series-shunt type voltage regulator, with the output voltage determined by the voltage drop across a transistor pair connected in series-shunt with the -30 volt rectified output. The output is filtered and fed-back to an error (operational) amplifier circuit to generate an error signal which controls the series and the shunt transistor and regulates the -20 volt output.

3-33. An additional -30 volt output from the rectifier circuit (labeled -30V No. 1 in figure 3-2) provides a feedback signal to the preregulator circuit to control the SCR phase angle (delay before turn-on during each cycle) and thus regulate the average dc output voltages. The feedback signal is developed by diodes A8CR11 through A8CR14 connected to the 30-volt taps of the inverter output transformers. The feedback signal is proportional to the magnetic flux density of the transformers and varies with variations in flux density. The feedback signal is compared to a +15 volt reference and supplied to one input of error (operational) amplifier A1U1 in the preregulator control circuit. The output of the error amplifier feeds one input to the firing angle comparator that controls the turn-on of the preregulator SCR's. The other input to the error amplifier is connected to the inhibit preregulator circuit on the protection and control card to control turn-off of the preregulator SCR's in the event of an overcurrent or overvoltage condition.

3-34. *The load current signal from the current limit card is also connected to the preregulator control circuit to control the sinusoidal current source described in paragraph 3-28. This signal is developed by individual sense amplifiers on the current limit card that sense all the regulator outputs except for the -20 and +30 volt outputs.* The output of the sense amplifiers on the current limit card provide an overcurrent signal when any regulator current exceeds its overload value. The overcurrent signal is sent to the protection and control card to combine with circuits that sense overvoltage in each of the regulators and sense overtemperature in the power supply or computer (or extender). Any of the sense circuits can develop the inhibit preregulator signal that is sent to the error amplifier in the preregulator control circuit to turn off the preregulator. These circuits also drive the crowbar circuits to short-circuit the 160-volt preregulator output and the +20, -20, +4.85 and -2V outputs to prevent damage to the load circuits. In addition, these circuits control the inverter up signal to turn off the drive to the inverter circuit.

3-35. The undervoltage circuits on the protection and control card monitor the +4.85, +20 and -20 volt dc regulator outputs and the 16 volts ac from transformer T5 to determine when an undervoltage condition exists. These circuits supply the power failure detection status signals Power Up (PWU) and Internal Power Up (IPU). The IPU signal is sent to a connector on the computer (or extender) plenum chamber (A26) rear panel for connection to the IPU signal of the power supplies of other computers (or extenders) in a multi-computer system. The signal informs all computers whenever power of any one computer (or extender) decreases below a safe operating level. When the IPU signal drops, the PWU signals also go low to initialize the I/O control card circuitry and cause the computers to start an orderly shutdown procedure.

3-36. DETAILED DESCRIPTION.

3-37. This detailed description refers to the schematic diagrams shown in section VII and emphasizes the circuits that are unusual or peculiar to this power supply.

Note: Because power supplies manufactured starting with date code 1240 contain redesigned A1, A3, and A4 circuits, two sets of schematic diagrams are provided in section VII. Use table 3-1 to determine the applicable set of schematics.

3-38. INPUT CIRCUITS. (See Sheet 1 of either Figure 7-3 or 7-4.)

3-39 The 115-volt ac input from the computer (or extender) terminal board TB1 is connected to terminal board TB3 in the power supply and to the bridge rectifier in preregulator A6.

Note: Information shown in italics on this page pertains only when A1 Preregulator Control Card, part no. 02100-60046, and A4 Current Limit Card, part no. 02100-60061, are installed in the power supply.

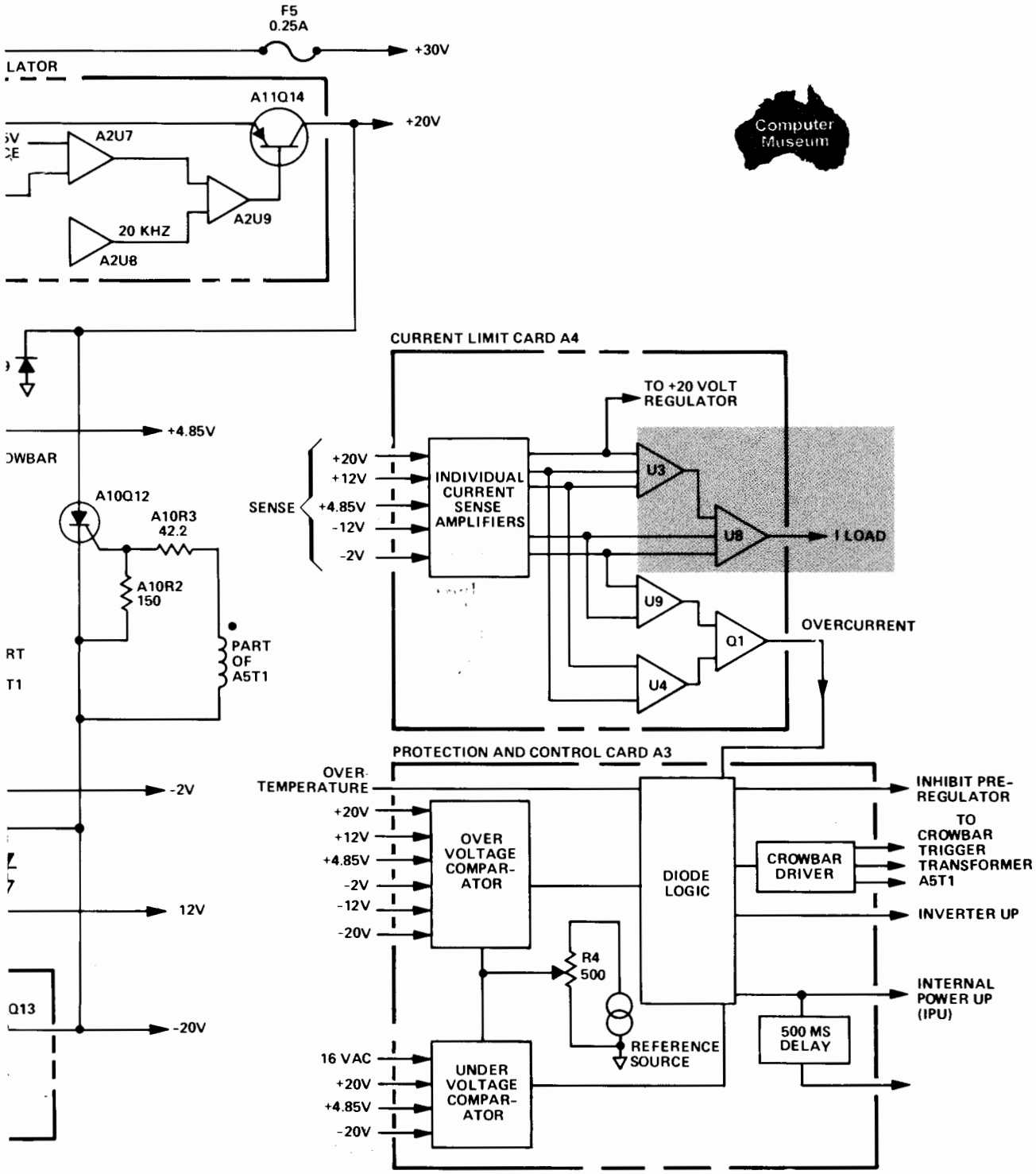
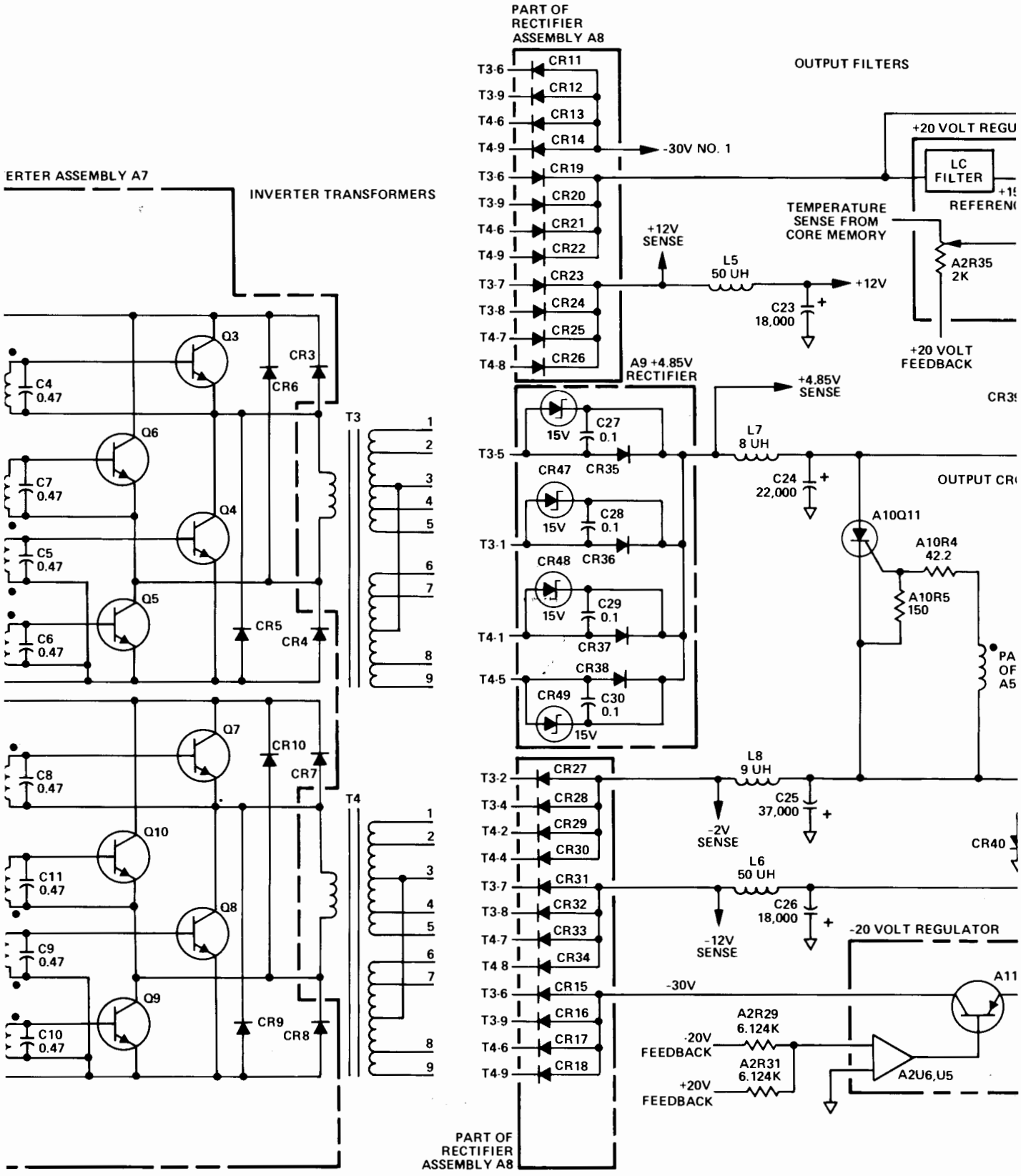
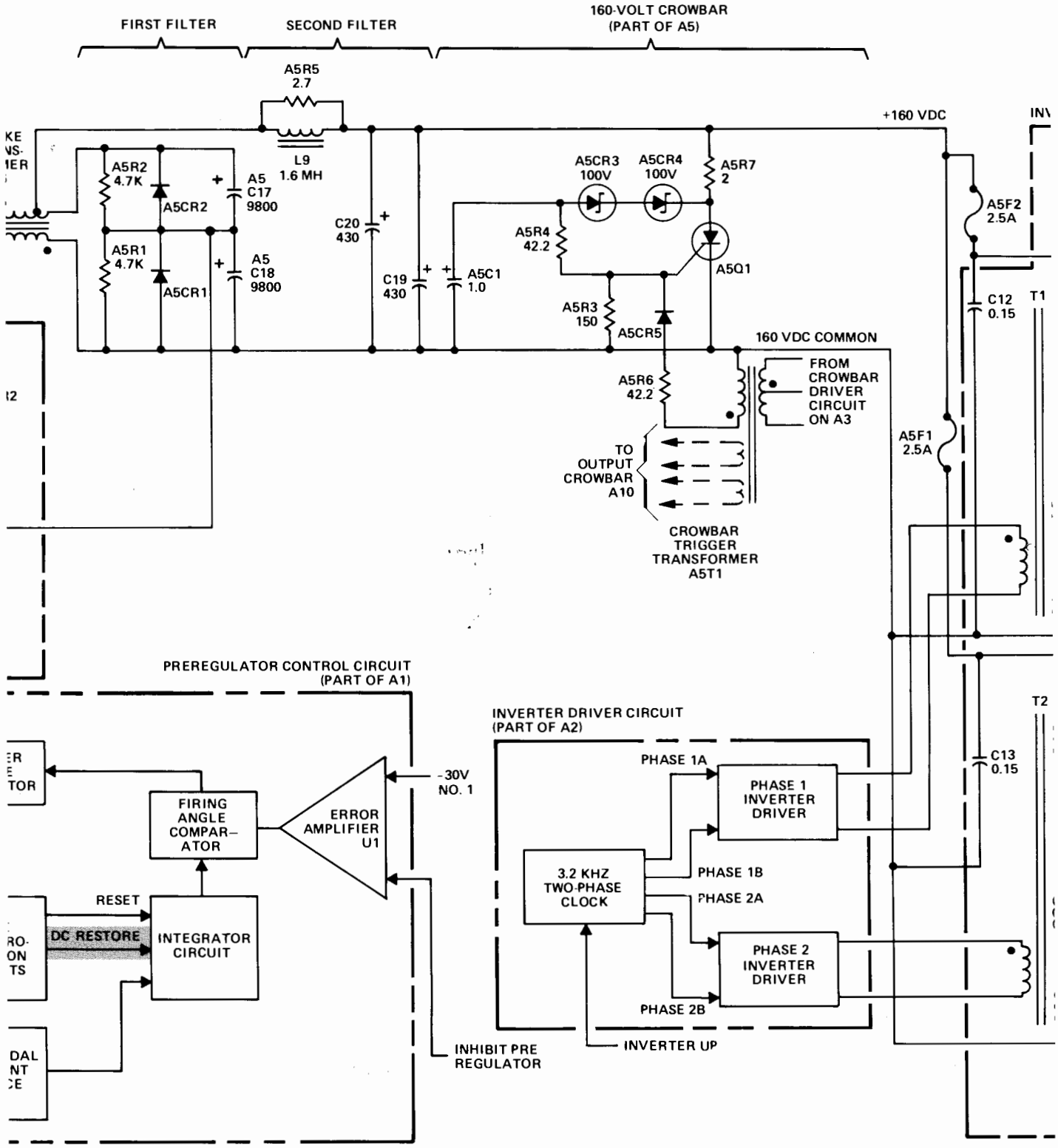
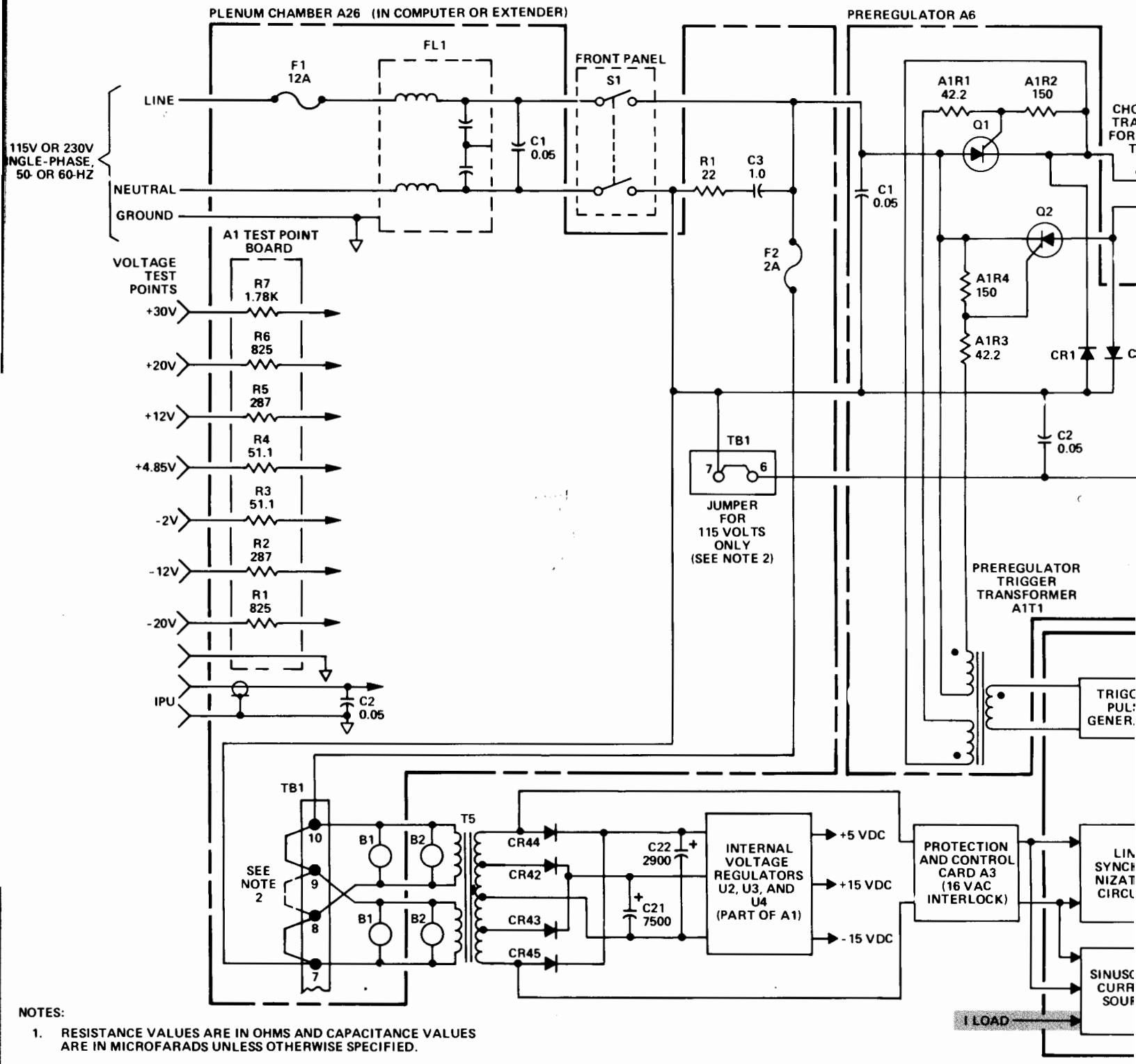


Figure 3-2. Power Supply, Functional Diagram


ERTER ASSEMBLY A7
INVERTER TRANSFORMERS
PART OF RECTIFIER ASSEMBLY A8
OUTPUT FILTERS
+20 VOLT REGU
LC FILTER
TEMPERATURE SENSE FROM CORE MEMORY
A2R35 2K
+20 VOLT FEEDBACK
-30V NO. 1
+12V SENSE
L5 50 UH
+12V
C23 18,000
A9 +4.85V RECTIFIER
+4.85V SENSE
L7 8 UH
C24 22,000
OUTPUT CR
A10Q11
A10R4 42.2
A10R5 150
L8 9 UH
C25 37,000
-2V SENSE
CR40
L6 50 UH
C26 18,000
-12V SENSE
-20 VOLT REGULATOR
-30V
A2R29 6.124K
-20V FEEDBACK
A2R31 6.124K
+20V FEEDBACK
A2U6,U5
T3
T4
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
C4 0.47
C5 0.47
C6 0.47
C7 0.47
C8 0.47
C9 0.47
C10 0.47
C11 0.47
CR11
CR12
CR13
CR14
CR15
CR16
CR17
CR18
CR19
CR20
CR21
CR22
CR23
CR24
CR25
CR26
CR27
CR28
CR29
CR30
CR31
CR32
CR33
CR34
CR35
CR36
CR37
CR38
CR47
CR48
CR49
C27 0.1
C28 0.1
C29 0.1
C30 0.1
15V
T3-6
T3-9
T4-6
T4-9
T3-7
T3-8
T4-7
T4-8
T3-5
T3-1
T4-1
T4-5
T3-2
T3-4
T4-2
T4-4
PART OF RECTIFIER ASSEMBLY A8


FIRST FILTER
SECOND FILTER
160-VOLT CROWBAR
(PART OF A5)
A5R5
2.7
L9
1.6 MH
+160 VDC
A5R2
4.7K
A5CR2
A5
C17
9800
A5R1
4.7K
A5CR1
A5
C18
9800
C20
430
C19
430
A5C1
1.0
A5CR3
100V
A5CR4
100V
A5R7
2
A5R4
42.2
A5Q1
A5R3
150
A5CR5
160 VDC COMMON
A5R6
42.2
FROM
CROWBAR
DRIVER
CIRCUIT
ON A3
TO
OUTPUT
CROWBAR
A10
CROWBAR
TRIGGER
TRANSFORMER
A5T1
A5F2
2.5A
A5F1
2.5A
C12
0.15
T1
T2
C13
0.15
PREREGULATOR CONTROL CIRCUIT
(PART OF A1)
FIRING
ANGLE
COMPAR-
ATOR
ERROR
AMPLIFIER
U1
-30V
NO. 1
RESET
DC RESTORE
INTEGRATOR
CIRCUIT
INHIBIT PRE
REGULATOR
INVERTER DRIVER CIRCUIT
(PART OF A2)
PHASE 1A
PHASE 1
INVERTER
DRIVER
3.2 KHZ
TWO-PHASE
CLOCK
PHASE 1B
PHASE 2A
PHASE 2
INVERTER
DRIVER
PHASE 2B
INVERTER UP



NOTES:

1. RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. JUMPERS ARE SHOWN CONNECTED (SOLID LINES) FOR 115-VOLT OPERATION FOR 230-VOLT OPERATION. THESE JUMPERS ARE REMOVED AND A JUMPER IS INSTALLED BETWEEN TERMINALS 8 AND 9 ONLY.
3. CIRCUITS THAT ARE SHOWN SHADED ARE DELETED WHEN A1 PREREGULATOR CONTROL CARD, PART NO. 02100-60108 OR A4 CURRENT LIMIT CARD, PART NO. 02100-60110, ARE INSTALLED IN POWER SUPPLY.

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Table 3-1. Applicable Schematic Diagrams

ASSEMBLY	PART NO.	SCHEM DIAG FIG. NO.
A1	02100-60046	Figure 7-3
A1	02100-60108	Figure 7-4
A3	02100-60047	Figure 7-3
A3	02100-60109	Figure 7-4
A4	02100-60061	Figure 7-3
A4	02100-60110	Figure 7-4

3-40. The ac input power is connected from terminal board TB3 to cooling fans B1 and B2 and to transformer T5. This transformer is a step-down transformer that furnishes 16 volts to the control circuits and furnishes 16 and 5.5 volts ac to rectifiers for the internal voltage regulators on preregulator control card A1.

3-41. The ac input power from terminal board TB3 is connected directly to the bridge rectifier in preregulator A6 as the main power input circuit.

3-42. PREREGULATOR CIRCUIT. (See Sheet 1 of either Figure 7-3 or 7-4.)

3-43. The full-wave phase-controlled preregulator bridge circuit is comprised of diodes A6CR1 and A6CR2 and SCR's A6Q1 and A6Q2. The SCR's are turned on by pulses from the preregulator control circuit trigger-pulse generator A6Q1 through preregulator trigger transformer A1T1. The "on" time of the SCR's during each cycle of the ac input voltage determines the value of the dc output voltage which is maintained at 160 volts. Operation of the preregulator control circuit is described in paragraph 3-58.

3-44. FIRST OUTPUT FILTER CIRCUIT. (See Sheet 1 of either Figure 7-3 or 7-4.)

3-45. The first output filter circuit contains choke-transformer T6, resistors A5R1 and A5R2, diodes A5CR1 and A5CR2, and capacitors A5C17 and A5C18. The primary and secondary windings of T6 are wound on the same core to provide high mutual inductance and are connected so as to aid the current flow around the loop formed by part of the bridge and the output filter. A jumper arrangement on computer (or extender) terminal board TB1 provides connections for 115-volt ac or 230-volt ac input. The jumper connections are described in paragraphs 3-46 and 3-51 to provide the same dc output voltage for either 115- or 230-volt ac input. Resistor A6R1 and capacitor A6C3 are connected across the bridge circuit to improve the "turn-on" characteristics of the SCR's. Resistor A6A1R1 is a current-limiting resistor and A6A1R2 is a noise-suppression resistor for SCR A6Q1. Resistors A5R1 and A5R2 are connected across capacitors A5C17 and A5C18 to provide a discharge path when power is turned off to prevent a hazard to maintenance personnel. Control of the SCR's to maintain a controlled 160-volt dc output is described in paragraphs 3-59 through 3-65.

3-46. 115-VOLT AC OPERATION. (See Sheet 1 of either Figure 7-3 or 7-4.)

3-47. For 115-volt operation, jumpers are connected between terminals 6 and 7, 7 and 8, and 9 and 10 of computer (or extender) terminal board TB1. This connects the "hot" side of the ac input to the bridge junction of SCR's A6Q1 and A6Q2 and the common side to the junction of diodes A6CR1 and A6CR2. The jumper connected between terminals 6 and 7 of TB1 connects capacitors A5C17 and A5C18 into the circuit as a voltage doubler as shown in the simplified schematic diagram in figure 3-3. During the positive half of the ac input voltage, (whenever SCR A6Q1 is fired) the current flows through SCR A6Q1, the secondary of transformer T6, capacitor A5C17, and the jumper (shown as a switch in figure 3-3) between terminals 6 and 7 of terminal board TB1 to the neutral side of the line. For the negative half-cycle, the current flows from neutral through the jumper between terminals 6 and 7 of terminal board TB1 to capacitor A5C18, the primary of T6, and SCR A6Q2 to the "hot" side of the ac line.

3-48. During the time that current is flowing through capacitor A5C17, the voltage across the secondary winding of T6 also appears across the primary winding due to mutual inductive coupling and this voltage back-biases diode A6CR2 and SCR A6Q2 so that no current can flow in the primary during the positive half-cycle. During the negative half-cycle A6Q2 conducts current through the primary to charge capacitor A5C18 and the voltage across the primary appears across the secondary and back-biases diode A6CR1 and SCR A6Q1.

3-49. Due to the jumper that connects the centertap between capacitors A5C17 and A5C18 to the line neutral, each of the capacitors is charged to an equal and opposite voltage in respect to line neutral. Thus, a forced voltage-doubling action occurs for the 115-volt circuit connection.

3-50. 230-VOLT AC OPERATION.

3-51. For 230-volt operation, all jumpers are removed except one which is connected between terminals 8 and 9 of computer or extender terminal board TB1. This jumper arrangement provides the same connections (as for 115-volt operation) to the bridge circuit but disconnects the connection between line neutral and capacitors A5C17 and A5C18 to change the voltage doubler circuit to a filter. During the positive half-cycle of the ac input voltage, (whenever SCR A6Q1 is fired) the current flows through SCR A6Q1, the secondary of transformer T6, capacitors A5C17 and A5C18, the primary of T6, and diode A6CR2 to neutral. During the negative half-cycle of the ac input voltage the current flows from neutral through diode A6CR1, the secondary of T6, capacitors A5C17 and A5C18, the primary of T6, and SCR A6Q2 to the "hot" side of the ac line.

3-52. SECOND OUTPUT FILTER CIRCUIT. (See Sheet 1 of either Figure 7-3 or 7-4.)

3-53. The second output filter is connected from a tap on choke-transformer T6 to inductor L9, resistor A5R5 and capacitors C19 and C20. This circuit operates to double the

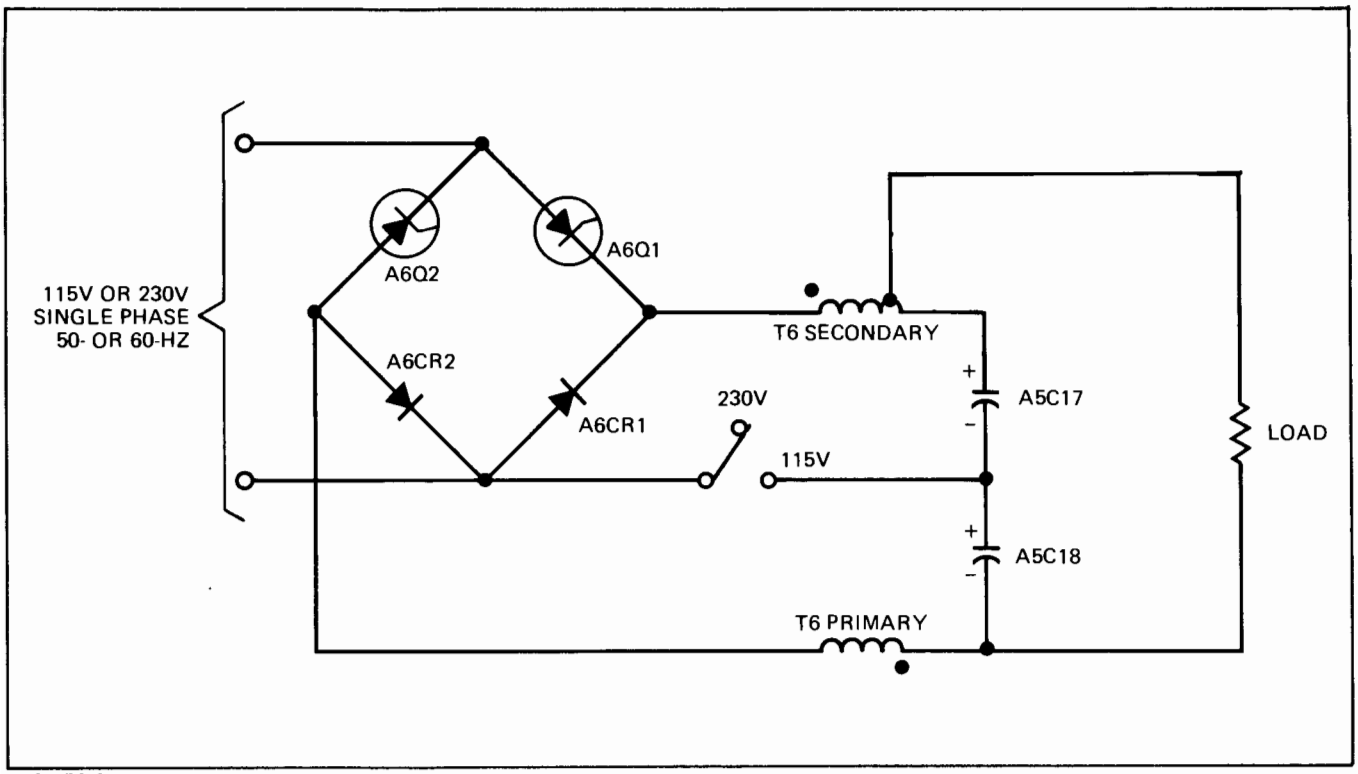

Figure 3-3. Preregulator Circuit, Simplified Schematic Diagram

ripple frequency and reduce the peak-to-peak voltage of the ripple for better filtering. The voltage developed at the tap on T6 represents the 120-Hz ripple of the bridge circuit output voltage This ripple adds to the 120-Hz ripple of capacitors A5C17 and A5C18 in the phase relationship necessary to fill in the valley portions of the waveform and produce a 240-Hz ripple which is more easily filtered by inductor L9. Resistor A5R5 connected across L9 serves to damp the resonant frequency of the output filter.

3-54. 160V CROWBAR CIRCUIT. (See Sheet 1 of either Figure 7-3 or 7-4.)

3-55. A crowbar circuit on the 160V output board (A5) is connected across the 160-volt dc output, comprising SCR A5Q1, zener diodes A5CR3 and A5CR4, resistors A5R3, A5R4, A5R6, and A5R7, capacitor A5C1, diode A5CR5, and crowbar trigger transformer A5T1. The crowbar circuit acts to place a low resistance short-circuit across the 160-volt output to protect the load if any of the dc outputs exceeds a preset value. If the 160-volt output should exceed the 200-volt drop of zener diodes A5CR3 and A5CR4, SCR A5Q1 is turned on to short-circuit the 160-volt output and blow the 12 ampere fuse F1 in the computer (or extender). Resistor A5R7 limits the peak current through SCR A5Q1. (This resistor is of special design to withstand high current surges and should never be replaced with a substitute for the exact type.) If any of the dc output voltages exceed a preset value, a signal is sent from the crowbar driver to crowbar trigger transformer A5T1 to apply a positive pulse through diode A5CR5 to the gate of SCR A5Q1. This action turns on SCR A5Q1 to short-circuit the 160-volt output. In this case, fuse F1 is normally not blown due to inhibiting of the preregulator as described in paragraph 3-63.

3-56. When the crowbar (short-circuit) action occurs, a reverse voltage could develop across capacitor A5C17 or A5C18 if there is any imbalance in either voltage or capacitance between the two capacitors. To prevent this reverse voltage, diodes A5CR1 and A5CR2 are connected across A5C17 and A5C18.

3-57. Two different 160-volt outputs (No. 1 and No. 2) are supplied by the output filter to the inverter circuits through fuses A5F1 and A5F2. The operation of the inverter circuits is described in paragraph 3-83.

3-58. PREREGULATOR CONTROL CIRCUIT FOR CARD A1, PART NO. 02100-60046. (See Figure 7-3, Sheet 1.)

Note: If the power supply contains preregulator control card, part no. 02100-60108, refer to paragraph 3-66 for the description of circuit operation.

3-59. The preregulator control circuit is located on preregulator control card A1 in the power supply. This circuit controls the firing time of the SCR's in the preregulator (A6) to maintain a constant 160-volt output.

3-60. CONTROL INPUT. Transformer T5 supplies a 16-volt ac rms input to the preregulator control circuit which represents the magnitude and phase of the ac input line voltage. This voltage is routed through the protection and control card A3 to provide an interlock circuit. If the protection and control card A3 is not installed, the 16-volt ac input line is opened and consequently the preregulator

circuit is inoperative. When the 16-volt ac input is applied to the preregulator control circuit input, diodes A1CR12 and A1CR13 pass the full wave rectified signal (waveform A) shown in figure 3-4. This signal is applied to the line synchronization circuits at the base of transistor A1Q10 and to the sinusoidal current source at the emitter of transistor A1Q11. Transistor A1Q12 is biased by a signal that varies with the load current to control the gain (adjustable by resistor A1R11) of the current source A1Q11. The output of A1Q11 is integrated by capacitor A1C12 and applied to the gate of FET A1Q4A as the partial cosine wave-shaped voltage (waveform D) shown in figure 3-4. Transistor A1Q4A forms one-half of the firing angle comparator that determines the firing time of the preregulator SCR's. The charge on capacitor A1C12 rises as shown in waveform D in figure 3-4 during each half-cycle period of the ac input voltage. The line synchronization circuit supplies a pulse to the base of transistor A1Q6 at the zero voltage point in the rectified waveform to turn on A1Q6 and discharge A1C12 rapidly as shown by the trailing edge of the cosine waveform pulse. Resistor A1R28 in the collector circuit of A1Q6 limits the discharge current of capacitor A1C12. Transistor A1Q6 is saturated at the low point in the waveform, until the base voltage (see waveform C, figure 3-4) turns A1Q6 off and the voltage at the collector rises and the integration cycle repeats. The base level is established by dc restorer FET A1Q5 which operates on each half cycle of the input voltage to charge capacitor A1C3 to the voltage at the collector of transistor A1Q11 immediately before capacitor A1C12 is discharged. A pulse from the base of transistor A1Q8 (see waveform C, figure 3-4) turns FET A1Q5 on and off between each integration cycle before transistor A1Q6 is pulsed.

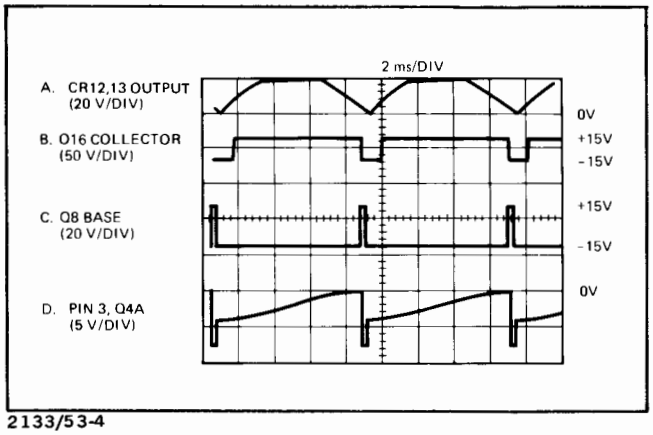

Figure 3-4. Preregulator Control Waveforms

3-61. The firing angle comparator circuit is a differential amplifier consisting of transistors A1Q4A and A1Q4B. The input to A1Q4A is the integrated waveform whose derivative (instantaneous slope) varies with the ac input line voltage as modified by the load-compensated sinusoidal current source transistors A1Q11 and A1Q12. The other input to the firing angle comparator is applied to A1Q4B from error (operational) amplifier A1U1. The error amplifier is controlled by the inhibit preregulator signal from protection and control card A3 and by the flux-sensing voltage from the output of the -30 volt dc rectifiers.

3-62. The integrated waveform voltage applied to the A1Q4A gate input of the comparator is compared with the amplified feedback voltage from error amplifier A1U1 applied to the gate of A1Q4B. When the voltage at the gate of A1Q4A reaches the level of the voltage at the gate of A1Q4B, the "crossover" voltage point is reached. At this point A1Q4A conducts, thus turning off transistors A1Q3 and A1Q2 in turn. When transistor A1Q2 turns off, gate drive is applied to transistor A1Q1 thus turning it on. Transistor A1Q1 is a blocking oscillator that operates regeneratively, to produce a series of pulses when a positive pulse appears at its base. Transistor A1Q2 is a trigger clamp that ensures the blocking oscillator is off when A1Q4A is not conducting. The pulses are generated by the blocking oscillator in 2-kHz pulse bursts, at a 60-Hz rate synchronized to the ac input frequency as shown in waveform B in figure 3-5. The time when each pulse burst is generated depends on the width of the pulse sent from A1Q4A which in turn depends upon the amplitude of the voltages applied to the gates of A1Q4A and A1Q4B. The pulses from the blocking oscillator are sent through preregulator trigger transformer A6A1T1 to SCR's A6Q1 and A6Q2 in the preregulator bridge circuits. The SCR that has a positive half-cycle of the ac input voltage applied to its anode will conduct as shown in waveform C in figure 3-5 to maintain a regulated 160-volt dc output (see waveform D, figure 3-5). Figure 3-6 shows the same waveforms for a loaded output. Although only one pulse from the blocking oscillator is necessary to turn on an SCR, a series (burst) is supplied to ensure that the SCR will turn on and remain on under all dynamic load conditions so that the bridge will not miss a cycle of operation in the ac rectification.

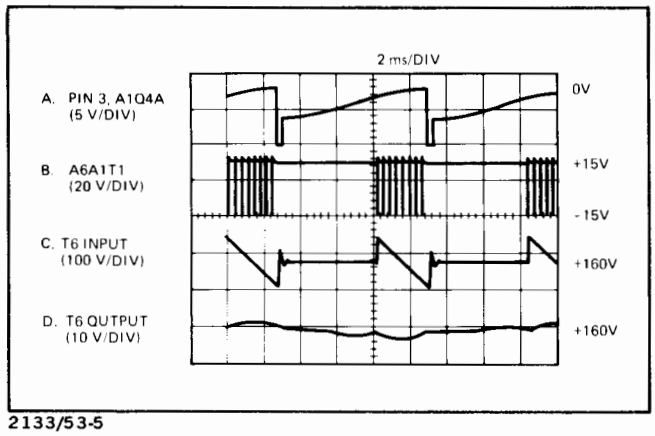

Figure 3-5. Preregulator Waveforms (Unloaded Output)

3-63. ERROR AMPLIFIER CIRCUIT. Error amplifier A1U1 supplies a control voltage to the A1Q4B side of the firing angle comparator. This control voltage establishes the crossover voltage point as described in paragraph 3-62. The non-inverting input at pin 5 of A1U1 is referenced to ground through resistor A1R15 and to the inhibit preregulator signal circuit on the protection and control card A3. The inhibit preregulator signal is generated by an excessive current, voltage, or temperature condition and causes error amplifier A1U1 to supply a positive control voltage to the gate of A1Q4B which turns on A1Q4B and in turn, turns on transistors A1Q3 and A1Q2. This action holds trigger

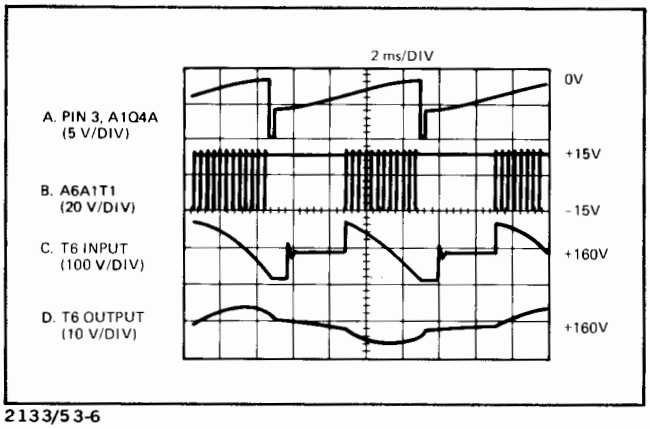

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Figure 3-6. Preregulator Waveforms (Loaded Output)

pulse generator transistor A1Q1 off and the SCR's are not fired so the preregulator is off.

3-64. The inverting input at pin 4 of error amplifier A1U1 is connected to the -30V No. 1 (flux-sensing feedback) signal from rectifier assembly A8. This signal is applied through a filter network to the inverting input at pin 4 of A1U1. When the dc output varies, the feedback signal varies accordingly to cause the amplifier A1U1 output to change as necessary to fire the preregulator SCR's at the proper time. For example, if the -30V No. 1 output increases (more negative) the feedback signal increases and the output of A1U1 becomes more positive. This output is applied to the gate of A1Q4B and causes A1Q4A to reach the crossover voltage point (described in paragraph 3-62) later in time. This results in the SCR's being fired later in time to pass a smaller portion of the ac input and bring the output back down to 160 volts dc.

3-65. The resistor-capacitor network connected from the output to the input of amplifier A1U1 is to decrease the gain of A1U1 at frequencies near the line frequency and filter resonant frequency to prevent oscillations and provide loop stability. The A1Q13 transistor circuit is used to prevent initial surges of current at power turn-on, which could damage components in the preregulator circuit. During normal operation, transistor A1Q13 is biased off by the resistor divider connected to -30V No. 1 which provides about -3 volts to the base of A1Q13. When power is initially turned on, the -30V No. 1 has not yet been developed to provide this -3 volt bias and transistor A1Q13 will be on to present a current path across amplifier A1U1. This prevents a sharp negative voltage increase at the output of amplifier A1U1 and provides gradual application of power. The variable resistor A1R36 connected to the input of amplifier A1U1 adjusts the value of the 160-volt dc output.

3-66. PREREGULATOR CONTROL CIRCUIT FOR CARD A1, PART NO. 02100-60108. (See Figure 7-4, Sheet 1.)

3-67. The preregulator control circuit is located on preregulator control card A1 in the power supply. This circuit controls the firing time of the SCR's in the preregulator (A6) to maintain a constant 160-volt output.

3-68. CONTROL INPUT. Transformer T5 supplies a 16-volt ac rms input to the preregulator control circuit which represents the magnitude and phase of the ac input line voltage. This voltage is routed through the protection and control card A3 to provide an interlock circuit. If the protection and control card A3 is not installed, the 16-volt ac input line is opened and consequently the preregulator circuit is inoperative. When the 16-volt ac input is applied to the preregulator control circuit input, diodes A1CR3 and A1CR4 pass the full wave rectified signal similar to waveform A shown in figure 3-4. This signal is applied through resistor A1R17 to the emitter of transistor A1Q6 to develop a sinusoidal current source at the collector of transistor A1Q6 which is proportional to the instantaneous value of the absolute value of the ac line voltage. The signal is also applied to the line synchronization circuit through resistor A1R10 to the base of transistor A1Q4. During normal operation, current from the collector of transistor A1Q6 is integrated by the charging of capacitor A1C2. This action produces a cosinusoidal waveform which is shifted 90 degrees in phase from the input line voltage (similar to waveform D, figure 3-4). Transistor A1Q12 is driven by transistor A1Q4 and discharges capacitor A1C2 to reset the integration every time the ac input line voltage (sine wave) passes through zero.

3-69. Transistor A1Q5 serves as a variable dc voltage source to set the voltage level to which capacitor A1C2 is reset when the ac input line voltage passes through zero. This voltage level is proportional to the magnitude of the ac input line voltage because of the connection of resistor A1R14 to the unregulated -22 volts dc.

3-70. The combined effects of the input line controlled current source transistor A1Q6, and the variable reset point provided by transistors A1Q5 and A1Q12 serve as a line voltage feed forward function. This function varies the conduction angle of the preregulator SCR's to correspond with variations in the input line voltage amplitude.

3-71. The firing angle comparator consists of transistors (switches) A1Q14 and A1Q13 connected in series. One input to the comparator is the cosinusoidal waveform developed across capacitor A1C2 as described in paragraph 3-68. The other input to the comparator is the output voltage of error amplifier A1U1. The error amplifier produces an output voltage proportional to the difference between the unloaded inverter output (-30V No. 1) and an interval reference voltage (derived from +15V and variable resistor A1R9).

3-72. The voltage developed across capacitor A1C2 is compared to the output voltage of error amplifier A1U1 as described in paragraph 3-71. When the voltage across capacitor A1C2 becomes more positive than the output voltage of error amplifier A1U1 by a specific amount (the amount equal to the sum of the base-emitter function voltages of transistors A1Q13 and A1Q14), a "crossover" voltage point is reached. At this point transistors A1Q13 and A1Q14 conduct and current flows from ground through resistor A1R28 and diode A1CR13 to the base of transistor A1Q18, turning it on. Transistor A1Q18 is a

blocking oscillator that operates as a trigger pulse generator to produce a series of pulses when turned on. Diode CR11 couples the oscillator circuit back to transistor A1Q12 to ensure that the oscillator is turned off prior to the beginning of each input line cycle. The pulses are generated by the blocking oscillator in 2 kHz pulse bursts, at a 120-Hz rate synchronized to the ac input frequency as shown in waveform B in figure 3-5. The pulses from the blocking oscillator are sent through preregulator trigger transformer A6A1T1 to SCR's A6Q1 and A6Q2 in the preregulator bridge circuits. The SCR that has a positive half-cycle of the ac input voltage applied to its anode will conduct as shown in waveform C in figure 3-5 to maintain a regulated 160-volt dc output as shown in waveform D in figure 3-5. Figure 3-6 shows the same waveforms for a loaded output. Although only one pulse from the blocking oscillator is necessary to turn on an SCR, a series of pulses (burst) is supplied to ensure that the SCR will turn on and remain on under all dynamic load conditions so that the bridge will not miss a cycle of operation in the ac rectification.

3-73. ERROR AMPLIFIER CIRCUIT. Error amplifier A1U1 supplies a control voltage to the base of A1Q13 of the firing angle comparator. This control voltage establishes the crossover voltage point described in paragraph 3-72. The non-inverting input at pin 5 of A1U1 is referenced to ground through resistor A1R39 and to the inhibit preregulator signal circuit on the protection and control card A3 through resistor A1R37 and diode A1CR20 (normally reverse-biased). The inhibit preregulator signal is generated by an excessive current, voltage, or temperature condition and causes error amplifier A1U1 to supply a positive control voltage to the base of transistor A1Q13 to turn it off. This action holds trigger pulse generator A1Q13 off and the SCR's are not fired so the preregulator is off.

3-74. The inverting input at pin 4 of error amplifier A1U1 is connected to a voltage divider which is connected between the -30V No. 1 (flux-sensing feedback) signal from rectifier assembly A8 and the +15V internal supply which serves as a voltage reference. The -30V No. 1 signal passes through low-pass filter A1L1-A1C10 to the voltage divider consisting of resistors A1R42, A1R8 and variable resistor A1R9. Variable resistor A1R9 sets the ratio of the voltage divider so that when the voltage at the connection between A1R8 and A1R42 is at zero volts, the proper preregulator output occurs.

3-75. The high-pass filter consisting of A1C9 and A1R41 operates in conjunction with capacitors A1C3 and A1C4 and resistors A1R26 and A1R40 to improve the dynamic response characteristics of the overall preregulator circuit. Diode A1CR7 acts to prevent the inverting input of A1U1. Diodes A1CR8, A1CR9, and A1CR10 couple the feedback loop of A1U1 to the emitter of transistor A1Q5. This connection prevents excessive voltage from charging capacitor A1C4 during turn-on or turn-off transient voltages to eliminate a source of possible delay before the preregulator comes into regulation.

3-76. INTERNAL VOLTAGE REGULATORS FOR CARD A1, PART NO. 02100-60046. (See Figure 7-3, Sheet 1.)

Note: If the power supply contains preregulator control card, part no. 02100-60108, refer to paragraph 3-78 for the description of circuit operation.

3-77. The power supply requires low-current regulated dc voltages of +5, +15, and -15 volts for operation of circuits inside the power supply. These voltages are supplied by voltage regulators A1U2, A1U3, and A1U4. Voltage regulator A1U2 is an integrated circuit consisting of a temperature compensated reference voltage amplifier, error amplifier, current limiter, and series pass transistor. This regulator is connected as a positive voltage regulator to supply +5 volts dc through control of external series pass transistor A1Q14. Operating voltages for A1U2 are +22 volts applied to pins 11 and 12 through diode rectifiers CR44 and CR45 from transformer T5 in addition to +15 volts applied to the non-inverting input at pin 5 from voltage regulator transistor A1Q15. The reference voltage from A1U2 at pin 6 (7.5 volts) is supplied to the inverting input of operational amplifier A1U3 (pin 4) which operates as a voltage regulator for the +15 volt output. The other input to A1U3 (pin 5) is connected to a resistive divider that supplies 7.5 volts when the regulated output is at +15 volts. When the output varies above or below +15 volts, the operational amplifier output changes to change the current through zener diode A1CR14 and the base voltage of transistor A1Q15 to regulate the output. Transistor A1Q17 is a current limiter that acts as a base-emitter shunt if the output current of A1Q15 becomes excessive. Resistor A1R52 and capacitor A1C23 are connected in the A1U3 circuit to ensure freedom from oscillations. Operational amplifier A1U4 operates essentially the same as A1U3 to supply a regulated -15 volt dc output.

3-78. INTERNAL VOLTAGE REGULATORS FOR CARD A1, PART NO. 02100-60108. (See Figure 7-4, Sheet 1.)

3-79. The power supply requires low-current regulated dc voltages of +5, +15, and -15 volts for operation of circuits inside the power supply. These voltages are supplied by voltage regulator circuits on the preregulator control card. The +15 volt supply serves as a master reference source for all circuit functions except protection and control card A3 functions. Transistor A1Q11 and associated circuits form a series-pass regulator for the 22 volts, dc from transformer T5. Diodes A1CR1 and A1CR2 from a temperature-compensated reference circuit. Transistors A1Q1 and A1Q2 form an error amplifier to drive series-pass transistor A1Q11. Transistor A1Q3 operates as a current-limit transistor, shunting current from transistor A1Q2 whenever the current through resistor A1R7 causes transistor A1Q3 to conduct.

3-80. The -15 volt regulator receives -22 volts dc from transformer T5 through diodes CR14 and CR15 during

operation with normal power input. During power shutdown, the input to the -15 volt regulator is supplied by the output of the -20 volt regulator through diode CR17. The input voltage developed across capacitor A1C14 is regulated by series-pass transistor A1Q7 which is driven by an error amplifier consisting of transistors A1Q16 and A1Q17. Resistors A1R35 and A1R37 form a voltage divider which produces a voltage at the base of transistor A1Q17 that is half-way between the +15V output voltage and the -15V output voltage. This voltage is compared to ground potential by transistor A1Q17 to hold the -15V output voltage equal and opposite to the +15V output voltage. Transistor A1Q15 serves as a current-limit transistor.

3-81. The +5 volt regulator receives +8 volts dc from transformer T5 through diodes CR42 and CR43. Resistor A1R21 passes about one-half of the load current and series-pass regulator transistor A1Q10 passes the other half. A voltage divider formed by resistors A1R22 and A1R25 just forward biases the base of error amplifier A1Q8 when the +5 and +15 volt outputs are in regulation. The base drive current is shunted from series-regulator transistor A1Q10 to maintain a +5 volt output voltage. Resistor A1R23 supplies base drive current to transistor A1Q10.

3-82. INVERTER CIRCUITS. (See Sheet 2 of either Figure 7-3 or 7-4.)

3-83. The 160-volt dc output of the preregulator is connected to the inverter bridge circuits on inverter assembly A7. One inverter bridge circuit consists of transistors A7Q3, A7Q4, A7Q5, and A7Q6 and the other consists of transistors A7Q7, A7Q8, A7Q9, and A7Q10. The inverter bridge circuits are turned on and off at a rate of 800 Hz by pulses from the inverter driver circuit coupled through transformers A7T1 and A7T2. The pulses drive the bridge circuits 90 degrees out of phase with each other to produce ac square wave outputs that are easily rectified and filtered.

3-84. INVERTER DRIVER CIRCUIT. (See Sheet 2 of either Figure 7-3 or 7-4.)

3-85. The inverter driver circuit consists of two sets of drivers, one for each inverter bridge. One set consists of transistors A2Q1 through A2Q4, the other set consists of A2Q5 through A2Q8. Each set has a pair of transistors whose bases are driven by signals that are 180 degrees out of phase (phase 1 and 2), and each pair is driven by signals that are 90 degrees out of phase (see figure 3-7). The drive signals are supplied by a multivibrator circuit consisting of transistors A2Q9 and A2Q11 that supply a 3.2 kHz clock signal to flip-flops U4A (A FF) and U4B (B FF). The FF outputs are processed by gates A2U1, A2U2, and A2U3 to supply the phase 1A, 2A, and 1B, 2B signals to the inverter drivers. The timing and phase relationships of these signals are shown in figure 3-7.

3-86. When the phase 1A signal is positive at the base of transistor A2Q2, transistor A2Q1 is turned off and current flows through A2Q3 and the primary winding of transformer A7T1, diode A2CR1, and transistor A2Q2 to ground. Transistor A2Q1 is held off until A2Q2 turns off, then the cycle reverses when A2Q4 is turned on by phase 1B to develop the square wave pulses in transformer A7T1 as shown in figure 3-8. The phase 2A and 2B inputs result in the same waveshape pulses in transformer A7T2 with the 90-degree output phase relationship corresponding to the inputs. These signals cause the inverter bridge circuits to turn on and off alternately to produce the same relative waveshapes and phase relationships in transformers T3 and T4 as in A7T1 and A7T2, respectively (see figure 3-9). Note the "step" in the leading and trailing edge of the transformer waveform shown in figure 3-7. This step is caused by the timing of the pulses applied to the bases of the transistors in the inverter driver circuit. The "step" results in a momentary idle time between turn-on and turn-off of individual transistors in each pair of transistors to prevent shorting the transistors across the 160-volt line.

3-87. RECTIFIER ASSEMBLIES. (See Sheet 2 of either Figure 7-3 or 7-4.)

3-88. Rectifier assembly A8 contains six banks of diode rectifiers that rectify all outputs of transformers T3 and T4 except the +4.85 volt output which is rectified by rectifier assembly A9. Each bank of four diodes in assembly A8 is comprised of two pairs of diodes, one pair being connected to each transformer. Since the transformer outputs are 90 degrees out of phase, the combined full-wave rectified outputs of the transformers overlap each other to form a basically pure dc output that requires very little filtering. The -2V, -12V, and +12V outputs are supplied through an LC filter to terminal boards TB1 and TB2 and the +30V and -30V outputs are supplied to the +20V and -20V regulators respectively. An additional -30V output (-30V No. 1) is taken from diodes A8CR11 through A8CR14 that sense the changes in flux density in transformers T3 and T4. This -30V No. 1 signal is a feedback signal used in regulation of the output by the preregulator control circuit as described in paragraph 3-64.

3-89. On the +4.85V rectifier assembly (A9), diode rectifiers CR35 through CR38 are protected against excessive peak inverse voltage by the parallel connection of zener diodes CR46 through CR49, and capacitors C27 through C30, respectively.

3-90. +20 VOLT REGULATOR. (See sheet 2 of either Figure 7-3 or 7-4.)

3-91. The +20 volt regulator is a switching-type voltage regulator with the output voltage level determined by the duty cycle of switching transistor A11Q14. The normal operating frequency is 20 kHz. The input to this regulator is supplied from the +30 volt output of rectifier assembly A8. The output voltage of the regulator is sensed by a control circuit which automatically adjusts the duty cycle of transistor A11Q14 to maintain a constant output voltage regardless of rapid variations in load current and input voltage. The +20 volt feedback voltage is applied to the inverting input of error (operational) amplifier A2U7 through the +20 voltage adjustment resistor A2R35, which is also connected to a temperature sense resistor located on the inhibit driver load card (A106) in the memory section

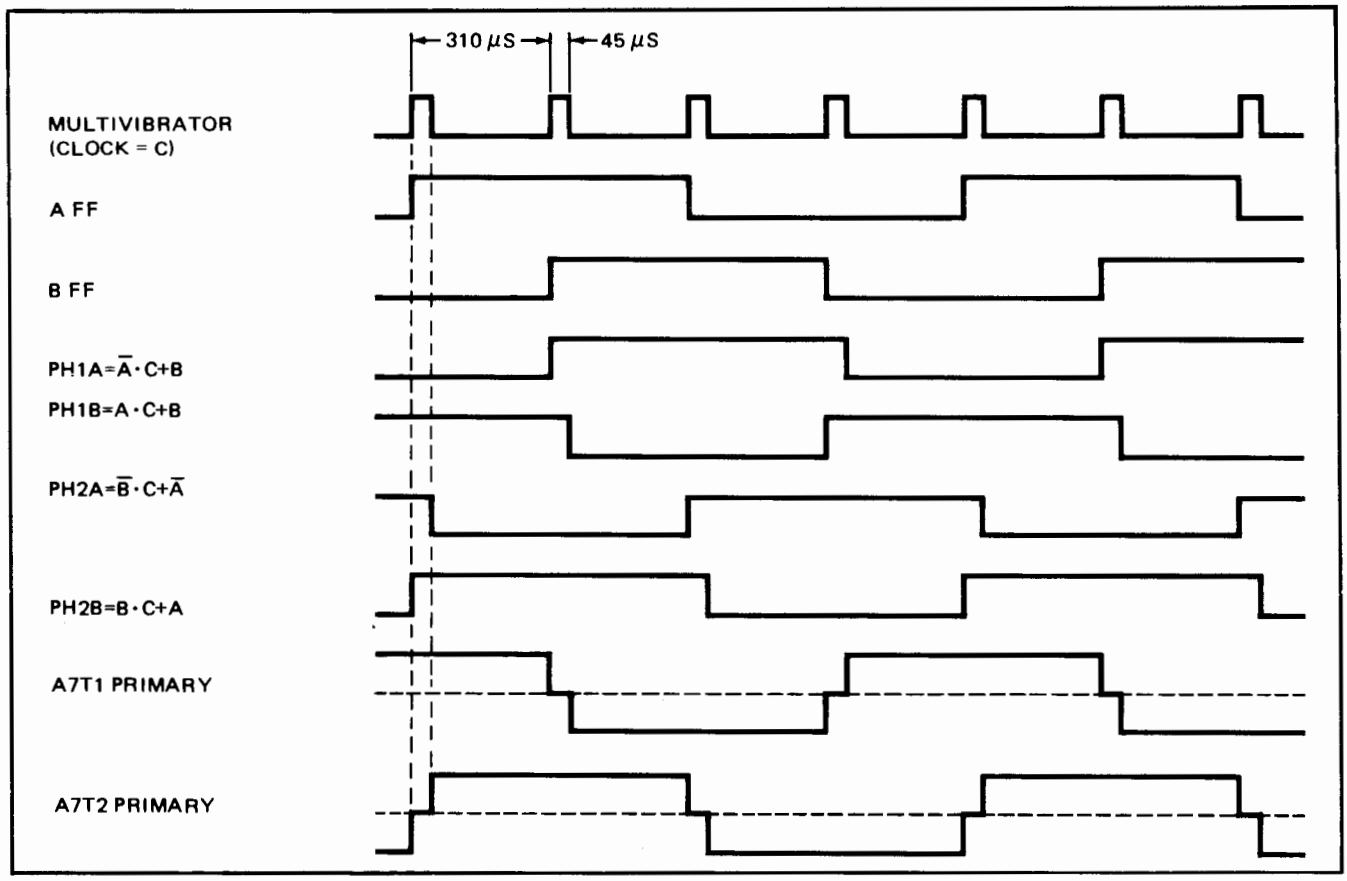

Figure 3-7. Inverter Driver Circuit, Timing Diagram

of the computer card cage. Since the proper operating voltage for the core memory varies with temperature, this temperature compensation is required to maintain the optimum operating voltage. (When the power supply is installed in a 2155A Extender, the temperature compensation is not required as the extender does not contain memory circuits. The temperature compensation resistor, in this case, is replaced by an 825-ohm load resistor connected across terminals 8 and 9 of power supply terminal board TB2.) The non-inverting input to error amplifier A2U7 is connected to a reference voltage of +15 volts (internal regulator) through a resistive divider comprised of resistors

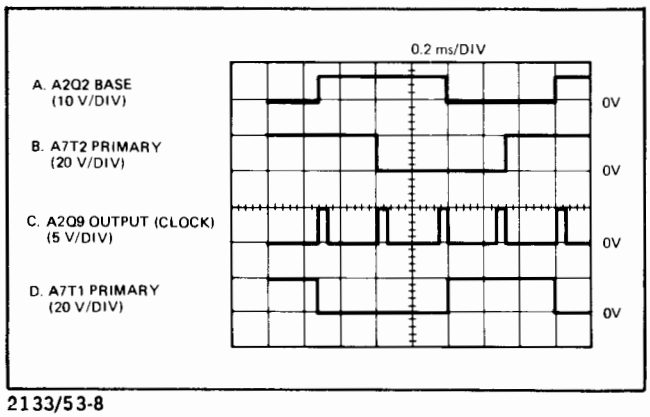

Figure 3-8. Inverter Driver Waveforms

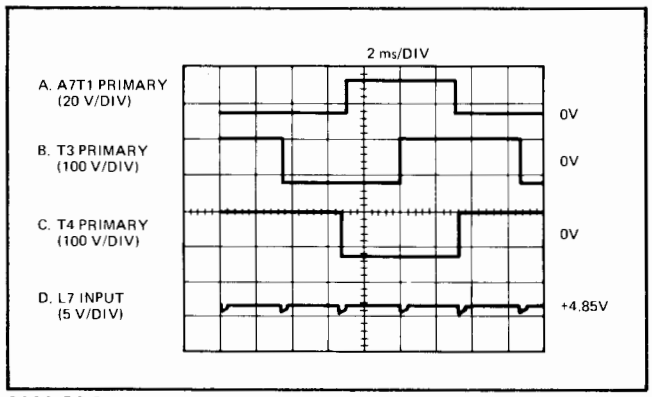

Figure 3-9. Inverter Input and Output Waveforms

A2R37 and A2R39. The output of error amplifier A2U7 varies with the +20 volt output as compensated by core memory temperature variations, and feeds the non-inverting input of comparator (operational amplifier) A2U9. The other input to A2U9 is from operational amplifier A2U8 which is operated as a 20 kHz oscillator that generates a triangular-shaped waveform. See figure 3-10. This same input (inverting) to A2U8 is connected to the +20 volt inhibit signal from current limit card A4 described in paragraph 3-103. The output of comparator A2U9 is a series of rectangular-shaped pulses (see figure 3-10) with the width of the pulses being determined by the amplitude of the

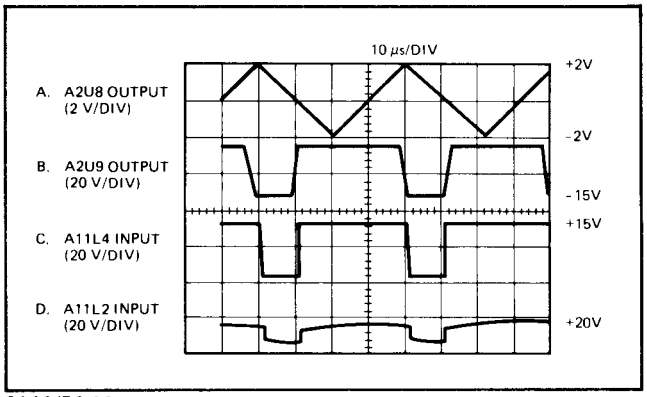

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Figure 3-10. +20 Volt Regulator Waveforms

output signal from error amplifier A2U8. These rectangular-shaped pulses are sent through transistor A2Q15 to drive the base of transistor A2Q16 which controls the duty cycle of switching transistor A11Q14.

3-92. The output stage of the +20 volt regulator is shown in simplified schematic form in figure 3-11. Transistor A2Q15 operates as a level shifter, converting the voltage pulse from the comparator (A2U9) to a current pulse at the base of transistor A2Q16. Transistor A2Q16 is the input stage of a current-limited fast-acting push-pull driver circuit consisting of transistors A2Q13, A2Q14, and A2Q16. Transistor A11Q14 is the main power switching transistor of the regulator, and is driven on and off alternately by the driver stage which is controlled by the comparator output. The on and off action provides 30-volt pulses across diode A11CR41 to the input of choke A11L4 which stores energy and transfers current to capacitor A11C14 while A11Q14 is conducting. When A11Q14 is turned off, the voltage at the junction of A11L4 and the collector of A11Q14 drops rapidly until diode A11CR41 conducts again. While A11Q14 is in the "off" state, the energy stored in A11L4 is released to maintain a continuous (but slightly varying) dc current in the loop consisting of A11L4, A11CR41, and A11C14. Thus, the loop serves to convert the variable duty cycle pulse applied across diode A11CR41 into a dc voltage (with a small triangular dc component) at capacitor A11C14 which is proportional to the duty cycle of the comparator output.

3-93. Chokes A11L2 and A11L3 and capacitor C16 serve to further filter the output of capacitor A11C14 to supply a low impedance dc output voltage.

3-94. In the push-pull driver circuit consisting of transistors A2Q13, A2Q14, and A2Q16 and associated circuitry, transistor A2Q16 serves as a high speed driver to A11Q14. Inductor A2L3 stores energy to speed up the turn off of A2Q16 by supplying a 0.8-volt reverse drive to the base as soon as the emitter current begins to decrease. Under normal operation, the current through inductor A2L3 is low enough so that the current through A2CR7 will decay to zero before A2Q16 turns on again. Whenever

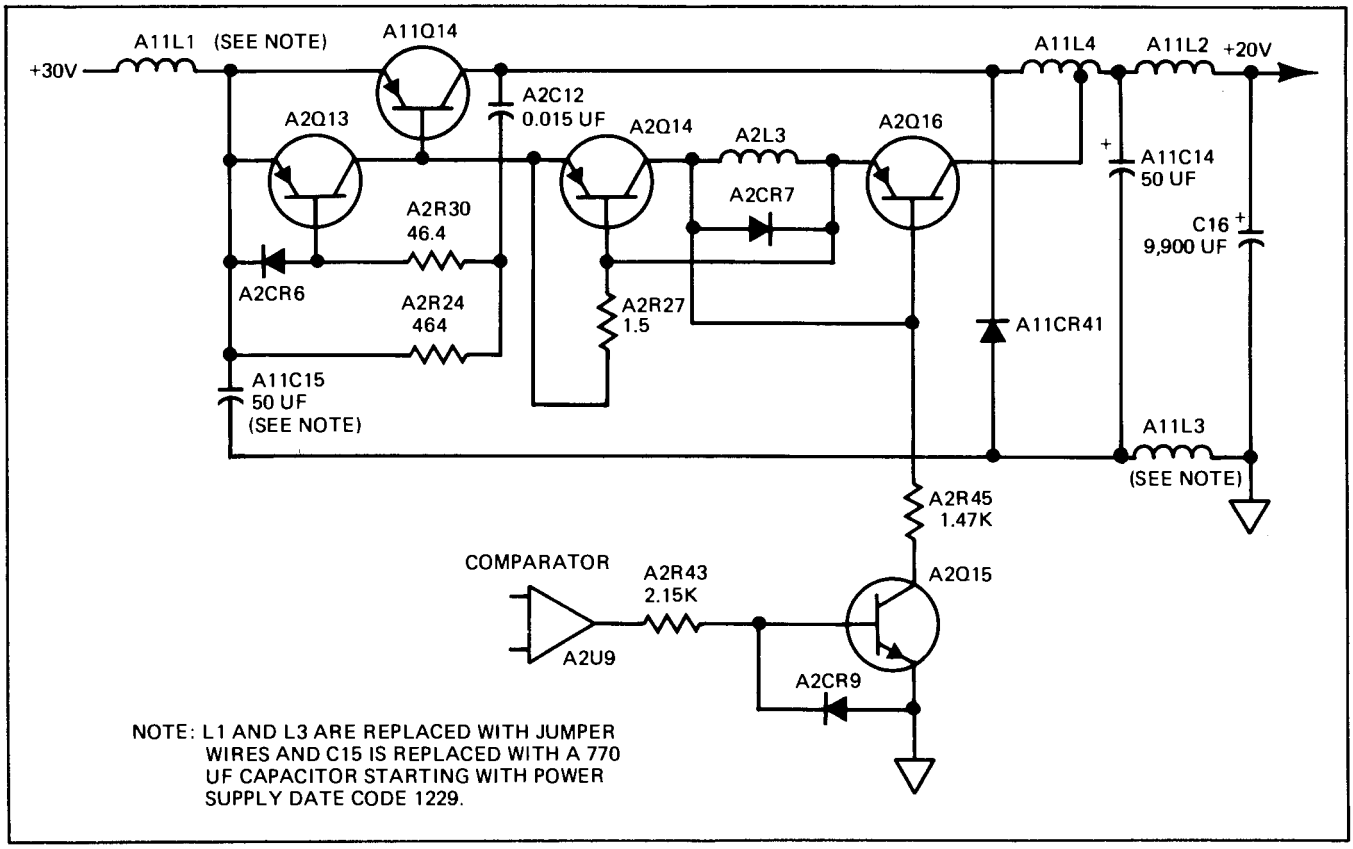

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Figure 3-11. +20 Volt Regulator Output, Simplified Schematic Diagram

the current through A2L3 becomes excessive, A2CR7 will remain forward biased after A2Q15 tries to turn on A2Q16. This holds A2Q14 and A2Q16 off to reduce the duty cycle of A2Q16 and limit the average current.

3-95. Transistor A2Q13 acts as a base clamp on A11Q14, to momentarily clamp the A11Q14 base to the emitter whenever A2Q16 begins to turn off A11Q14. The collector voltage of A11Q14 is coupled through capacitor A2C12 and resistor A2R30 to the base of A2Q13. Thus, when the collector voltage of A11Q14 begins to drop, a regenerative action occurs to draw the stored charge out of the base of A2Q14 to speed up the turn off action. This reduces the switching power losses in A11Q14.

3-96. -20 VOLT REGULATOR. (See Sheet 2 of either Figure 7-3 or 7-4.)

3-97. The -20 volt regulator is a push-pull, combination series-shunt type regulator capable of supplying a positive output current (sourcing) of 100 milliamperes and a negative output current (sinking) of 600 milliamperes at -20 volts. It is regulated within 1 percent of the value of the +20 volt regulator but of opposite polar.

3-98. In the first stage of the -20 volt regulator, the inverting input of error (operational) amplifier A2U6 is connected to a resistive voltage divider that is connected on one side to the +20 volt output and on the other side to the -20 volt output. The other input (non-inverting) of A2U6 is connected to ground potential. Since the output of error amplifier A2U6 will be of opposite polarity to the inverting input, any change in the +20 or -20 volt outputs will cause an opposite change in the output of A2U6. This causes the -20 volt output to be maintained at equal value (and opposite polarity) to the +20 volt output.

3-99. Operational amplifier A2U5 acts as a level shifting amplifier. The output of error amplifier A2U6 is amplified by A2U5. The input circuit to A2U5 is also connected to ground potential through capacitor A2C5 and to -30 volts through choke A2L2. These circuits control the input and output voltage excursion range of A2U5 to correspond to the range of the preceding and succeeding circuits.

3-100. Transistor A2Q10 operates as a current limit circuit for series-pass transistor A11Q13 by sensing the voltage drop across filter choke A2L1. Capacitor A2C6 serves as the output filter for the -20 volt regulator.

3-101. OUTPUT CROWBAR CIRCUIT. (See Figure 7-3, Sheet 1.)

3-102. The output crowbar circuit is comprised of two SCR's, one of which is connected from the -2 volt to the +4.85 volt output and the other is connected from the -20 volt to the +20 volt output. Gate pulses that fire the SCR's are supplied by the crowbar trigger transformer (A5T1 secondary) on the 160 volt output board A5. The primary of transformer A5T1 is connected to the crowbar driver circuit on protection and control card A3, described in paragraph 3-129.

3-103. CURRENT LIMIT CARD A4, PART NO. 02100-60061. (See Figure 7-3, Sheet 4.)

Note: If the power supply contains current limit card part no. 02100-60110, refer to paragraph 3-110 for the description of circuit operation.

3-104. The current limit card contains individual current sense amplifiers (operational amplifiers) U1, U2, U5, U6, and U7 to sense the value of the output load current of the +20, +12, +4.85, -2, and -12 volt regulators respectively. This sensing is accomplished by connecting the inputs of the sense amplifiers across the output filter choke in each regulator output section. Whenever the output current varies, the sense amplifier output varies accordingly due to the voltage change of the dc component across the filter choke. The resistor-capacitor network at the input of each sense amplifier provides low-pass ac filtering and the resistor-capacitor network connected between output and inverting input determines the amplifier dc gain and ac response characteristics. Zener diode CR9 connected to U7 provide automatic control of the operating voltage supplied to these amplifiers. This control is necessary when large common mode voltage changes (such as during initial turn-on) occur at the input to the amplifier which would be outside its operating range. Thus, the operating voltage of the amplifier is allowed to "float" to adjust to these changes.

3-105. The outputs of the sense amplifiers are combined into one circuit arrangement to develop the load current output and are combined in another circuit arrangement to develop the overcurrent signal.

3-106. LOAD CURRENT OUTPUT. The load current output signal is a voltage developed by the output of the sense amplifiers fed through resistor networks and operational amplifiers U3 and U8. The output of the +4.85, +20, and +12 volt sense amplifiers is applied through resistors R21, R19, and R20, respectively, to the inverting input of amplifier U3. The signal developed is proportional to the weighted sum of the load currents. This signal is combined, through another resistor network, with the - and -12 volt sense amplifier outputs and applied to the inverting input of amplifier U8. The output of amplifier U8 is a control voltage that is proportional to the weighted sum of all the regulator load currents. (In effect, it is directly proportional to the preregulator output current which flows through choke L9 in the preregulator filter.) This control signal is sent to the load current compensation circuit in the preregulator control section.

3-107. The output of the +20 volt sense amplifier is connected through pin 16 of the current limit card to the +20 volt regulator circuit through pins 2 and B of inverter driver card A2. This signal inhibits comparator A2U9 in the 20 volt regulator if a sharp increase occurs in the load current.

3-108. OVERCURRENT. The overcurrent signal is developed by the output of the -2, -12, +4.85, and +12

volt sense amplifiers fed through diodes, resistor networks, and amplifiers U4 and U9. The outputs of the -2 and -12 volt sense amplifiers are "or-tied" through diodes CR12 and CR13 and a voltage divider to amplifier U9. The outputs of the +4.85 and +12 volt sense amplifiers are "or-tied" through CR2 and CR3 and a voltage divider to amplifier U4. Amplifiers U9 and U4 are normally in the "off" condition. When any regulator output current exceeds it's overload value, the output of amplifier U9 or U4 turns on transistor Q1 to supply the overcurrent signal. This signal is supplied to the protection and control card to develop the inhibit preregulator signal described in paragraph 3-118.

3-109. TEST POINTS. Test points E1 through E5 are provided at the outputs of the +20, +12, +4.85, -2, and -12 volt sense amplifiers, respectively, to facilitate circuit testing.

3-110. CURRENT LIMIT CARD A4, PART NO. 02100-60110. (See Figure 7-4, Sheet 4.)

3-111. The current limit card contains individual current sense amplifiers (operational amplifiers) U1, U2, U4, U5, and U6 to sense the value of the output load current of the +20, +12, +4.85, -2, and -12 volt regulators respectively. This sensing is accomplished by connecting the inputs of the sense amplifiers across the output filter choke in each regulator output section. Whenever the output current varies, the sense amplifier output varies accordingly due to the voltage change of the dc component across the filter choke. The resistor-capacitor network at the input of each sense amplifier provides low-pass ac filtering and the resistor-capacitor network connected between output and inverting input determines the amplifier dc gain and ac response characteristics. Zener diode CR8 connected to amplifier U1 and U2 and zener diode CR5 connected to U6 provide automatic control of the operating voltage supplied to these amplifiers. This control is necessary when large common mode voltage changes (such as during initial turn-on) occur at the input to the amplifier which would be outside its operating range. Thus, the operating voltage of the amplifier is allowed to "float" to adjust to these changes.

3-112. The outputs of the sense amplifiers are combined into one circuit arrangement to develop the overcurrent signal.

3-113. The output of the +20 volt sense amplifier is connected through pin 16 of the current limit card to the +20 volt regulator circuit through pins 2 and B of inverter driver card A2. This signal inhibits comparator A2U9 in the 20 volt regulator if a sharp increase occurs in the load current.

3-114. OVERCURRENT. The overcurrent signal is developed by the output of the -2, -12, +4.85, and +12 volt sense amplifiers fed through diodes, resistor networks, and amplifiers U7 and U3. The outputs of the -2 and -12 volt sense amplifiers are "or-tied" through diodes CR11 and CR12 and a voltage divider to amplifier U7. The outputs of the +4.85 and +12 volt sense amplifiers are "or-tied" through CR1 and CR2 and a voltage divider to amplifier U3. Amplifiers U7 and U3 are normally in the "off" condition. When any regulator output current exceeds it overload value, the output of amplifier U7 or U3 turns on transistor Q1 to supply the overcurrent signal. This signal is supplied to the protection and control card to develop the inhibit preregulator signal described in paragraph 3-118.

3-115. TEST POINTS. Test points E1 through E5 are provided at the outputs of the +20, +12, +4.85, -2, and -12 volt sense amplifiers, respectively, to facilitate circuit testing.

3-116. PROTECTION AND CONTROL CARD A3, PART NO. 02100-60047. (See Figure 7-3, Sheet 3.)

Note: If the power supply contains protection and control card, part no. 02100-60109, refer to paragraph 3-135 for the description of circuit operation.

3-117. The protection and control card performs functions that protect the power supply and computer (or extender) circuits (hardware). These circuits also protect data (software) stored in the computer memory and registers when failures occur in power supply or computer circuits or in the ac power source. This card also contains circuits that provide for an orderly start-up and shut-down during normal turn-on and turn-off of the ac power.

3-118. MONITOR CIRCUITS. Each of the regulated dc output voltages is continuously monitored to detect overvoltage, and the +20, -20, and +4.85 volt regulator outputs and the ac power line voltage are continuously monitored to detect undervoltage. Thermal switches on the power supply heat sinks and in the computer (or extender) are monitored to detect overtemperature conditions. The overcurrent signal is sent from the current limit card to the protection and control card whenever a regulator output exceeds its overload value. When a overvoltage or overtemperature condition occurs, the inhibit preregulator (INH PREG) signal and the "not" inverter up ($\overline{\text{INU}}$) signal are developed. The inhibit preregulator signal results in turn off of the preregulator, and the "not" inverter up signal results in turn-off of the inverter drive signal. In addition, a crowbar driver signal is developed to crowbar (short-circuit) all output voltages to protect the computer (or extender) circuits. When an overcurrent condition occurs, only the inhibit preregulator signal is generated. When an undervoltage condition occurs, a power failure detection signal ("not" PWU) is developed, prior to the complete loss of voltage, to save the current status of the computer program and to allow automatic restart after power is restored to normal.

3-119. BASIC SECTIONS OF PROTECTION AND CONTROL CARD. Circuit description of the protection and control card is divided into six basic sections, as follows:

a. Positive overvoltage comparator and latch.
b. Negative overvoltage comparator.

c. Undervoltage comparator.
d. Shutdown output signal generator.
e. Internal voltage reference.
f. Power-up output circuit.

3-120. Positive Overvoltage Comparator and Latch. This section consists of transistors U1Q1 through U1Q5 and transistor Q2 and associated circuits. Transistors U1Q1, U1Q2, U1Q3, and U1Q5 serve as multiple non-inverting inputs to a differential comparator circuit. Transistor U1Q4 serves as the inverting input. Whenever the voltage at a non-inverting input exceeds the +4.85 volt reference source applied to the base of U1Q4, transistor Q2 drives an output voltage from a -15 volt normal state to a +15 volt overvoltage state value. The output is coupled back through diode CR11, resistor R26, and capacitor C14 to the non-inverting input at the base of transistor U1Q5 causing it to saturate and latch the comparator circuit whenever one of the non-inverting inputs detects an overvoltage. The latch condition can only be removed by turning off the power. The output of transistor Q2 enables transistor Q1 (crowbar driver), transistor U3Q4 ("not" inverter up) and sends the Inhibit Preregulator signal through diode CR7. Resistor R9 in the emitter circuit of transistor U1Q4 is a current source resistor for the differential comparator and capacitor C10 in the base circuit of transistor U1Q5 decouples the latching input from noise voltage spikes that may be radiated or conducted from the adjacent high-powered switching circuits.

3-121. The thermal sense input is coupled to the latch circuit (U1Q5) through diode CR9. For this reason, the power supply will remain off after an overtemperature has occurred and been corrected, unless the power switch is turned off and back on, or unless diode CR9 is removed. (Removal of CR9 allows automatic restart of the computer after the temperature has returned to normal.)

3-122. The overall comparator circuit switching action is aided by capacitor C11 in the collector circuit of U1Q3 and capacitor C26 in the base circuit of transistor Q2. These capacitors speed up the switching and ensure that once the switching action begins it will continue until latched regardless of input changes.

3-123. The input circuits to transistors U1Q1, U1Q2, and U1Q3 comprise voltage divider pairs of resistors and voltage spike filter capacitors.

3-124. Negative Overvoltage Comparator. The negative overvoltage comparator consists of transistors U2Q1 and U2Q2 and associated circuits. The voltage divider resistors at the input to transistor U2Q1 are connected to the -2, -12, and -20 volt regulator outputs. Each voltage divider develops a voltage that is normally positive but which passes below ground level when the associated regulator output voltage exceeds its overvoltage limit. When this occurs, the "or-tied" diode (CR13, CR16, or CR18) conducts to cut off U1Q1. This action allows the voltage developed across resistor R30 to be applied to a non-inverting input of the positive overvoltage comparator at the base of U1Q5 through diode CR12, initiating the same latching action described in paragraph 3-120.

3-125. Diode CR31 protects the base-emitter junction of transistor U2Q1 from excessive reverse bias voltage. Resistor R73 and capacitor C28 provide a feedback signal from crowbar driver transistor Q1 to the base of U2Q1 whenever the crowbar is triggered. This feedback signal ensures the latch condition of transistor Q2 whenever the crowbar is triggered, even if it is triggered by noise voltage spikes or a single failure in the protection circuit. Capacitors C16, C18, and C19 filter noise voltage spikes in the input circuit of transistor U2Q1. Diode CR14 is a temperature compensation diode and resistor R33 is a bias-developing resistor in the base circuit of transistor U2Q2. Diode CR30 clamps the voltage developed across source resistor R38 in the emitter circuits of U2Q1 and U2Q2.

3-126. Undervoltage Comparator. The undervoltage comparator is similar in operation to the negative overvoltage comparator described in paragraph 3-124.

3-127. The base circuit of transistor U2Q4 serves as the inverting input to the comparator. The base is biased high by resistor R44 whenever the +20, +4.85, or -20 volt regulator outputs are below their undervoltage level. Transistor U2Q3 serves as the non-inverting input of this comparator and is referenced to the emitter-base junction of transistor Q4 (reference source) which provides temperature compensation for diodes CR24, CR28, and CR29 which form the "or-tied" inputs to this comparator. Whenever the cathode of one of these diodes drops below a +4.5 volt reference level, transistor U2Q4 turns off. This develops a voltage across resistor R34 which turns on transistor U2Q5 through zener diode CR22. The base of emitter-follower transistor Q6 goes low as does the IPU signal. When the IPU signal goes low, a control signal is fed back to the base of transistor U2Q4 through the resistor-capacitor network R72, C25, and R71. This feedback signal ensures that the IPU signal will remain low for at least 1 millisecond and shifts the trip point of the comparator up higher so that the source of the undervoltage must increase slightly above the voltage at which it tripped IPU, before IPU will return high.

3-128. Shutdown Output Signal Generator. The shutdown output signal generator circuit (transistors U3Q4, Q1 and associated circuitry) is controlled by the output of the positive overvoltage comparator (collector of transistor Q2). The positive signal applied through diode CR3 turns on transistor U3Q4 to turn off the inverter driver circuit whenever an overvoltage is detected. This same positive signal is sent through diode CR7 as the inhibit preregulator signal to turn off the preregulator circuit. The inhibit preregulator signal may also be developed by an open thermal switch (A6S1, A9S2 or S3) through diode CR8 and zener diode CR4 or by an overcurrent signal from the current limit card fed through diode CR5.

3-129. The circuit of transistor Q1 functions as a crowbar driver blocking oscillator. This circuit drives crowbar trigger transformer A5T1 (see figure 7-3, sheet 1) on 160V output board A5. Transformer A5T1 provides feedback (to sustain oscillations) to pin 11 of A3, through resistor R11, capacitor C3, and diode CR1 to the base of Q1.

Normally, transistor Q1 is inhibited from oscillation by resistor R12 and capacitor C2 which act as a noise filter to prevent Q1 from being triggered by random high frequency noise pulses from adjacent circuits. When the output of the overvoltage comparator (Q2) exceeds +8 volts, CR2 conducts to turn on blocking oscillator transistor Q1. Capacitor C4 counteracts the delay factor which would be caused by resistor R7 and capcitor C2. Once the blocking oscillator fires, the crowbar latch condition enables it to continue firing. Resistor R73 and capacitor C28 feed back a signal from the oscillator to the base of U2Q1 (comparator) to ensure that the latch condition is set despite random transient pulses that might otherwise cause it to reset.

3-130. Each of the three secondary windings of crowbar trigger transformer A5T1 are connected to a separate SCR. One of the SCR's is located on 160V output board A5 (see figure 7-3, sheet 1) in series with 2-ohm resistor A5R7. When this SCR is fired by the crowbar driver (blocking oscillator) it shunts the 160-volt output and discharges the preregulator output capacitors. The other two SCR's are on output crowbar A10 and are connected between the +20 and -20 volt output and between the +4.85 and -2 volt output, respectively (see figure 7-3, sheet 1). When these SCR's are fired, the associated filter capacitors are discharged.

3-131. Internal Voltage Reference. (See figure 7-3, Sheet 3.) The internal voltage reference circuit on A3 consists of transistors Q3 and Q4 which provide a temperature-compensated reference voltage for all functions of the protection and control card A3.

3-132. Diode CR10 is a low-temperature coefficient zener diode biased for maximum temperature stability. Resistors R25, R4 (REF ADJ), and R1 form an adjustable voltage divider centered at +4.5 volts. Transistors Q3 and Q4 form a temperature-balanced buffer stage. Capacitor C21 is connected in the emitter circuit of transistor Q3 to filter high frequency noise voltages radiated by adjacent circuits and prevent oscillation at the emitter of transistor Q3.

3-133. Power Up Output Circuit. The power up output circuit is a one-half second monostable multivibrator comprised of transistors U3Q2, U3Q1, and Q5. When the IPU signal goes low, as described in paragraph 3-127, due to the action of transistor Q6 (or the same Q6 in another 2100 Computer or 2155A Extender interconnected by IPU) the PWU signal goes low immediately and remains low for one-half second after IPU has returned high. The low PWU signal starts the power failure routine to provide an orderly shutdown and save the contents of the computer registers and memory.

3-134. The PWU signal goes low whenever the IPU signal goes low. This happens whenever U2Q5 is turned on by either the undervoltage comparator (through CR22), the overvoltage comparator (through CR15) or by the thermal switches (through CR23).

3-135. PROTECTION AND CONTROL CARD A3, PART NO. 02100-60109. (See Figure 7-4, Sheet 3.)

3-136. The protection and control card performs functions that protect the power supply and computer (or extender) circuits (hardware). These circuits also protect data (software) stored in the computer memory and registers when failures occur in power supply or computer circuits or in the ac power source. This card also contains circuits that provide for an orderly start-up and shut-down during normal turn-on and turn-off of the ac power.

3-137. MONITOR CIRCUITS. Each of the regulated dc output voltages is continuously monitored to detect overvoltage, and the +20, -20, and +4.85 volt regulator outputs and the ac power line voltage are continuously monitored to detect undervoltage. Thermal switches on the power supply heat sinks and in the computer (or extender) are monitored to detect overtemperature conditions. The overcurrent signal is sent from the current limit card to the protection and control card whenever a regulator output exceeds its overload value. When a overvoltage or overtemperature condition occurs, the inhibit preregulator (INH PREG) signal and the "not" inverter up ($\overline{\text{INU}}$) signal are developed. The inhibit preregulator signal results in turn off of the preregulator, and the "not" inverter up signal results in turn-off of the inverter drive signal. In addition, a crowbar driver signal is developed to crowbar (short-circuit) all output voltages to protect the computer (or extender) circuits. When an overcurrent condition occurs, only the inhibit preregulator signal is generated. When an undervoltage condition occurs, a power failure detection signal ("not" PWU) is developed, prior to the complete loss of voltage, to save the current status of the computer program and to allow automatic restart after power is restored to normal.

3-138. BASIC SECTIONS OF PROTECTION AND CONTROL CARD. Circuit description of the protection and control card is divided into six basic sections, as follows:

a. Positive overvoltage comparator and latch.
b. Negative overvoltage comparator.
c. Undervoltage comparator.
d. Shutdown output signal generator.
e. Internal voltage reference.
f. Power-up output circuit.

3-139. Positive Overvoltage Comparator and Latch. This section consists of transistors A3Q9 through A3Q12, A3Q17 and associated circuits. Transistors A3Q9 through A3Q12 serve as non-inverting inputs to a differential comparator circuit. Diode CR29 serves as the inverting input. Whenever the voltage at a non-inverting input exceeds the +4.85 volt reference source applied to the anode of diode CR29, the collector of transistor A3Q17 drives an output voltage from a -15 volt normal state to a +15 volt overvoltage state value. The output is coupled back through diode CR31, resistor R73, and capacitor C25 to the non-inverting input at the base of transistor A7Q12 causing it to

saturate and latch the comparator circuit whenever one of the non-inverting inputs detects an overvoltage. The latch condition can only be removed by turning off the power. The output of transistor A3Q17 enables transistor A3Q16 (crowbar driver), transistor A3Q8 ("not" inverter up) and sends the Inhibit Preregulator signal through diode CR32. Resistor R70 in the emitter circuits of transistors A3Q9 through A3Q12 is a current source resistor for the differential comparator.

3-140. The thermal sense input is coupled to the latch circuit (A3Q12) through diodes CR30 and CR24. For this reason, the power supply will remain off after an overtemperature has occurred and been corrected, unless the power switch is turned off and back on, or unless diode CR30 or CR24 is removed. (Removal of CR30 or CR24 allows automatic restart of the computer after the temperature has returned to normal.)

3-141. The overall comparator switching action is aided by capacitor C14 in the collector circuit of A3Q11 and capacitor C23 in the base circuit of transistor A3Q17. These capacitors speed up the switching and ensure that once the switching action begins it will continue until latched regardless of subsequent input changes.

3-142. The input circuits to transistors A3Q9, A3Q10, and A3Q11 comprise voltage divider pairs of resistors and voltage spike filter capacitors.

3-143. Negative Overvoltage Comparator. The negative overvoltage comparator consists of transistor A3Q7 and associated circuits. The voltage divider resistors at the input to transistor A3Q7 are connected to the -2, -12, and -20 volt regulator outputs. Each voltage divider develops a voltage that is normally positive but which passes below ground potential when the associated regulator output voltage exceeds its overvoltage limit. When this occurs, the "or-tied" diode (CR16, CR17, or CR18) conducts to cut off A3Q7. This action allows the current through resistor R42 to be applied to a non-inverting input of the positive overvoltage comparator at the base of transistor A3Q12 through diode CR21, initiating the same latching action described in paragraph 3-139.

3-144. Capacitor C20 and resistor R51 provide a feedback signal from crowbar driver transistor A3Q16 to the base of A3Q7 whenever the crowbar is triggered. This feedback signal ensures the latch condition of transistor A3Q17 whenever the crowbar is triggered, even if it is triggered by noise voltage spikes or a single failure in the protection circuit. Capacitors C9, C10, and C11 filter noise voltage spikes in the input circuit of transistor A3Q7.

3-145. Undervoltage Comparator. The base-emitter function of transistor A3Q2 serves as the undervoltage comparator. This function is reverse biased when both the +4.85 volt and the +20 volt regulator outputs are above their undervoltage levels. The emitter of transistor A3Q2 is connected to the +4.5 volt reference voltage and the base is connected, through diodes CR7 and CR12, to the "and-tied" diodes CR6 and CR8. Diode CR7 provides temperature compensation for diodes CR6 and CR8 and diode CR12 provides temperature compensation for the base-emitter function of transistor A3Q2. Whenever the cathode voltage of diode CR6 or CR8 drops below the 4.5-volt reference level, current flow from resistors R17 and R18 (which had been holding A3Q2 in the "off" state) is shunted through the forward-biased diode (CR6 or CR8) allowing resistor R22 to sink current from the base of transistor A3Q2, thus turning it on.

3-146. When transistor A3Q2 turns on (due to a positive undervoltage) it causes transistor A3Q4 to turn on through resistor R21. This action turns off transistor A3Q3 and causes timing capacitor C3 to discharge. Turning off transistor A3Q3 allows transistor A3Q6 to turn off and the PWU signal, at the emitter of emitter-follower A3Q5, is drawn towards zero volts by resistors R8 and R10. Resistor R29 and capacitor C8 provide positive ac feedback to the base of transistor A3Q3 to ensure that the PWU signal does not pulsate during the period of time required to discharge capacitor C3. Capacitor C3 may also be discharged by the IPU line to another computer when the IPU lines are connected together in a multi-computer system.

3-147. Transistor A3Q1 and associated circuits serve to detect failure of the -20 volt regulator to track the +20 volt regulator and to detect power failure due to undervoltage or loss of ac line power. Resistors R4 and R16 form a voltage divider which allows transistor A3Q1 to turn on when the magnitude of the -20 volt regulator output changes in excess of 3.5 volts more than the +20 volt regulator output changes. When transistor A3Q1 turns on it sinks current from the base of transistor A3Q2. This action initiates the positive undervoltage sequence described in paragraph 3-146.

3-148. Another input to transistor A3Q1 is through diode CR2 from the negative side of capacitor C4. The current flow through resistors R1 and R2 (line adjust) charges capacitor C4 and it discharges through resistor R3, diodes CR4 and CR5 and transformer T5. The positive peak voltage from the negative side of capacitor C4 to common potential is proportional to the average value of the input line voltage. (This positive peak voltage is nearly independent of line frequency, waveform distortion, or capacitance variations of capacitor C4.) Whenever this peak voltage becomes greater than common potential, transistor Q1 is turned on initiating the positive undervoltage sequence described in paragraph 3-146. Diode CR1 controls the response time of capacitor C4 to ensure that the loss of more than one power line cycle will be detected. Resistor R13 and Diode CR3 provide additional bias current to capacitor C4 only when transistor A3Q2 is on. This acts to produce a margin of about 4 volts ac between the line voltage value at which the PWU signal goes doen and the value at which the PWU signal goes up.

3-149. Shutdown Output Signal Generator. The shutdown output signal generator circuit (transistors A3Q8, A3Q16, and associated circuitry) is controlled by the output of the positive overvoltage comparator (collector of transistor A3Q17). The positive signal applied through

diode CR23 turns on transistor A3Q8 to turn off the inverter driver circuit whenever an overvoltage is detected. This same positive signal is sent through diode CR32 as the inhibit preregulator signal to turn off the preregulator circuit. The inhibit preregulator signal may also be developed by an open thermal switch (A6S1, A9S2, or S3) through diode CR26 or by an overcurrent signal from the current limit card fed through diode CR27.

3-150. The circuit of transistor A3Q16 functions as a crowbar driver blocking oscillator. This circuit gives crowbar trigger transformer A5T1 (see figure 7-4, sheet 1) on 160V output board A5. Transformer A5T1 provides feedback (to sustain oscillations) to pin 11 of A3, through resistor R71, capacitor C24, and diode CR25 to the base of A3Q16. Normally, transistor A3Q16 is inhibited from oscillation by resistor R62. When the output of the overvoltage comparator (A3Q17) exceeds +6.2 volts, transistor A3Q15 conducts to turn on blocking oscillator A3Q16. Once the blocking oscillator fires, the crowbar latch condition ensures that it will continue to fire. Capacitor C20 and resistor R51 feed back a signal from the oscillator to the base of transistor A3Q7 (comparator) to ensure that the latch condition is set despite random transient pulses that might otherwise cause it to reset.

3-151. Each of the three secondary windings of crowbar trigger transformer A5T1 are connected to a separate SCR. One of the SCR's is located on 160V output board A5 (see figure 7-4, sheet 1) in series with 2-ohm resistor A5R7. When this SCR is fired by the crowbar driver (blocking oscillator) it shunts the 160-volt output and discharges the preregulator output capacitors. The other two SCR's are on output crowbar A10 and are connected between the +20 and -20 volt output and between the +4.85 and -2 volt output, respectively (see figure 7-4, sheet 1). When these SCR's are fired, the associated filter capacitors are discharged.

3-152. Internal Voltage Reference. The internal voltage reference circuit consists of CR28 and associated components. Transistors A3Q13 and A3Q14 provide a temperature-compensated reference voltage for all functions of protection and control card A3.

3-153. Diode CR28 is a low-temperature coefficient zener diode biased for maximum temperature stability. Resistors R67, R66 (REF ADJ) and R68 form an adjustable voltage divider centered at +4.5 ± 0.5 volts. Transistors A3Q13 and A3Q14 form a temperature-balanced buffer stage. Capacitor C18 is connected in the emitter circuit of A3Q14 to filter high frequency noise voltages radiated by adjacent circuits and prevent oscillation at the emitter of transistor Q13.

3-154. Power Up Output Circuit. The power up output circuit is a one-half second monostable multivibrator comprised of transistors A3Q3, A3Q4, A3Q5, and A3Q6. When the IPU signal goes low, as described in paragraph 3-146 due to the action of transistor A3Q4 (or the same A3Q4 in another 2100 Computer or 2155A Extender interconnected by IPU) the PWU signal goes low immediately and remains low for one-half second after IPU has returned high. The low PWU signal starts the power failure routine to provide an orderly shutdown and save the contents of the computer registers and memory.

3-155. The PWU signal goes low whenever the IPU signal goes low. This happens whenever A3Q4 is turned on by either the undervoltage comparator (through resistor R21), or by the overvoltage comparator (through diode CR10) or by a thermal switch (through resistor R44 and diode CR20).

TROUBLESHOOTING

SECTION IV

4-1. INTRODUCTION.

4-2. Troubleshooting is based on checkout procedures presented in the form of a series of flowcharts. A basic checkout troubleshooting flowchart directs initial tests and makes reference to adjustment procedures in the text and to subordinate troubleshooting flowcharts, each related to a circuit area. There is a set of flowcharts for power supplies with date codes prior to 1240 and a set for power supplies with date codes of 1240 and higher. All flowcharts and adjustment procedures are in section V.

4-3. TEST DATA.

4-4. Performing the basic checkout test procedure is the first step of power supply testing. Overall performance of the power supply is tested with the power supply installed in the computer (or extender). If proper indications are not obtained, references are made to more detailed tests and adjustments to isolate the trouble. If proper indications are obtained, the power supply is assumed to be ready for operation.

4-5. TROUBLESHOOTING DATA.

4-6. The troubleshooting data in this section is used for checking the power supply circuits to isolate trouble symptoms, which are detected during power supply testing, to a replaceable assembly or part. Troubleshooting data included in this section consists of test procedures and troubleshooting diagrams. Information in other sections of this manual which will be required during troubleshooting includes the circuit descriptions and related diagrams presented in section VII and the replaceable parts information presented in section VI. Total familiarty with the content, purpose and use of the information presented in these sections is recommended before attempting to troubleshoot or repair the power supply.

4-7. INFORMATION IN OTHER MANUALS.

4-8. Information in other manuals which may be required during troubleshooting includes that presented in the following:

a. Computer *Installation and Maintenance Manual* (part no. 02100-90002 for 2100A or part no. 02100-90162 for 2100S).

b. 2155A I/O Extender Manual (part no. 02155-90002).

c. The applicable diagnostic test procedures contained in the *Manual of Diagnostics.*

4-9. BASIC CHECKOUT.

4-10. GENERAL.

4-11. The basic checkout test procedure is performed on a power supply installed in a computer (or extender). This test procedure should be conducted immediately after a power supply is installed, and as required thereafter as part of a regularly scheduled maintenance program, as the first step of troubleshooting, and after repairs or modifications are made to the power supply. The basic checkout should always be performed prior to attempting to perform the detailed checkout. Successful completion of all steps in the basic checkout procedure ensures that the power supply is operational.

4-12. REQUIRED TEST EQUIPMENT.

4-13. The test equipment required for basic checkout procedure is listed as part of the tests in Section V that are conducted during basic checkout.

4-14. TEST PROCEDURE.

4-15. The basic checkout procedure consists of a series of tests that check the operation of key circuit functions in the power supply. The purpose of these tests is to provide an expedient means of detecting obvious trouble symptoms. The results of each test, when compared to expected normal results, provides an indication as to whether or not the circuit under test is functioning normally. Instructions are included for analyzing trouble symptoms, and references are provided to troubleshooting data for the circuits most likely to be causing the trouble indication. Troubles encountered during the performance of the basic checkout must be corrected before detailed testing is attempted.

4-16. Instructions for performing the basic checkout procedure are contained in the following steps:

a. At the front panel of the computer (or extender), turn the POWER switch to OFF.

b. Remove the top and bottom panels of the computer (or extender) and the top and bottom covers of the power supply.

WARNING

Dangerous ac line voltage is present in the computer (or extender) even though the POWER switch has been turned off at the computer (or extender) front panel. Pro-

tective panels and covers installed on the power supply and on the bottom of the card cage are designed to prevent personal contact with components that are wired directly to the hot side of the ac line. Use caution when servicing in these areas even though the protective panels and covers are in place. If it is necessary to remove a protective panel or cover during servicing, first turn off the computer (or extender) and disconnect the computer (or extender) ac power cable from the ac power source. If it is necessary to apply power to the computer (or extender) while a protective panel or cover is removed, use extreme caution to avoid contact with the exposed area. Refer to paragraph 5-7 for additional safety information before proceeding.

c. Inspect the electrical assemblies and parts comprising the power supply for visible indications of trouble, such as burned wiring, broken wiring connections, loose or improper cable connections, or plug-in cards installed in wrong slots or improperly seated in mating connectors. Also inspect for excess dirt accumulations or foreign matter that could restrict air flow and cause overheating. Take immediate action to correct any condition that may be the cause of trouble. Note those conditions that do not require immediate corrective action, but which should be serviced when regularly scheduled preventive maintenance is performed.

d. At the front panel of the computer, check that the LOADER ENABLE switch-indicator is off. Check all maintenance switches for proper operating positions. Refer to section I of the computer *Installation and Maintenance Manual* (part no. 02100-90002, for 2100A or part no. 02100-90162 for 2100S).

e. Turn the computer (or extender) POWER switch to ON. Check that fans at the rear of the power supply are operating. Check each fan for abnormal airflow and audible indications of defective motor bearings, fan blade obstructions, or other indications of abnormal operation.

CAUTION

Do not continue with this procedure unless all fans are operating normally. Loss of air flow from an inoperative or improperly operating fan may cause overheating which could result in serious damage to computer (or extender) components. Turn off power and do not attempt further operation until the trouble has been corrected.

f. Perform the procedures described in the basic checkout flowchart, figure 5-6 for power supplies with date codes prior to 1240 or figure 5-14 for power supplies with date codes 1240 or higher.

4-17. DETAILED CHECKOUT.

4-18. Detailed checkout is performed on a power supply that is removed from a computer (or extender) for servicing on a test bench. The detailed checkout is required when indicated during basic checkout or after repairs or modifications have been made to a power supply. Successful completion of all steps in the detailed checkout procedure ensures that all circuits in the power supply are operational.

4-19. REQUIRED TEST EQUIPMENT.

4-20. The test equipment required for detailed checkout procedure is listed as part of the tests in Section V that are conducted during detailed checkout.

4-21. TEST PROCEDURE.

4-22. The detailed checkout procedure consists of a series of bench tests and adjustments that check the operation of detailed circuitry in the power supply. Detailed checkout is conducted by performing that part of the basic checkout flowchart instructions which require bench tests and adjustments. The results of each test, when compared to expected normal results, provide an indication as to whether or not the circuit under test is functioning normally. If the circuit is not functioning normally, the flowchart instructions are followed to a separate troubleshooting flowchart for analyzing trouble symptoms, and references are provided to troubleshooting data for the circuits most likely to be causing the trouble indication.

4-23. Instructions for performing the detailed checkout procedure are contained in the following steps:

a. Refer to point B in the basic checkout flowchart diagram, figure 5-6 or 5-14.

b. Perform the bench tests and adjustments described in the flowchart (figure 5-6 or 5-14).

c. If incorrect indications are obtained during any of the tests, refer to the appropriate troubleshooting flowchart as referenced in figure 5-6 or 5-14.

d. After isolation and correction of a trouble, repeat the test that was being performed when the trouble was detected and continue the checkout.

MAINTENANCE

SECTION V

5-1. INTRODUCTION.

5-2. This section describes preventive maintenance, adjustments, tests, and part-replacement procedures for the power supply. These procedures are supported by figures 5-1 through 5-5. Figures 5-6 through 5-21 provide troubleshooting information to support both section IV and section V. Figures 5-6 through 5-13 are for power supplies having date codes prior to 1240. Figures 5-14 through 5-21 are for power supplies having date codes of 1240 or higher.

5-3. Preventive maintenance is performed at scheduled intervals, and its purpose is to prevent or minimize equipment deterioration. Included in the preventive maintenance procedures are voltage tests which check power supply operation.

5-4. Adjustments and test procedures are performed when required and their purpose is to aid in trouble isolation and to ensure normal operation after a trouble has been isolated and corrected.

5-5. Adjustments are included for a power supply installed in a computer (or extender) and tests and adjustments are included for a power supply being serviced on a bench.

5-6. To determine the appearance and location of components and assemblies for the performance of maintenance, refer to the parts location diagrams presented in Section VII.

5-7. SAFETY PRECAUTIONS.

WARNING

When the input power is connected, use caution when working inside the power supply. Many exposed conductors carry low dc voltages which are capable of supplying heavy currents if short-circuited, resulting in high heat and the possibility of painful burns. Use caution when manipulating metal tools or probes. A wrist watch, or a metal necklace, bracelet, or ring must not be worn. Avoid dropping tools, screws, or other metal objects onto conductors. Remove power and recover dropped objects at once; if forgotten, damage could result later. AC power-line voltage and 160 volts dc are exposed when certain covers are removed; these covers are described in the following paragraph. Exercise extreme caution when working in the power supply with these covers removed, and never work under this condition unless another person is nearby and within sight. If feasible, unplug the ac power cable before performing any work inside the power supply and wait 3 minutes for filter capacitors to discharge after removing power. To prevent explosion resulting from internal heating, always be sure that a replacement filter capacitor is properly connected with respect to polarity. Danger of death or serious injury exists if the precautions above are not observed.

5-8. HIGH VOLTAGE POINTS.

5-9. The highest ac voltage in the power supply is the ac line voltage. The highest dc voltage in the power supply is 160 volts. The ac line voltage is exposed at the input circuits of the power supply (terminal board TB3, transformer T5, and preregulator assembly A6). The 160 volts dc is exposed at several points within the power supply when the top or bottom power supply covers are removed.

5-10. TEST EQUIPMENT GROUND.

5-11. If the test equipment has a metal case, the negative test lead preferably should not be internally connected to the case. Instead, the case should be connected to a good earth ground through the test equipment power cord. This precaution prevents the danger of shock or possibility of a short when the negative lead is connected to a point not at ground potential.

5-12. PREVENTIVE MAINTENANCE.

5-13. GENERAL.

5-14. The following preventive maintenance procedures are performed at monthly or semimonthly intervals, the frequency depending upon the physical conditions prevailing at the particular site. Performance once per month is adequate for most sites. The monthly performance is applicable to power supplies which operate 24 hours per day, seven days per week. The interval may be reduced in accordance with the amount of time the power supply is turned off. The power supply is not removed from the computer (or extender) to perform preventive maintenance.

5-15. EQUIPMENT REQUIRED.

5-16. The following items are required to perform preventive maintenance:

a. Source of compressed air for cleaning the filter, or a cleaned filter.

b. A vacuum cleaner for removing dust from the power supply.

c. One digital voltmeter of the type listed in table 1-2.

d. One general purpose Centigrade thermometer, accurate to at least ±1 degree, for measuring ambient temperature.

e. One oscilloscope of the type listed in table 1-2.

5-17. PROCEDURE.

5-18. Before starting preventive maintenance, set up the thermometer for measuring ambient temperature. The thermometer must be near the computer (or extender), but away from cold drafts and heat radiating objects. Do not place the thermometer on or in the computer (or extender). Plug in the digital voltmeter and turn it on. Then proceed as described in the following paragraphs.

Note: If the power supply is in an extender, also connect the extender to a 2100 Computer as described in the extender manual.

5-19. AIR FILTER. Clean the air filter at the rear of the power supply using the following procedure:

a. Remove the air filter from the power supply by pulling firmly on the filter frame. (The filter is held in place by metal banana plugs attached to each corner of the filter frame.)

b. Remove the filter from the computer room and blow the dirt from the filter. Blow in the opposite direction from that in which air normally moves through the filter. Then reinstall the filter. If compressed air is not available at the computer site, install a spare filter which has been cleaned.

5-20. CABLES. With the computer (or extender) POWER switch off and the ac power cable disconnected, remove the top and bottom panels of the computer (or extender) and the top and bottom covers of the power supply and check the cables and connectors for cracks, burns, or wear. Also inspect the ac power cable, paying particular attention to the portions of the cable near the connector and the cable clamp. Repair if necessary.

5-21. DUST. If required, remove dust and other light debris from the power supply, using the vacuum cleaner. Loosen encrusted dust with a soft-bristled brush, and pay particular attention to heat dissipating areas.

5-22. CIRCUIT CARDS. With the bottom and top panels of the computer (or extender), and the bottom cover of the power supply removed, check all circuit cards for proper seating. Adjust where necessary.

5-23. FANS. Turn on the computer POWER switch and check for proper operation of the cooling fans. Ensure that no object interferes with the rotation of the fan blades.

5-24. VOLTAGE CHECKS. Before making voltage checks, the voltmeter must be allowed time to warm up as prescribed by the manufacturer of the instrument. Also, the computer must run, with any type of program, for at least 15 minutes before making the voltage measurements. If any voltage is not within specified limits, make the necessary adjustments as described in paragraph 5-27. Make the voltage checks as described below:

a. Stop the computer program.

b. Measure the seven dc voltages listed in table 5-1. These voltages are available at test jacks mounted on the rear panel of the computer.

c. Set the oscilloscope for reading ac voltage, and check each of the seven voltages listed in table 5-1 for ripple and noise. For each voltage, the indicated ripple and noise should be less than that listed in table 5-1.

5-25. PREVENTIVE MAINTENANCE SUMMARY.

5-26. Preventive maintenance for the power supply consists of the following:

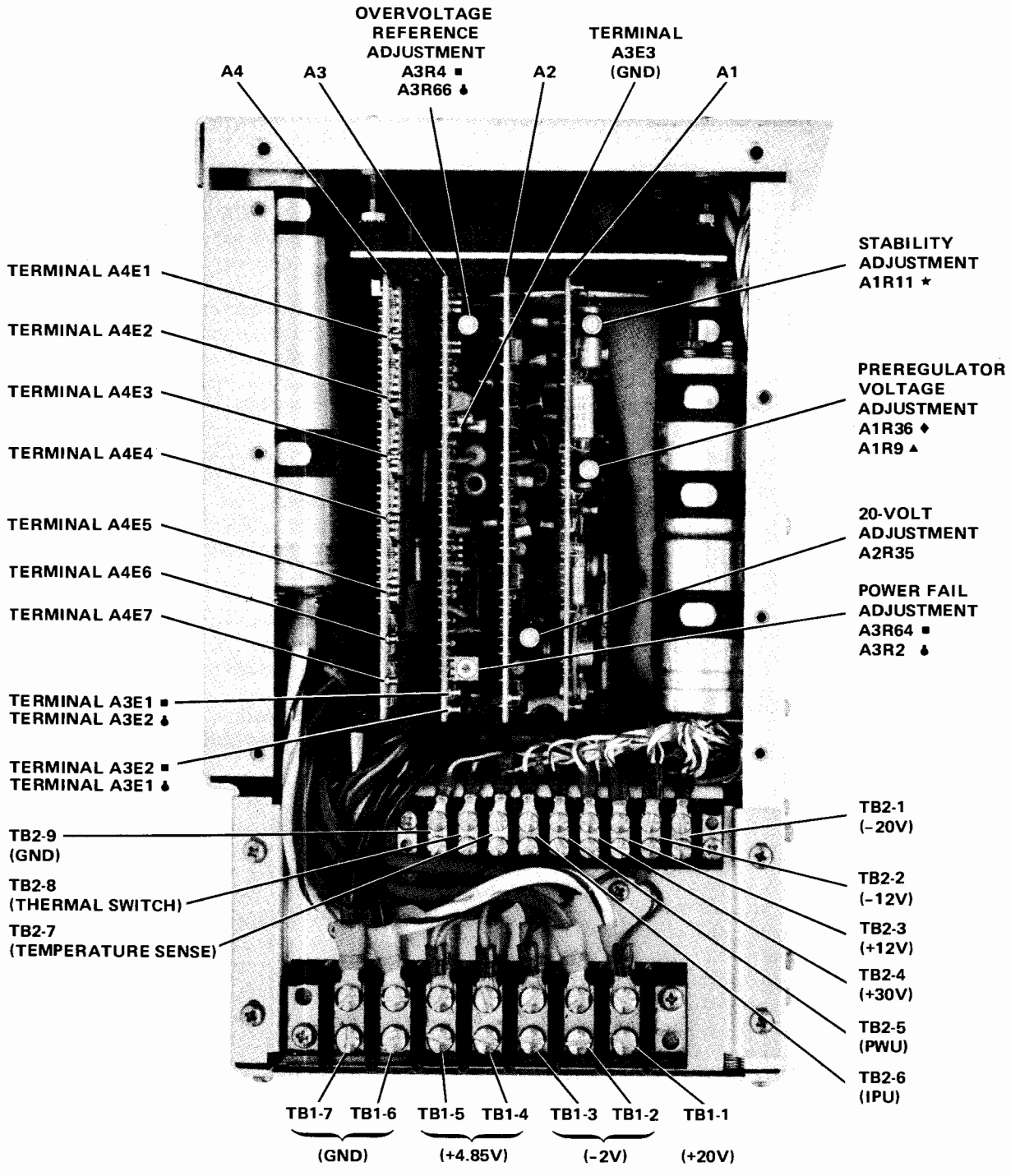
a. Clean the air filters.
b. Check cables for wear.
c. Remove dust.
d. Check circuit cards for proper seating.
e. Check operation of the cooling fans.
f. Check the dc operating voltages at the rear of the computer (or extender).

5-27. ADJUSTMENTS TO INSTALLED POWER SUPPLY.

5-28. There are four adjustments that can be made to the power supply when it is installed in the computer (or extender). Paragraphs 5-29 through 5-44 give the procedures for each adjustment in the power supply that can be performed in the field. Figure 5-1 shows the locations of these adjustments. Note that the power supply assumes the reference designation A25 when it is installed in a computer (or extender).

Table 5-1. DC Supply Voltages

TEST JACK	READING		RIPPLE AND NOISE VOLT. TOL. P-P
	MIN.	MAX.	
+30	+29.0	+30.5	<20%
+20	(See Table 5-2)		±0.5%
+12	+12.0	+12.5	<2%
+4.85	+4.80	+4.90	
-2	-1.85	-2.0	
-12	-12.0	-12.7	
-20	(See Table 5-2)		±0.5%



NOTES: FOR COMPLETE REFERENCE DESIGNATIONS WHEN POWER SUPPLY IS INSTALLED IN A COMPUTER OR EXTENDER, PREFIX ALL REFERENCE DESIGNATIONS WITH A25.

■ APPLIES TO A3, PART NO. 02100-60047.

♦ APPLIES TO A3, PART NO. 02100-60109.

★ APPLIES TO A1, PART NO. 02100-60046 ONLY.

♦ APPLIES TO A1, PART NO. 02100-60046.

▲ APPLIES TO A1, PART NO. 02100-60108.

REF 2133/53-25

Figure 5-1. Power Supply Adjustments

5-29. PREREGULATOR ADJUSTMENT.

5-30. The +30, +12, +4.85, -2, and -12 volt supply outputs are controlled by preregulator adjustment resistor A25A1R36 on the preregulator control card (see figure 5-1).

Note: The preregulator is adjusted to bring the +4.85 volt supply within the tolerance listed in table 5-1. With the +4.85 volt supply operating within that tolerance, all other supplies should also be operating within their specified tolerances. If any one of the other supplies does not operate within its specified tolerance, the power supply is malfunctioning.

5-31. EQUIPMENT. Adjustment of the preregulator requires one digital voltmeter, of the type listed in table 1-2.

5-32. PROCEDURE. The procedure consists of adjusting the preregulator until the +30, +12, +4.85, -2, and -12 volt supply outputs remain within tolerance under load and no-load conditions. The procedure is as follows:

a. Ensure that the POWER switch is set to OFF. Then remove the computer (or extender) top and bottom panels, card cage card retainer, and power supply bottom cover.

b. Turn the POWER switch to ON.

c. Connect the voltmeter to the +4.85V test jack on the rear panel. While observing the voltmeter, adjust the preregulator voltage adjustment resistor A25A1R36 until the +4.85 volt supply is within the limits specified in table 5-1.

d. Connect the voltmeter, in turn, to the +30V, +12V, -2V, and -12V test jacks on the rear panel while observing the voltmeter and verify that each supply voltage is within the limits specified in table 5-1. If any voltage is not within the specified limits, the power supply is malfunctioning. If this is the case, refer to paragraph 4-9 for troubleshooting the power supply.

5-33. MEMORY SUPPLY (+20 VOLTS AND -20 VOLTS) ADJUSTMENT.

5-34. The +20 volt and -20 volt supply outputs are controlled by the 20-volt adjustment resistor A25A2R35 on the inverter driver card (see figure 5-1). The outputs of the +20 and -20 volt regulators are set in accordance with the ambient temperature at the time of adjustment. Table 5-2 lists the voltages required for various temperatures. If resistor A25A2R35 cannot be adjusted to give the proper voltmeter readings, refer to paragraph 4-9 for troubleshooting the power supply.

5-35. EQUIPMENT. Adjustment of the +20 and -20 volt regulators requires the following equipment:

a. One digital voltmeter of the type listed in table 1-2.

b. One centigrade thermometer (for measuring room temperature) accurate to at least ±1 degree.

5-36. PROCEDURE. The procedure for adjusting the +20 volt and -20 volt supply outputs is as follows:

a. Ensure that the POWER switch is set to OFF. Then remove the computer (or extender) bottom panel and the power supply bottom cover.

b. Set up the thermometer for measuring ambient temperature. The thermometer must be near the computer (or extender) but away from cold drafts and heat radiating objects. Do not place the thermometer on or in the computer (or extender).

c. Turn the POWER switch to ON and allow the temperature reading to stabilize. Connect the voltmeter to the +20V test jack on the rear panel. Observe the voltmeter, and adjust resistor A25A2R35 until the voltmeter reading is in the range specified in table 5-2 for the ambient temperature.

d. Connect the voltmeter to the -20V test jack on the rear panel. The voltmeter reading should be within one percent of the final reading obtained in step "c."

e. Turn the POWER switch to OFF, and replace the power supply bottom cover and computer (or extender) bottom panel.

5-37. OVERVOLTAGE REFERENCE ADJUSTMENT.

5-38. The computer (or extender) circuits are protected from an overvoltage by the crowbar circuits in the power supply. The reference voltage which controls the operation of the crowbar circuits is adjusted by the overvoltage reference adjustment resistor A25A3R4 (A3, part no. 02100-60047) or A25A3R66 (A3, part no. 02100-60109) on the protection and control card (see figure 5-1). The overvoltage adjustment should be performed when directed in the troubleshooting section of this manual. If resistor A25A3R4 (A3, part no. 02100-60047) or A25A3R66 (A3, part no. 02100-60109) cannot be adjusted to give the proper voltmeter reading, refer to paragraph 4-9 for troubleshooting the power supply.

5-39. EQUIPMENT. Adjustment of the overvoltage reference requires one digital voltmeter of the type listed in table 1-2.

5-40. PROCEDURE. The procedure for performing the overvoltage adjustment is as follows:

a. Ensure that the POWER switch is set to OFF, then connect the voltmeter between terminals A25A3E3 (ground) and A25A3E1 (see figure 5-1).

Table 5-2. Output of +20 Volt and -20 Volt Regulators

TEMPERATURE (°C)	DC VOLTAGE RANGE			TEMPERATURE (°C)	DC VOLTAGE RANGE		
	MINIMUM	CENTER	MAXIMUM		MINIMUM	CENTER	MAXIMUM
0	21.10	21.30	21.50	28	19.64	19.84	20.04
1	21.05	21.25	21.45	29	19.59	19.79	19.99
2	21.00	21.20	21.40	30	19.54	19.74	19.94
3	20.94	21.14	21.34	31	19.49	19.69	19.89
4	20.89	21.09	21.29	32	19.44	19.64	19.84
5	20.84	21.04	21.24	33	19.38	19.58	19.78
6	20.80	21.00	21.20	34	19.33	19.53	19.73
7	20.74	20.94	21.14	35	19.28	19.48	19.68
8	20.68	20.88	21.08	36	19.23	19.43	19.63
9	20.63	20.83	21.03	37	19.18	19.38	19.58
10	20.58	20.78	20.98	38	19.12	19.32	19.52
11	20.53	20.73	20.93	39	19.07	19.27	19.47
12	20.48	20.68	20.88	40	19.02	19.22	19.42
13	20.42	20.62	20.82	41	18.97	19.17	19.37
14	20.37	20.57	20.77	42	18.92	19.12	19.32
15	20.32	20.52	20.72	43	18.86	19.06	19.26
16	20.27	20.47	20.67	44	18.81	19.01	19.21
17	20.22	20.42	20.62	45	18.76	18.96	19.16
18	20.16	20.36	20.56	46	18.71	18.91	19.11
19	20.11	20.31	20.51	47	18.66	18.86	19.06
20	20.06	20.26	20.46	48	18.60	18.80	19.00
21	20.01	20.21	20.41	49	18.55	18.75	18.95
22	19.96	20.16	20.36	50	18.50	18.70	18.90
23	19.90	20.10	20.30	51	18.45	18.65	18.85
24	19.85	20.05	20.25	52	18.40	18.60	18.80
25	19.80	20.00	20.20	53	18.34	18.54	18.74
26	19.75	19.95	20.15	54	18.29	18.49	18.69
27	19.70	19.90	20.10	55	18.24	18.44	18.64

NOTE: Voltages listed are negative for the -20 volt regulator.

b. Turn the POWER switch to ON.

c. While observing the voltmeter, adjust resistor A25A3R4 (A3, part no. 02100-60047) or A25A3R66 (A3, part no. 02100-60109) until the voltmeter reads +4.60 ±0.02 volts dc. If the proper reading cannot be obtained, refer to paragraph 4-9 for troubleshooting the power supply.

5-41. POWER FAIL ADJUSTMENT.

5-42. The following procedure describes how to adjust for the threshold voltage (power line voltage) at which the power fail interrupt occurs. This voltage is 100 to 102 volts rms for 115-volt operation and 200 to 204 volts rms for 230-volt operation. Since the power fail detection circuits are line-frequency sensitive, this adjustment should be performed if the computer (or extender) is changed from 60-Hz operation to 50-Hz operation, or from 50-Hz operation to 60-Hz operation. This line-frequency sensitivity characteristic does not apply to power supplies that contain an A3 protection and control card with a card revision code of 1215 or higher.

5-43. EQUIPMENT. The power fail adjustment requires the following equipment:

a. One ac digital voltmeter with at least a 3-digit display, or an expanded-scale ac voltmeter. The meter must be capable of reading ac voltage to within ±1 percent of the true value.

b. One variable autotransformer capable of supply sufficient power for the computer (or extender). The computer requires up to 1400 volt-amperes, depending on the optional features used. (To reduce the power requirement to a minimum, all circuit cards for optional features can be disconnected before making the adjustment.) Be sure to turn off power before disconnecting or installing cards. The autotransformer must be capable of reducing the power-line voltage to 90 volts rms if the computer (or extender) is connected for 115-volt operation, or to 180 volts rms if connected for 230-volt operation.

5-44. PROCEDURE. To perform the power fail adjustment proceed as follows:

CAUTION

The power fail interrupt causes a program jump to core storage location 4. If there is no power fail interrupt program in the computer, location 4 should contain a halt instruction. Otherwise a jump may occur from location 4 to a program which will destroy wanted data or cause undesired operation of I/O devices or controlled equipment.

a. Turn on the voltmeter, and allow the prescribed warm-up time before using the instrument.

Note: When performing the power fail adjustment on a power supply installed in an extender, be sure that the extension cables are connected to the associated computer and that the computer is connected to the normal ac input.

b. Ensure that the computer (and/or extender) POWER switch is set to OFF.

c. Remove the computer top panel and set the automatic restart switch S1 on I/O control card A7 to the ARS ("not" automatic restart) position.

d. Remove the computer (or extender) bottom panel and the power supply bottom cover.

e. Connect the autotransformer between the computer (or extender) and the power line.

f. Connect the voltmeter for measuring the output voltage of the autotransformer.

g. Set the autotransformer to furnish 115 volts rms to the computer (or extender), 230 volts if the computer (or extender) is connected for 230-volt operation.

h. Turn the computer (and/or extender) POWER switch to ON. Allow sufficient warm-up time before making the adjustment. A program can be run during this time if desired.

i. Slowly decrease the output of the autotransformer until the indicator lamps at the operator panel on the computer just go out. For A3 card, part number 02100-60047, the voltmeter should read 95 ± 1 volts rms (or 190 ± 2 volts rms for 230-volt operation). For A3 card, part number 02100-60109, the voltmeter should read 100 ± 0.5 volts rms (or 200 ± 1 volts rms for 230-volt operation).

j. Slowly increase the output of the autotransformer until the indicator lamps at the operator panel on the computer just go on. For A3 cards, part number 02100-60047, the voltmeter should read 100 ± 1 volts rms (or 200 ± 2 volts rms for 230-volt operation). For A3 card, part number 02100-60109, the voltmeter should read 101 ± 0.5 volts rms (or 202 ± 1 volts rms for 230 volt operation).

Note: There is up to one-second delay from the time that the upper threshold voltage is detected until the indicator lamps go on.

k. If the lower threshold point is not within tolerance, adjust the power fail adjustment resistor A25A3R64 (A3, part no. 02100-60047) or A25A3R2 (A3, part no. 02100-60109). (See figure 5-1.) Turn the adjustment clockwise to increase the threshold point, or counter-clockwise to decrease the threshold point. After adjusting the resistor, repeat steps "i" and "j" and readjust the resistor, as necessary. If the difference between the upper and lower threshold points exceeds 8 volts (A3, part no. 02100-60047) or 2 volts (A3, part no. 02100-60109), refer to paragraph 4-9 for troubleshooting the power supply.

Note: If the power fail circuit is suspected of causing problems, observe the PWU output (A25TB2-5) with an oscilloscope while performing step "k". Verify that the PWU signal switches from the high state to the low state without oscillation or pulsing of any kind.

l. If the threshold points are within tolerance, replace the power supply bottom cover and the computer (or extender) bottom panel.

5-45. BENCH TESTS AND ADJUSTMENTS.

5-46. Bench tests and adjustments are performed on the power supply when removed from the computer (or extender). These tests and adjustments are required after repairs have been made to a power supply. To perform these tests and adjustments, the equipment listed in paragraph 5-48 and the preliminary procedures described in paragraph 5-50 are required.

5-47. EQUIPMENT.

5-48. The following equipment is required for test and adjustment of the power supply:

a. Oscilloscope of the type listed in table 1-2.

b. Variable autotransformer of the type listed in table 1-2.

c. Multimeter of the type listed in table 1-2.

d. Digital voltmeter of the type listed in table 1-2.

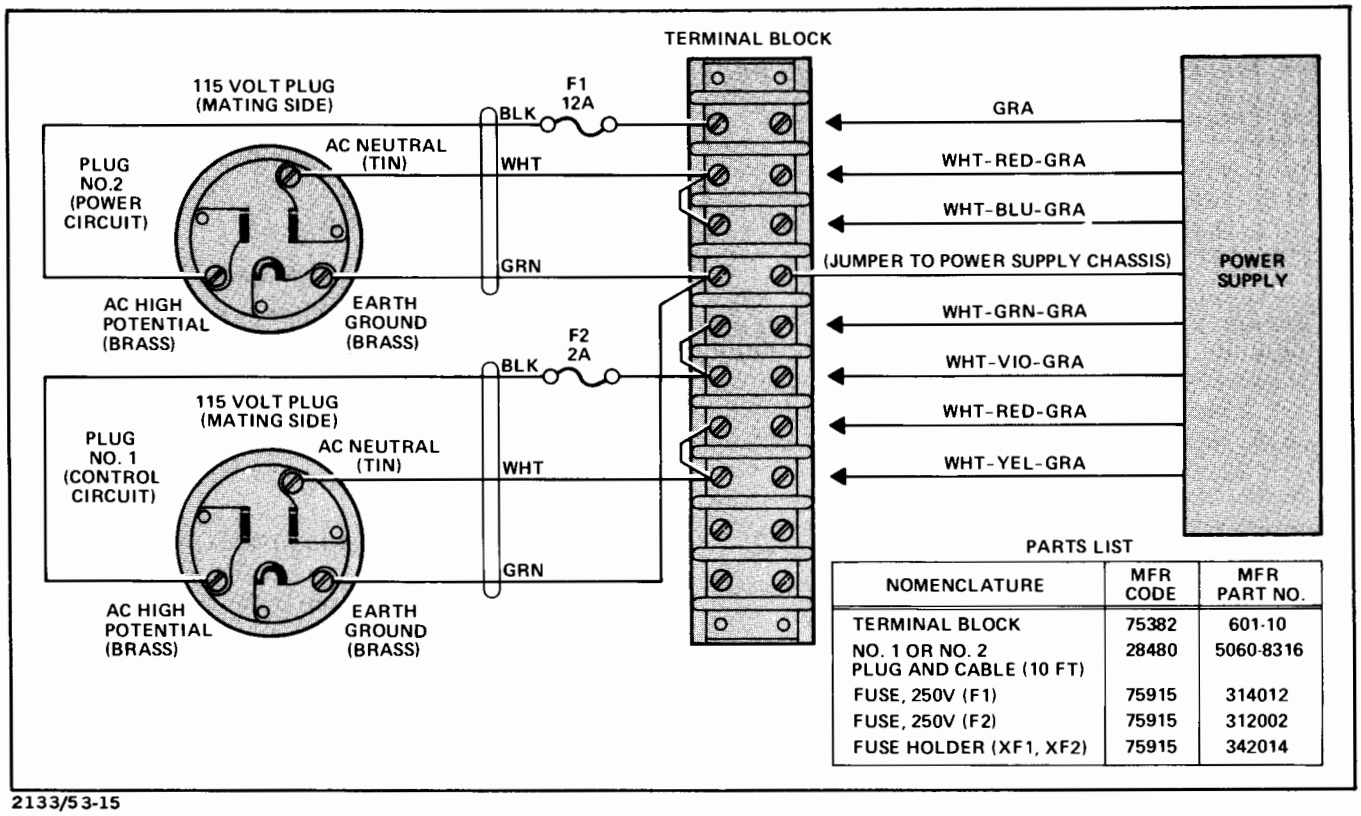
e. Power supply, HP 6202B (or equivalent).

f. Power supply card extender, part no. 02100-60049, (part of 12900A Maintenance Accessory Kit).

g. Power line connection test cable (to be fabricated as shown in figure 5-2).

h. Power supply load test fixture (to be fabricated as shown in figure 5-5).

i. An 825-ohm resistor, HP part no. 0757-0421 (connected to terminal board TB2 in place of the temperature compensation circuit of the computer).



PARTS LIST

NOMENCLATURE	MFR CODE	MFR PART NO.
TERMINAL BLOCK	75382	601-10
NO. 1 OR NO. 2 PLUG AND CABLE (10 FT)	28480	5060-8316
FUSE, 250V (F1)	75915	314012
FUSE, 250V (F2)	75915	312002
FUSE HOLDER (XF1, XF2)	75915	342014

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Figure 5-2. Power Line Connection Test Cable (Fabricated)

5-49. PRELIMINARY PROCEDURES.

5-50. Prior to performing tests and adjustments of the power supply, perform the following preliminary procedures.

a. Fabricate the power line connection test cable as shown in figure 5-2.

b. Connect the 825-ohm resistor, listed in paragraph 5-48, between terminals 7 and 9 of terminal board TB2 (see figure 5-1 for terminal identification). This resistor will already be connected if the power supply has been removed from a 2155A Extender.

c. Connect a jumper between terminals 8 and 9 of terminal board TB2. This jumper takes the place of the thermal switch circuit.

d. Remove the top and bottom covers of the power supply.

5-51. CONTROL VOLTAGE AND TRANSFORMER TEST.

5-52. The control voltage and T5 transformer test is performed to determine that the internal voltage regulator outputs remain stable when the ac line input is varied between its high and low limits. Perform the preliminary procedures in paragraph 5-50 and proceed as follows:

a. Install card extender, part no. 02100-60049, into connector XA1 (see figure 5-1) and insert preregulator control card A1 into the card extender.

CAUTION

In the following step, the autotransformer should be set to 0 volts output before connection to the ac power source. If the ammeter indicates more than one ampere anytime during this test, reduce the autotransformer output to 0 volts and refer to the troubleshooting procedures in figure 5-7 or 5-15.

b. Connect a metered variable autotransformer between plug no. 1 of the power line connection test cable and the ac source (see figure 5-2). Do not connect power line connection test cable plug no. 2 to the ac source.

c. Slowly adjust the autotransformer at a rate of about 10 volts per second for an output of 95 volts. Using a digital voltmeter and an oscilloscope, measure the +15, -15, and +5 volts at the card pins (see figure 7-3, sheet 1) for the voltages listed in table 5-3. If the voltages are incorrect, refer to the troubleshooting procedures in figure 5-7 or 5-15.

Table 5-3. Control Voltages

VDC	CARD PIN (XA1)	READING MIN.	READING MAX.	RIPPLE VOLTAGE AND NOISE TOLERANCE (PEAK-TO-PEAK)
+15	4,C	+13.7	+15.3	0.1V
-15	9,K	-13.7	-15.3	0.1V
+5	18,V	+ 4.7	+ 5.3	0.1V

d. Increase the autotransformer output to 130 volts and repeat the measurements made in step "c". Each voltage should be within 0.1 volt of the value indicated in step "c". If any of the voltages are not within this value, refer to the troubleshooting procedures in figure 5-7 or 5-15.

e. Reduce the autotransformer output to 115 volts and using the HP 427A meter, measure at the card pins (see figure 7-3, sheet 1) for the voltages listed in table 5-4. If the voltages are incorrect, refer to the troubleshooting procedures in figure 5-7 or 5-15.

5-53. INVERTER DRIVER TEST.

5-54. The inverter driver test is performed by observing the inverter driver output waveforms on an oscilloscope to ensure that the circuit is operating properly. Perform the preliminary procedures in paragraph 5-50, and proceed as follows:

CAUTION

In the following step, the autotransformer should be set to 0 volts output before connection to the ac power source. If the ammeter indicates more than one ampere anytime during this test, reduce the autotransformer output to 0 volts and refer to the troubleshooting procedures in figure 5-8 or 5-16.

a. Connect a metered variable autotransformer between plug no. 1 of the power line connection test cable and the ac source (see figure 5-2). Do not connect power line connection test cable plug no. 2 to the ac source.

b. Install card extender, part no. 02100-60049, into connector XA2 (see figure 5-1) and insert inverter driver card A2 into the card extender.

Table 5-4. Control Transformer Voltages

CARD PIN (XA1)	READING MIN.	READING MAX.
1,A,8,J	0V	0V
2,B	16V ac	20V ac
3,C	16V ac	20V ac
5,E	22V dc	26V dc
6,F	8V dc	10V dc
22,Z	0V	0V

c. While observing the ammeter to ensure that the current does not exceed one ampere, slowly adjust the autotransformer for an output of 115 volts.

d. Set the oscilloscope controls as follows:

(1) DISPLAY control to A.

(2) VOLTS/DIV control to 10 (set to 1 if 10:1 voltage divider probe is used).

(3) Input coupling switch to DC.

(4) TIME/DIV control to 0.5 MSEC.

(5) Sweep selector to MAIN.

(6) SWEEP MODE switch to AUTO.

(7) EXT INT LINE switch to INT.

(8) SLOPE switch to +.

CAUTION

In the following step, be extremely careful not to short any of the pins to adjacent pins (with the probe) to avoid damage to parts on the card.

e. Connect the ground clip of the channel A probe to the inverter driver card ground test point and connect the probe to the pins shown in figure 5-3, in turn, while observing the waveforms shown.

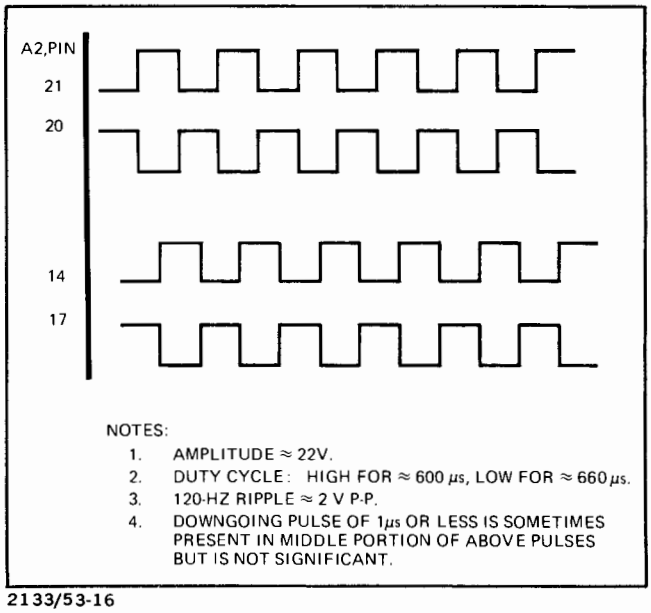

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Figure 5-3. Inverter Driver Test Waveforms

5-55. PREREGULATOR AND INVERTER TEST.

5-56. The following test is performed to ensure that the preregulator and control circuit and the inverter circuit is operating properly. Perform the preliminary procedures in paragraph 5-50, and proceed as follows:

a. Place the power supply on its side to allow access to the top and bottom for test connections. Connect the HP 427A meter (set to 300-volt dc scale) across the +160 volt terminals A5E53 and A5E48 (negative) shown in figure 7-2.

CAUTION

In the following step, the autotransformer should be set to 0 volts output before connection to the ac power source. If the ammeter indicates more than 3 amperes anytime during this test, reduce the autotransformer output to 0 volts and refer to the troubleshooting procedures in figure 5-9 or 5-17.

b. Connect the power line connection test cable plug no. 1 from the power supply to the ac source as shown in figure 5-2. Connect a metered variable autotransformer between plug no. 2 of the test cable and the ac source.

c. While observing the ammeter, to ensure the current does not exceed 3 amperes, slowly adjust the autotransformer (at a rate of about 10 volts per second) for an output of 40 volts.

d. Measure the reduced output voltages at terminal boards TB1 and TB2 (figure 5-1) for the values listed in table 5-5. If the measured voltages are incorrect, refer to the troubleshooting procedures in figure 5-9 or 5-17.

WARNING

After the input voltage is increased in the following step, the capacitors on the 160V output board retain their charge for over one minute after power is removed. Be careful not to touch terminals or parts on the power supply until power has been off for at least 3 minutes.

Table 5-5. Output Voltages with Reduced Input

TEST POINT	NORMAL VOLTAGE	MEASURED VOLTAGE	
		MIN.	MAX.
TB1-4,5	+4.85V dc	+ 3.0	+ 4.0
TB1-2,3	-2V dc	- 1.0	- 1.6
TB2-3	+12V dc	+ 7.0	+ 9.0
TB2-2	-12V dc	- 7.0	- 9.0
TB2-4	+30V dc	+18.0	+22.0

e. Increase the output of the autotransformer to 102 volts. Verify that the HP 427A meter connected in step "a" indicates 155 ± 5 volts. If indication is incorrect, refer to the troubleshooting procedures in figure 5-9 or 5-17.

f. Reduce the autotransformer output to 0 volts and allow 3 minutes for capacitors to discharge.

g. Install card extender, part no. 02100-60049, into connector XA3 (see figure 5-1) and insert protection and control card A3 into the card extender.

h. Disconnect the HP 427A meter and connect it to terminal board TB1 terminal 4 (4.85V dc) and terminal 6 (ground).

i. Increase the autotransformer output to 102 volts. The meter should indicate 4.95 ± 0.10 volts dc.

j. If the voltage measured in step "i" does not equal 4.95 ± 0.10 volts, adjust the preregulator control card A1 voltage adjustment resistor R36 for the proper indication.

k. Measure the output voltages at terminal boards TB1 and TB2 (figure 5-1) and at the pins of protection and control card A3 (figure 7-3, sheet 3) for the values listed in table 5-6. If the voltages measured at the card pins or the terminal boards are incorrect (or in disagreement) refer to the troubleshooting procedures in figure 5-9 or 5-17.

l. Reduce the autotransformer output to 0 volts to allow 3 minutes for capacitors to discharge.

m. Remove the card extender into connector XA1 and insert preregulator control card A1 into the card extender.

n. Install the card extender into connector XA1 and insert preregulator control card A1 into the card extender.

o. Increase the output of the autotransformer to 115 volts.

p. Set the oscilloscope controls as follows:

(1) DISPLAY control to A.

(2) VOLTS/DIV control to 1 (set to 0.1 if 10:1 voltage divider probe is used).

(3) Input coupling switch to DC.

(4) TIME/DIV control to 2 MSEC.

(5) SWEEP MODE switch to AUTO.

(6) Sweep selector switch to MAIN.

(7) EXT INT LINE switch to INT.

(8) SLOPE switch to +.

Table 5-6. Output Voltages

OUTPUT TERM.	CARD A3 PIN NO.	READING	
		MIN.	MAX.
TB1-4,5	X,Y,21	+ 4.85	+ 5.0
TB1-2,3	M	- 1.7	- 2.1
TB2-3	3,C	+11.6	+12.5
TB2-2	7,H	-11.6	-12.5
TB1-1	19,W	+19.9	+20.1
TB2-1	R,14	-19.9	-20.1
TB2-4	None	+28.0	+32.0

q. Connect the channel A probe to the junction of capacitor A1C3 and resistor A1R27 (see figure 7-3, sheet 1). The waveform displayed on the oscilloscope should be an integrated waveform as shown in figure 5-4.

r. If the integrated waveform voltage amplitude is incorrect, adjust stability adjustment resistor A1R11 (figure 5-1) for a stable - 1.5 ± 0.1 volt amplitude of the semisinusoidal portion of the waveform.

5-57. PWU AND IPU SIGNAL TESTS AND ADJUSTMENTS (FOR A3 CARD, PART NO. 02100-60047).

5-58. Tests and adjustments of the Power Up (PWU) and Internal Power Up (IPU) circuits are performed to determine that these circuits are operating properly. Perform the preliminary procedures in paragraph 5-50, and proceed as follows:

a. Connect the power line connection test cable plug no. 2 from the power supply to the ac source as shown in figure 5-2. Connect a metered autotransformer between plug no. 1 of the test cable and the ac source.

b. Adjust the autotransformer for an output of 115 volts.

Note: If adjustments performed in the following steps do not result in correct indications, refer to the troubleshooting procedures in figure 5-10.

c. Using an HP 427A meter, measure the voltage at terminal A3E2 (see figure 5-1). Adjust variable resistor A3R64, if necessary, for an indication of 4.5 ± 0.05 volts dc. Connect an oscilloscope to this terminal and check to ensure that voltage spikes or ripple is less than ±0.05 volts.

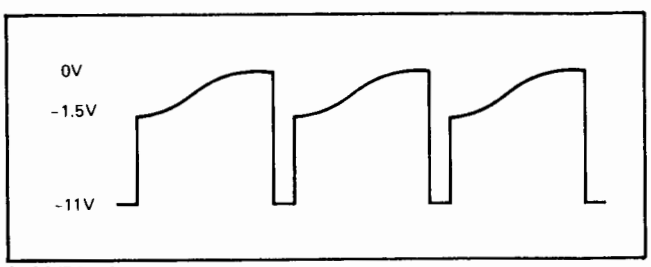

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Figure 5-4. Integrated Waveform

d. Connect the HP 427A meter (set to the 10-volt dc range) to terminal 6 of A25TB2 (see figure 5-1) to monitor the IPU signal. The HP 427A meter should indicate 4 ± 1 volts.

e. Disconnect the HP 427A meter from terminal 6 and connect the meter to terminal 5 of A25TB2 (see figure 5-1) to monitor the PWU signal. The HP 427A meter should indicate 4 ± 1 volts.

f. Connect the oscilloscope to terminal 5 of A25TB2.

g. Slowly reduce the output of the autotransformer to 97 volts while monitoring the HP 427A meter. The meter indication should drop to less than 0.5 volts at an autotransformer output of 97.5 ± 0.5 volts. The oscilloscope display should step from 4 ± 1 volts to less than 0.5 volt without oscillation or intermittent pulsing.

h. If the indication in step "g" is incorrect, adjust variable resistor A3R64 (see figure 5-1) slightly and repeat steps "g" and "h" for the proper indication.

i. Monitor the HP 427A meter while increasing the autotransformer output from 97 volts to 102 volts. Within 0.5 second after reaching the 102-volt level, the meter should increase sharply from 0 to 4 ± 1 volts. The oscilloscope display should step from less than 0.5 volt to 4 ± 1 volts without oscillation or intermittent pulsing.

5-59. PWU AND IPU SIGNAL TESTS AND ADJUSTMENTS (FOR A3 CARD, PART NO. 02100-60109).

5-60. Tests and adjustments of the Power Up (PWU) and Internal Power Up (IPU) circuits are performed to determine that these circuits are operating properly. Perform the preliminary procedures in paragraph 5-50, and proceed as follows:

a. Connect the power line connection test cable plug no. 2 from the power supply to the ac source as shown in figure 5-2. Connect a metered autotransformer between plug no. 1 of the test cable and the ac source.

b. Adjust the autotransformer for an output of 100 volts.

Note: If adjustments performed in the following steps do not result in correct indications, refer to the troubleshooting procedures in figure 5-18.

c. Using an HP 427A meter, measure the voltage at output terminal TB1-4 or TB1-5 (+4.85 volt supply). Adjust variable resistor A3R2 in a clockwise direction until a reading of approximately 0 volts is obtained (indicating that the +4.85 volt supply has been shut down because of an under voltage condition). Then, slowly adjust variable resistor A3R2 in a counterclockwise direction just until the +4.85 volt supply is again operating.

d. Connect the HP 427A meter (set to the 10-volt dc range) to terminal 6 of A25TB2 (see figure 5-1) to monitor the IPU signal. The HP 427A meter should indicate 5.4 ± 0.5 volts.

e. Disconnect the HP 427A meter from terminal 6 and connect the meter to terminal 5 of A25TB2 (see figure 5-1) to monitor the PWU signal. The HP 427A meter should indicate 3.4 ± 0.5 volts.

f. Connect the oscilloscope to terminal 5 of A25TB2.

g. Slowly reduce the output of the autotransformer to 100 volts while monitoring the HP 427A meter. The meter indication should drop to less than 0.5 volt at an autotransformer output of 101 ± 0.5 volts. the oscilloscope display should step from 5.4 ± 0.5 volts to less than 0.5 volt without oscillation or intermittent pulsing.

h. If the indication in step "g" is incorrect, adjust variable resistor A3R2 (see figure 5-1) slightly and repeat steps "g" and "h" for the proper indication.

i. Monitor the HP 427A meter while increasing the autotransformer output from 100 volts to 101 volts. Within 0.5 second after reaching the 101-volt level, the meter should increase sharply from 0 to 5.4 ± 0.5 volts. The oscilloscope display should step from less than 0.5 volt to 5.4 ± 0.5 volts without oscillation or intermittent pulsing.

5-61. OVERVOLTAGE AND OVERTEMPERATURE DETECTION TEST.

5-62. The overvoltage and overtemperature detection test is conducted to determine if the detection circuits in the power supply are operating properly. Perform the preliminary procedure in paragraph 5-50 and proceed as follows:

a. Install card extender, part no. 02100-60049, into connector XA3 (see figure 5-1) and insert protection and control card A3 into the card extender.

b. Connect the power line connection test cable plug no. 1 from the power supply to the ac source as shown in figure 5-2. Connect a metered autotransformer between plug no. 2 of the test cable and the ac source.

c. Adjust the autotransformer for an output of 115 volts.

d. Using an HP 427A meter, measure the voltage at terminal A3E1. Adjust variable resistor A3R4, if necessary, for an indication of 4.50 ± 0.05 volts dc.

e. Using an oscilloscope, monitor the voltage at each output terminal to verify that any voltage spikes do not exceed the overvoltage values shown in table 5-7.

f. Adjust the autotransformer for an output of 0 volts.

Table 5-7. Voltage Ranges for Overvoltage (Crowbar Trigger) Condition

OUTPUT VOLTAGE	OUTPUT TERM.	OVERVOLTAGE (VDC) RANGE
- 2	TB1-2,3	- 2.8 to - 3.1
+ 4.85	TB1-4,5	+ 5.3 to + 5.75
-12	TB2-2	-14.0 to -15.5
+12	TB2-3	+14.0 to +15.5
-20	TB2-1	-23.5 to -27.0
+20	TB1-1	+23.5 to +25.5

Note: If correct indications cannot be obtained in the following steps, refer to the troubleshooting procedures in figure 5-11 or 5-19.

g. Connect a multimeter to the collector of transistor A3Q2 (see figure 7-3, sheet 3 for location of A3Q2) and verify an indication of - 15 volts dc.

h. Using an external power supply (HP 6202B, or equivalent) apply an overvoltage (as listed in table 5-7) to each output terminal while monitoring the meter that was connected in step "g". To apply the overvoltage, start at 0 volts and increase the voltage slowly until the meter indicates that the collector of A3Q2 steps and latches to +15 volts dc. After each trial, return the voltage to 0 volts to reset the latch circuit.

i. If the meter indicates that the collector voltage of A3Q2 steps from - 15 to +15 volts dc (and latches) at a lower or higher voltage than that listed in table 5-7, refer to troubleshooting flowchart, figure 5-11 or 5-19.

j. To simulate an overtemperature condition, disconnect the jumper that was connected between terminals 8 and 9 of terminal board TB2 in step "c" of paragraph 5-50. Using an HP 427A meter, monitor the voltage at pins 10,L of card A3 while removing the jumper. The voltage should rise from 0 to 5.3 volts dc when the jumper is removed. The collector of transistor A3Q2 should step from - 15 to +15 volts before pins 10,L reach maximum voltage. Reconnect the jumper.

5-63. OVERCURRENT TEST.

5-64. The overcurrent test is performed to determine that the current limit sense amplifiers and associated circuits are operating properly under varying load conditions. Perform the preliminary procedures in paragraph 5-50 and proceed as follows:

CAUTION

In the following step, the autotransformer should be set to 0 volts output before connection to the ac power source. If the ammeter indicates more

than 13 amperes anytime during this test, reduce the autotransformer output to 0 volts and refer to the troubleshooting procedures in figure 5-12 or 5-20.

a. Connect the power line connection test cable plug no. 1 from the power supply to the ac source as shown in figure 5-2. Connect a metered variable autotransformer between plug no. 2 of the test cable and the ac source. Adjust the autotransformer output to 115 volts.

b. Verify that the output voltages are as listed in table 5-6.

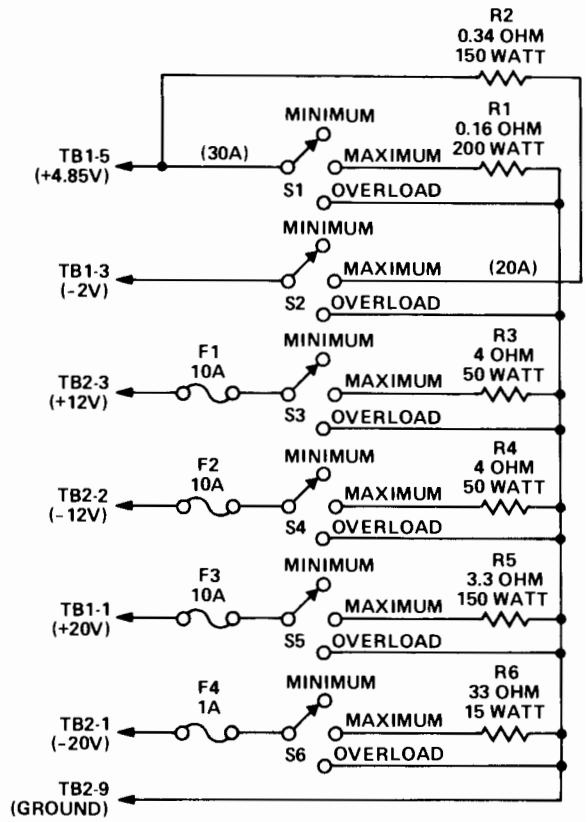
c. Connect the power supply load test fixture as shown in figure 5-5, with all switches set to MINIMUM.

Note: In the following step, the power supply may crowbar and turn off when the switch position is changed. If this occurs, set the switch to the position to be tested and reset the crowbar latch circuit by temporarily disconnecting power line connection test cable plug no. 1 from the ac source, then reconnect it.

d. Using an HP 427A meter to measure dc voltage and an HP 180A oscilloscope to measure ac ripple voltage, measure at current limit card A4 test points (see figure 5-1) in the sequence shown in table 5-8 for the switch positions listed. After measuring for the OVERLOAD switch position at each test point, monitor the meter closely while switching back to the MINIMUM switch position. The voltage should return to the MINIMUM load value within 10 seconds.

Table 5-8. Current Limit Card Test Point Voltages

TEST POINT	SWITCH POSITION	MINIMUM READING (VDC)	MAXIMUM READING (VDC)	MAXIMUM RIPPLE VOLTAGE (P-P)
A4E4 (-2V)	MINIMUM	- 0.5	- 2	0.3
	MAXIMUM	- 5	- 8	0.4
	OVERLOAD	- 8	-12	
A4E5 (-12V)	MINIMUM	+ 2	+ 3.5	0.1
	MAXIMUM	- 5	- 7	
	OVERLOAD	-10	-13	
A4E2 (+12V)	MINIMUM	- 0.2	- 2	0.1
	MAXIMUM	+ 6	+ 9	3
	OVERLOAD	+10	+13	
A4E3 (+4.85V)	MINIMUM	0	+ 2	0.5
	MAXIMUM	+ 6	+ 9	1
	OVERLOAD	+ 9	+12	
A4E1 (+20V)	MINIMUM	- 0.5	- 1.5	0.05
	MAXIMUM	+ 5	+ 7	0.2
	OVERLOAD	+12	+18	



PARTS LIST

REFERENCE DESIGNATION	MFR CODE	MFR PART NO.
F1,F2,F3	75915	314010
F4	75915	312001
R3,R4	44655	0560D
R6	44655	0366
S1 THRU S6	71590	JV9003
FUSEHOLDER, XF1 THRU XF4	75915	342014

NOTE:

RESISTORS R1, R2 AND R5 MAY BE FABRICATED USING THE FOLLOWING ADJUSTABLE TAP RESISTORS:

RESISTOR VALUE	MFR CODE	MFR PART NO.
1 OHM, 50 WATT	44655	0560A
2 OHM, 50 WATT	44655	0560B

R1 REQUIRES FOUR 1-OHM RESISTORS IN PARALLEL. R2 REQUIRES THREE 1-OHM AND ONE 2-OHM RESISTOR IN PARALLEL. R5 REQUIRES FOUR 1-OHM RESISTORS IN SERIES.

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Figure 5-5. Power Supply Load Test Fixture

e. Connect the HP 427A meter and HP 180A oscilloscope to the output terminals (see figure 5-1) listed in table 5-9 and measure the voltages listed for the MAXIMUM and MINIMUM switch positions. If correct indications cannot be obtained refer to the troubleshooting procedures in figure 5-11 or 5-19.

5-65. PART REMOVAL AND REPLACEMENT PROCEDURES.

5-66. The following paragraphs describe the methods for removing and installing various parts in the power supply. Before performing any of the procedures, read the entire description of the procedure. Heed all **WARNING** and **CAUTION** notices.

5-67. CARD REMOVAL AND REPLACEMENT.

CAUTION

Failure to observe the following procedures may result in damage to components on circuit cards.

5-68. Before removing or installing cards in the power supply, turn off power and allow 3 minutes for filter capacitors to discharge.

5-69. To remove a card from the power supply, remove the bottom cover of the power supply, then withdraw the card by pulling it outward from the card connector.

5-70. When removing or installing cards in the power supply, use extreme care not to damage traces or protruding components on the card or on adjacent cards.

5-71. REPLACEMENT OF SEMICONDUCTOR DEVICES.

CAUTION

Failure to observe the following procedures may result in damage to components.

5-72. When replacing semiconductor devices, be sure not to omit or scratch the surface of the insulating washer which separates the device from the mounting surface, if such a washer is used. These washers are shown in the applicable parts location diagrams in section VII. Use thermal joint compound, Wakefield series 120 (HP part no. 6040-0239) or equivalent on both sides of these washers when installing a semiconductor device.

5-73. When replacing the stud-type semiconductor devices in the power supply, use a torque wrench to avoid damage to the devices and anodized washers. Torque the mounting nuts to 15 pound-inches on devices located on the following assemblies:

a. A6 Preregulator assembly thyristors and diodes (3,8, figure 6-5).

Table 5-9. Loaded Output Voltages

TERM. AND VOLTAGE	SWITCH POSITION		RIPPLE VOLTAGE (P-P)
	MIN.	MAX.	
TB2-4 (+30V)	35	28	3
TB1-1 (+20V)	20.1	20.0	0.1
TB2-3 (+12V)	12.5	11.6	0.2
TB1-5 (+4.85V)	5.0	4.75	0.1
TB1-3 (-2V)	- 2.1	- 1.7	0.05
TB2-2 (-12V)	-12.5	-11.6	0.2
TB2-1 (-20V)	-20.1	-20	0.1

b. A8 Rectifier assembly diodes (3,4,8, figure 6-9).

c. A9 +4.85 Volt Rectifier assembly diodes (4, figure 6-8).

d. A10 Output Crowbar assembly thyristors and diodes (4,9, figure 6-6).

e. A11 ±20 volt Regulator assembly diodes (12, figure 6-7).

5-74. INTEGRATED CIRCUIT REPLACEMENT.

5-75. The following procedure is recommended for replacing an integrated circuit:

a. Clip the integrated circuit pins close to the integrated circuit pack with a pair of diagonal cutters.

b. Using a 30-watt soldering iron, unsolder and remove each pin from the circuit card.

c. Using a rubber bulb with a suction tube, withdraw molten solder from each hole in the circuit card.

d. Mount the new integrated circuit on the card and solder each pin.

e. Clean the area of the replaced part with cleaning solvent and a clean brush.

5-76. REPLACEMENT OF WIRE LUGS.

5-77. Crimp-type lugs are used in the power supply section. If it becomes necessary to replace one of these, use a solder lug. (In field repair operations, soldering is more reliable than crimping.) If a solder lug of the required size is not available, the crimp-type lug may be reused by soldering to it. With either type of lug, do not permit solder to run onto the portion which will be under a screw. (Hold this portion of the lug uppermost when soldering.) Observe the usual precautions for obtaining a good solder connection.

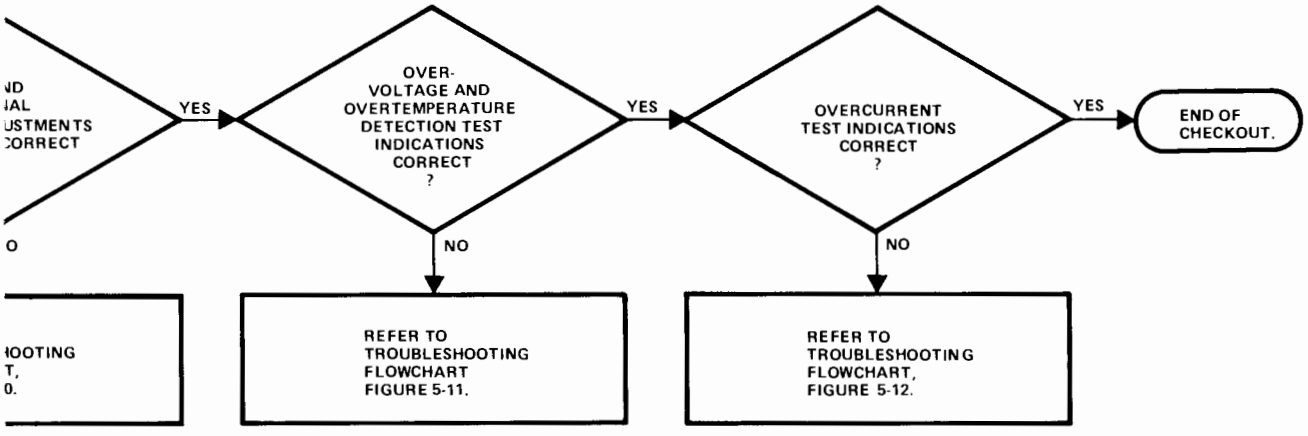
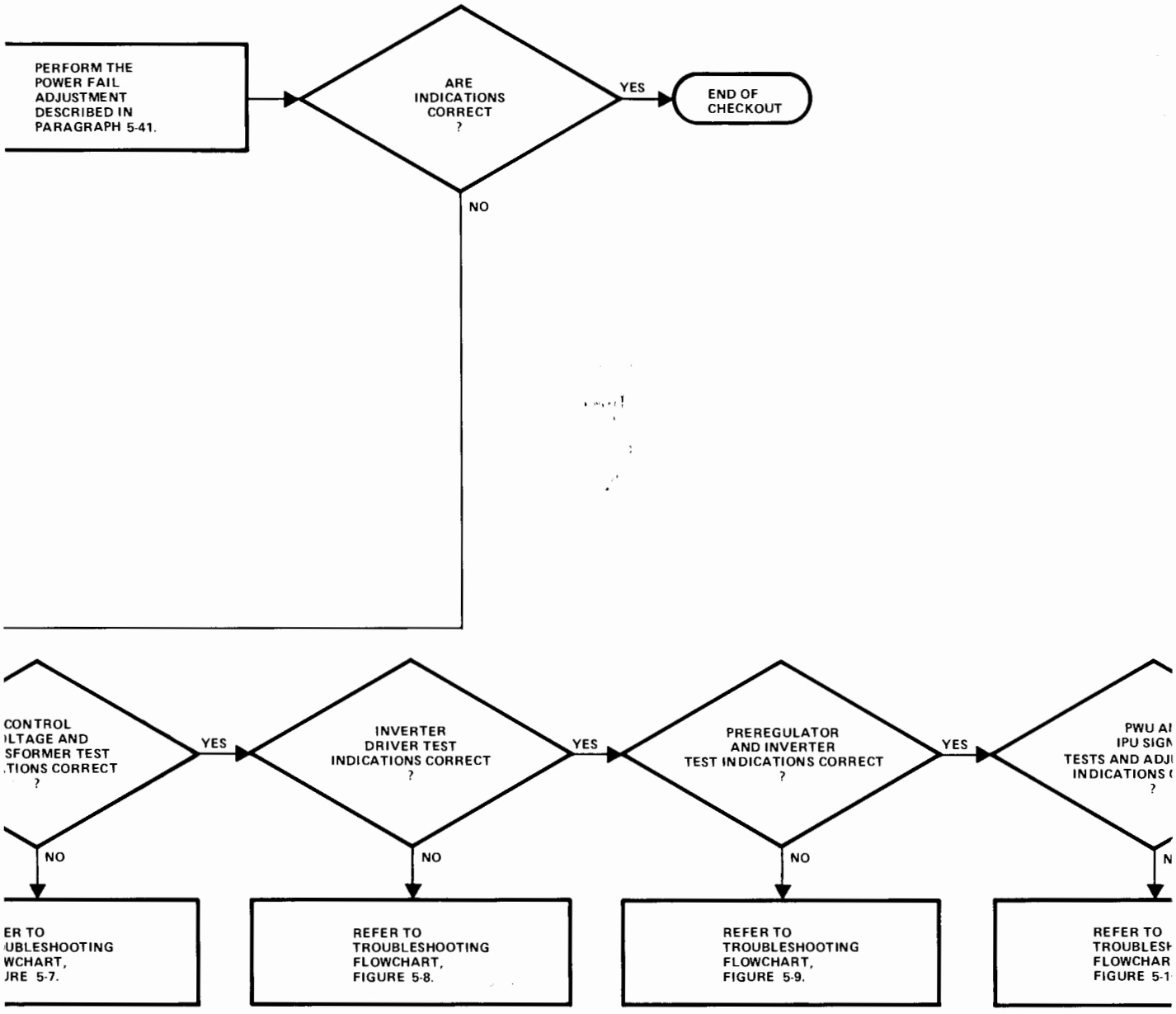
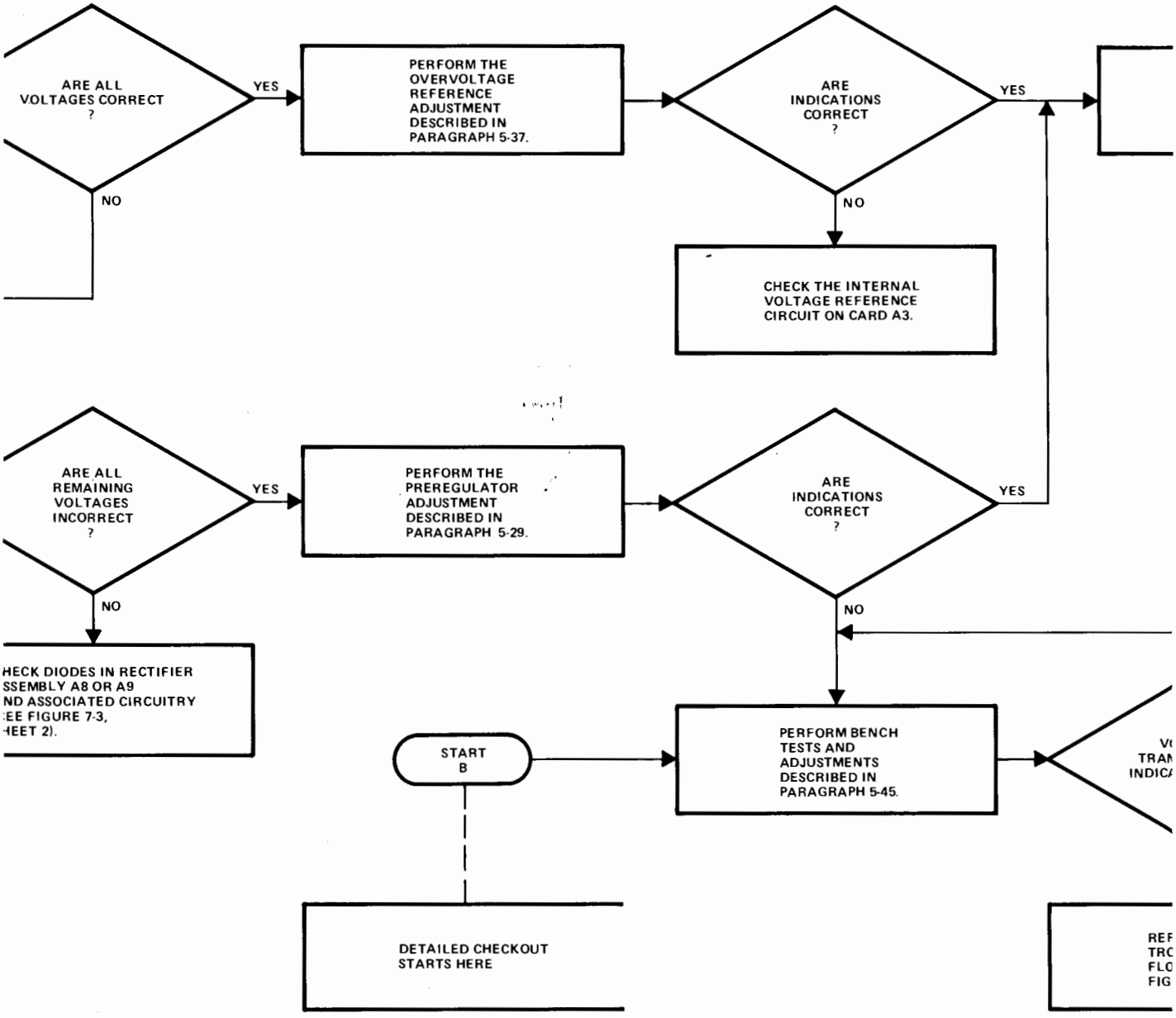
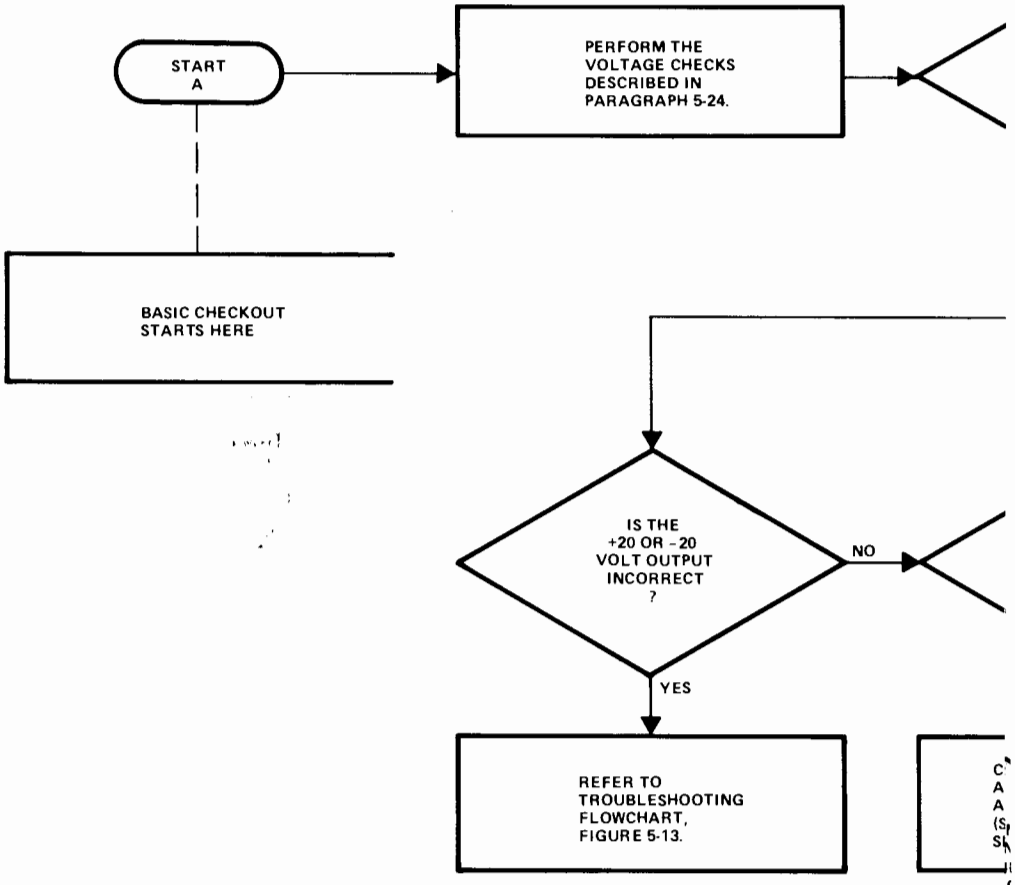


Figure 5-6. Basic Checkout Troubleshooting Flowchart, Date Codes Prior to 1240


PERFORM THE POWER FAIL ADJUSTMENT DESCRIBED IN PARAGRAPH 5-41.
ARE INDICATIONS CORRECT ?
YES
END OF CHECKOUT
NO
CONTROL
LTAGE AND
SFORMER TEST
TIONS CORRECT
?
YES
INVERTER DRIVER TEST INDICATIONS CORRECT ?
YES
PREREGULATOR AND INVERTER TEST INDICATIONS CORRECT ?
YES
PWU AI
IPU SIGN
TESTS AND ADJ
INDICATIONS
?
NO
NO
NO
N
ER TO
UBLESHOOTING
WCHART,
URE 5-7.
REFER TO TROUBLESHOOTING FLOWCHART, FIGURE 5-8.
REFER TO TROUBLESHOOTING FLOWCHART, FIGURE 5-9.
REFER TO
TROUBLESH
FLOWCHAR
FIGURE 5-1


ARE ALL VOLTAGES CORRECT ?
YES
NO
PERFORM THE OVERVOLTAGE REFERENCE ADJUSTMENT DESCRIBED IN PARAGRAPH 5-37.
ARE INDICATIONS CORRECT ?
YES
NO
CHECK THE INTERNAL VOLTAGE REFERENCE CIRCUIT ON CARD A3.
ARE ALL REMAINING VOLTAGES INCORRECT ?
YES
NO
PERFORM THE PREREGULATOR ADJUSTMENT DESCRIBED IN PARAGRAPH 5-29.
ARE INDICATIONS CORRECT ?
YES
NO
HECK DIODES IN RECTIFIER SSEMBLY A8 OR A9 ND ASSOCIATED CIRCUITRY EE FIGURE 7-3, HEET 2).
START B
PERFORM BENCH TESTS AND ADJUSTMENTS DESCRIBED IN PARAGRAPH 5-45.
DETAILED CHECKOUT STARTS HERE


START
A
PERFORM THE VOLTAGE CHECKS DESCRIBED IN PARAGRAPH 5-24.
BASIC CHECKOUT STARTS HERE
IS THE +20 OR -20 VOLT OUTPUT INCORRECT ?
NO
YES
REFER TO TROUBLESHOOTING FLOWCHART, FIGURE 5-13.

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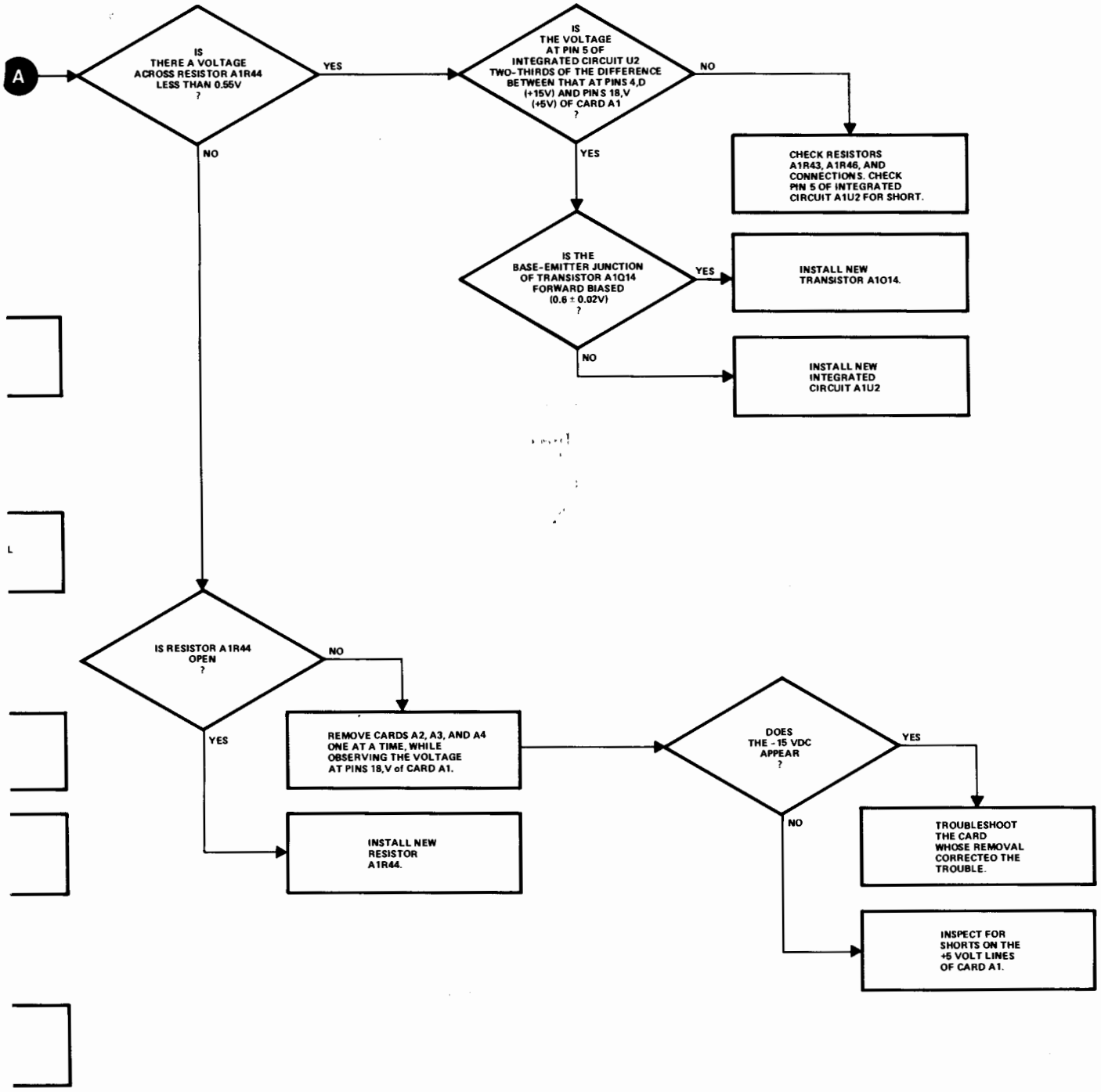
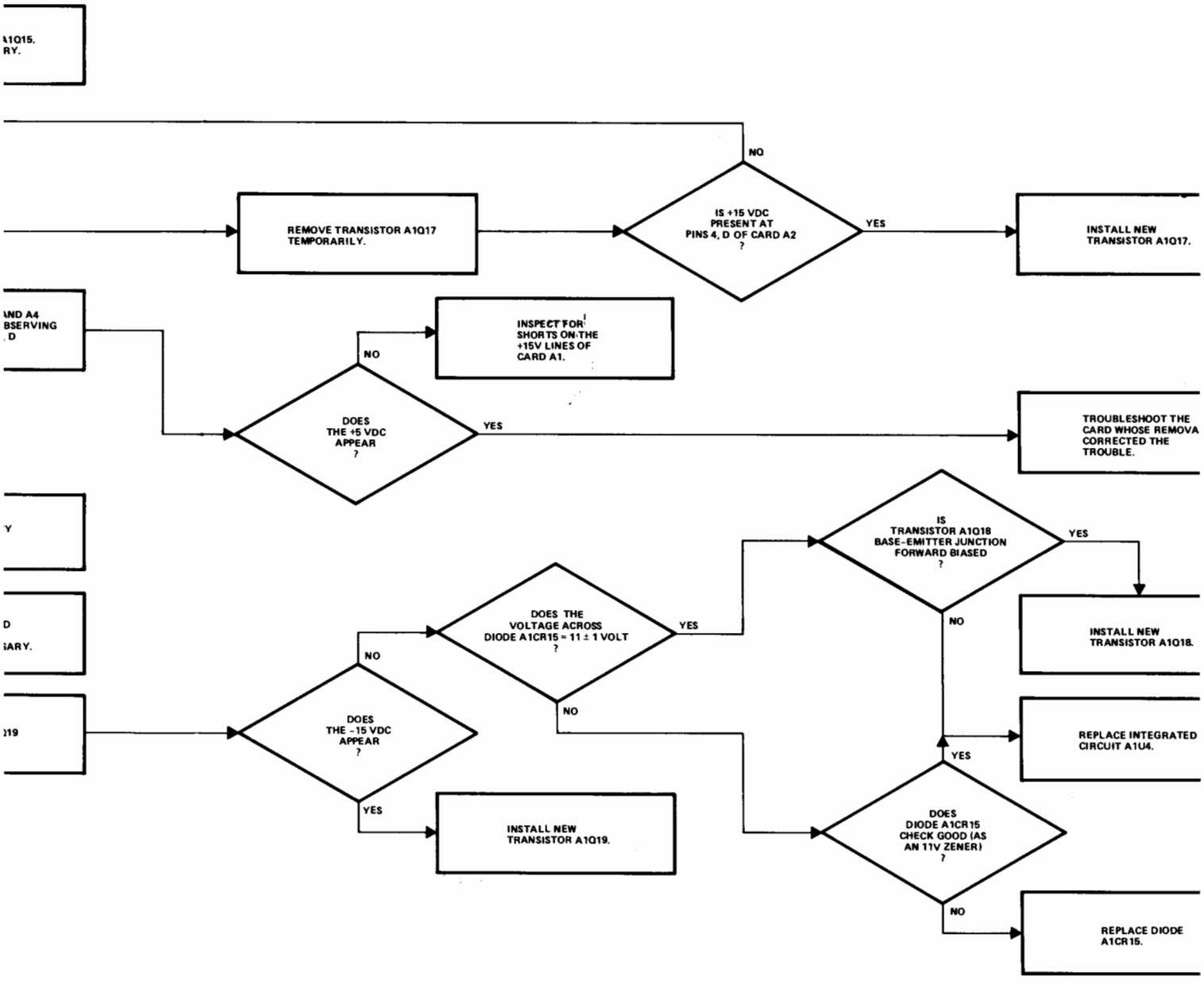
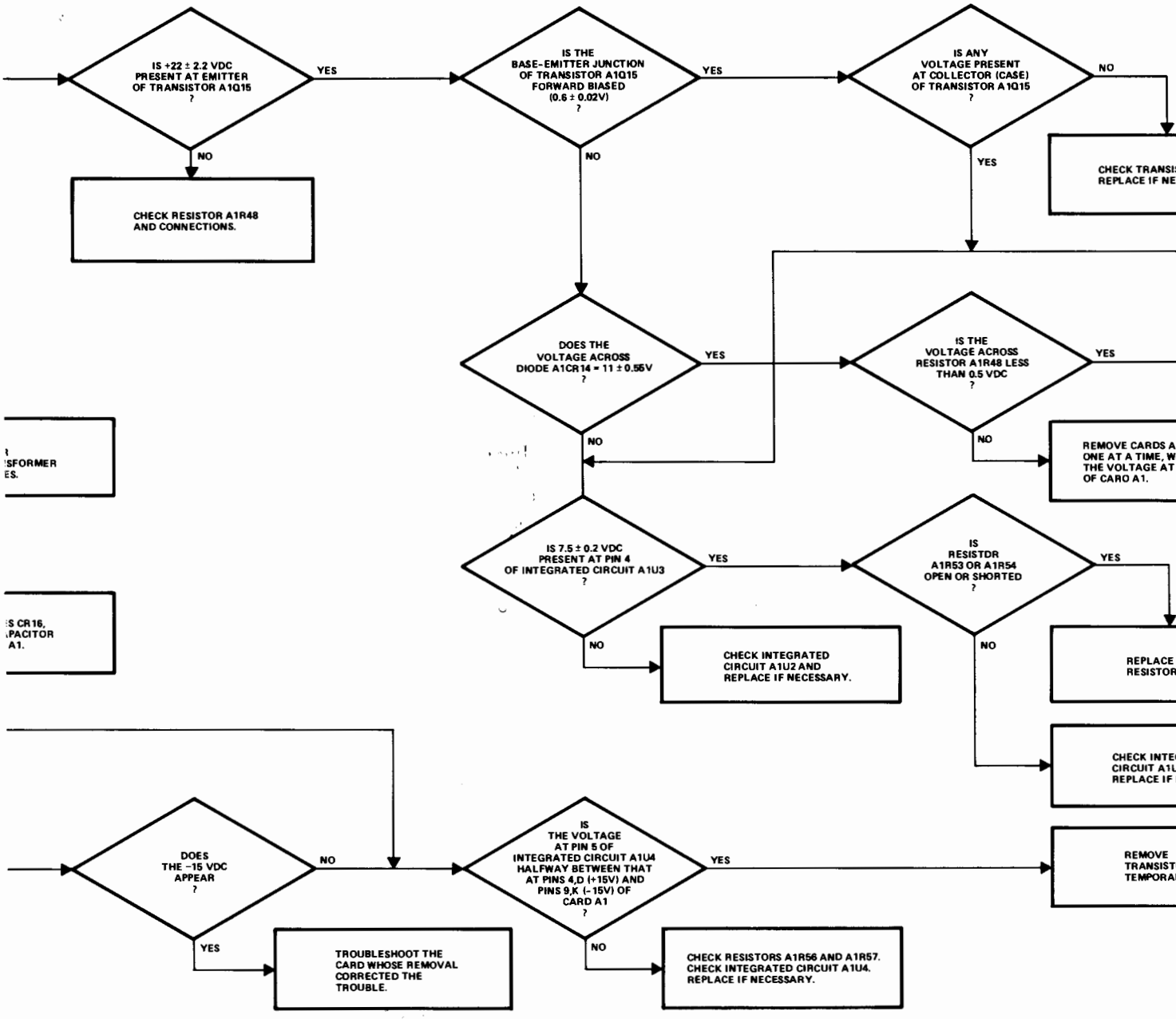
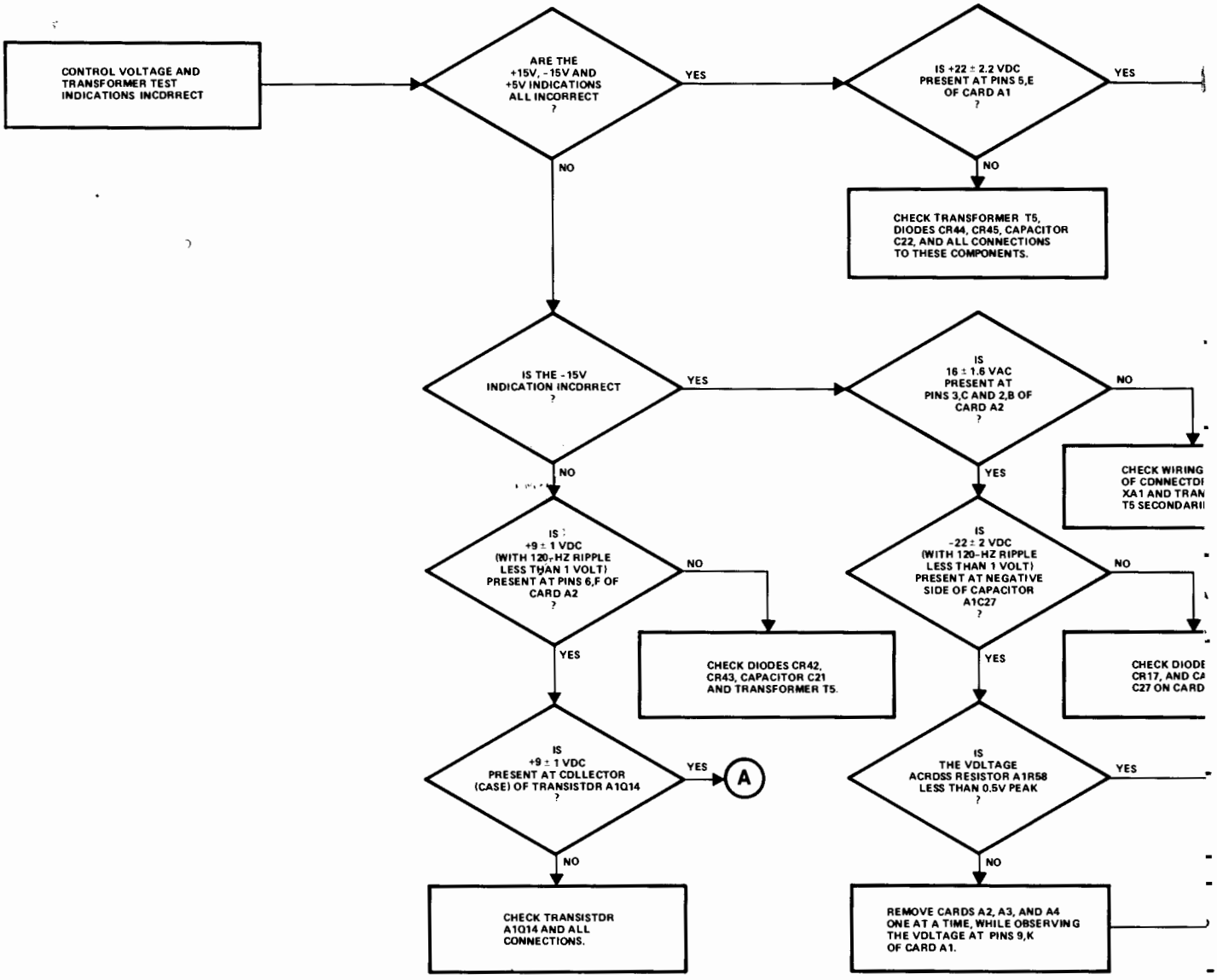


Figure 5-7. Control Voltage and Transformer Test Troubleshooting Flowchart, Date Codes Prior to 1240


A1Q15.
RY.
NO
REMOVE TRANSISTOR A1Q17 TEMPORARILY.
IS +15 VDC PRESENT AT PINS 4, D OF CARD A2 ?
YES
INSTALL NEW TRANSISTOR A1Q17.
AND A4
BSERVING
D
NO
INSPECT FOR SHORTS ON THE +15V LINES OF CARD A1.
DOES THE +5 VDC APPEAR ?
YES
TROUBLESHOOT THE CARD WHOSE REMOVA CORRECTED THE TROUBLE.
Y
D
ARY.
IS TRANSISTOR A1Q18 BASE-EMITTER JUNCTION FORWARD BIASED ?
YES
INSTALL NEW TRANSISTOR A1Q18.
DOES THE VOLTAGE ACROSS DIODE A1CR15 = 11 ± 1 VOLT ?
YES
NO
NO
REPLACE INTEGRATED CIRCUIT A1U4.
Q19
DOES THE -15 VDC APPEAR ?
NO
YES
INSTALL NEW TRANSISTOR A1Q19.
YES
DOES DIODE A1CR15 CHECK GOOD (AS AN 11V ZENER) ?
NO
REPLACE DIODE A1CR15.


IS +22 ± 2.2 VDC PRESENT AT EMITTER OF TRANSISTOR A1Q15 ?
YES
NO
CHECK RESISTOR A1R48 AND CONNECTIONS.
IS THE BASE-EMITTER JUNCTION OF TRANSISTOR A1Q15 FORWARD BIASED (0.6 ± 0.02V) ?
YES
NO
IS ANY VOLTAGE PRESENT AT COLLECTOR (CASE) OF TRANSISTOR A1Q15 ?
NO
YES
CHECK TRANSI
REPLACE IF NE
DOES THE VOLTAGE ACROSS DIODE A1CR14 = 11 ± 0.55V ?
YES
NO
IS THE VOLTAGE ACROSS RESISTOR A1R48 LESS THAN 0.5 VDC ?
YES
NO
REMOVE CARDS A
ONE AT A TIME, W
THE VOLTAGE AT
OF CARD A1.
ISFORMER
ES.
IS 7.5 ± 0.2 VDC PRESENT AT PIN 4 OF INTEGRATED CIRCUIT A1U3 ?
YES
NO
CHECK INTEGRATED CIRCUIT A1U2 AND REPLACE IF NECESSARY.
IS RESISTDR A1R53 OR A1R54 OPEN OR SHORTED ?
YES
NO
REPLACE
RESISTOR
S CR16,
PACITOR
A1.
CHECK INTE
CIRCUIT A1U
REPLACE IF
DOES THE −15 VDC APPEAR ?
NO
YES
TROUBLESHOOT THE CARD WHOSE REMOVAL CORRECTED THE TROUBLE.
IS THE VOLTAGE AT PIN 5 OF INTEGRATED CIRCUIT A1U4 HALFWAY BETWEEN THAT AT PINS 4,D (+15V) AND PINS 9,K (−15V) OF CARD A1 ?
YES
NO
CHECK RESISTORS A1R56 AND A1R57. CHECK INTEGRATED CIRCUIT A1U4. REPLACE IF NECESSARY.
REMOVE
TRANSIST
TEMPORA


CONTROL VOLTAGE AND TRANSFORMER TEST INDICATIONS INCORRECT
ARE THE +15V, -15V AND +5V INDICATIONS ALL INCORRECT ?
YES
NO
IS +22 ± 2.2 VDC PRESENT AT PINS 5,E OF CARD A1 ?
YES
NO
CHECK TRANSFORMER T5, DIODES CR44, CR45, CAPACITOR C22, AND ALL CONNECTIONS TO THESE COMPONENTS.
IS THE -15V INDICATION INCORRECT ?
YES
NO
IS 16 ± 1.6 VAC PRESENT AT PINS 3,C AND 2,B OF CARD A2 ?
NO
YES
CHECK WIRING OF CONNECTOR XA1 AND TRAN T5 SECONDARI
IS +9 ± 1 VDC (WITH 120-HZ RIPPLE LESS THAN 1 VOLT) PRESENT AT PINS 6,F OF CARD A2 ?
NO
YES
CHECK DIODES CR42, CR43, CAPACITOR C21 AND TRANSFORMER T5.
IS -22 ± 2 VDC (WITH 120-HZ RIPPLE LESS THAN 1 VOLT) PRESENT AT NEGATIVE SIDE OF CAPACITOR A1C27 ?
NO
YES
CHECK DIODE CR17, AND CA C27 ON CARD
IS +9 ± 1 VDC PRESENT AT COLLECTOR (CASE) OF TRANSISTOR A1Q14 ?
YES
A
NO
CHECK TRANSISTOR A1Q14 AND ALL CONNECTIONS.
IS THE VOLTAGE ACROSS RESISTOR A1R58 LESS THAN 0.5V PEAK ?
YES
NO
REMOVE CARDS A2, A3, AND A4 ONE AT A TIME, WHILE OBSERVING THE VOLTAGE AT PINS 9,K OF CARD A1.

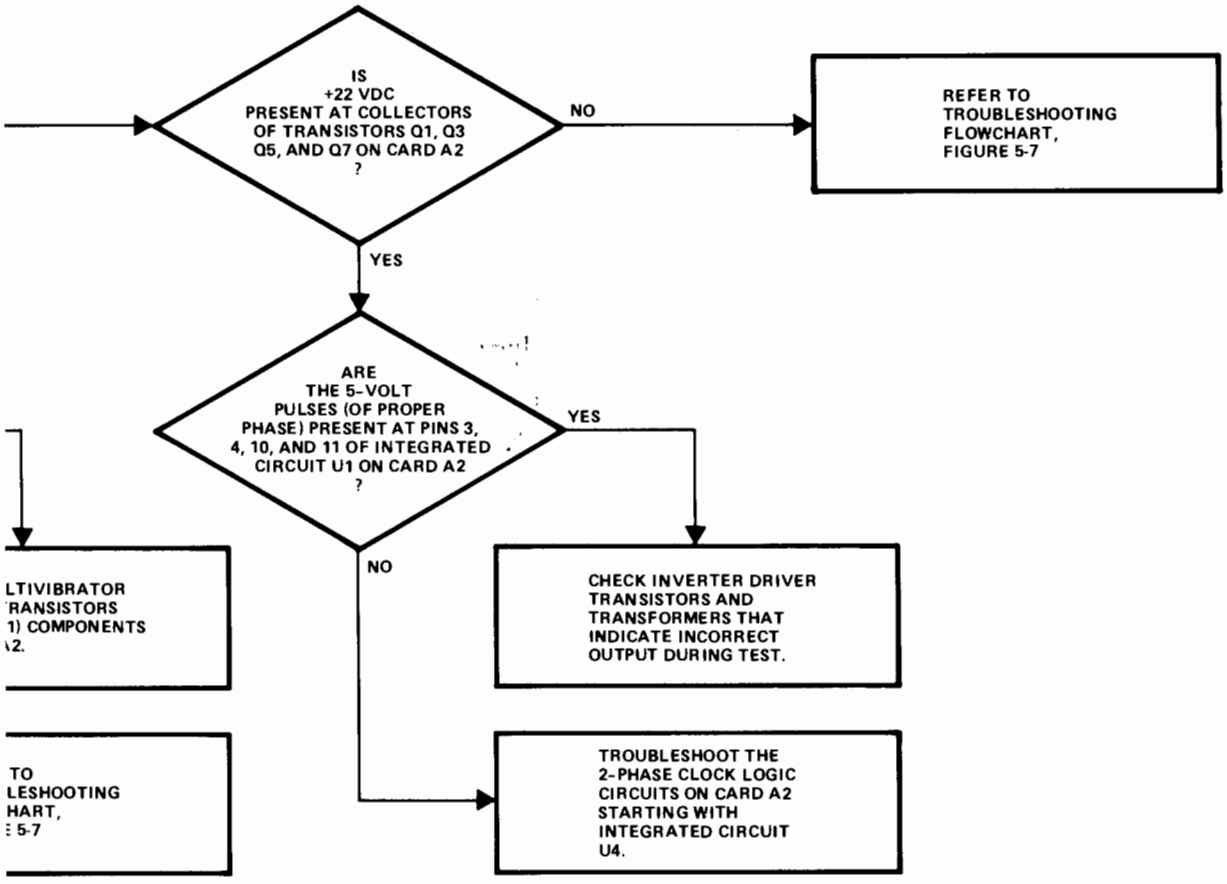
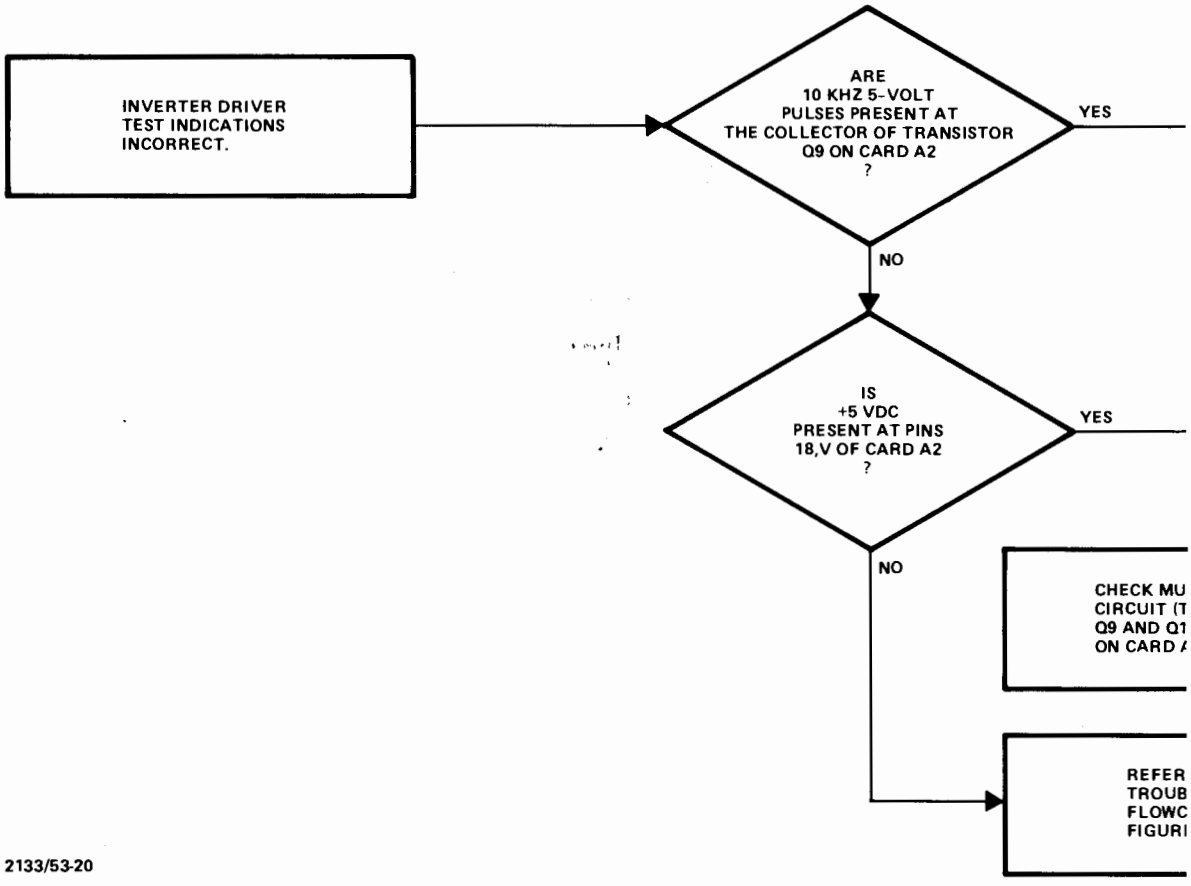


Figure 5-8. Inverter Driver Test Troubleshooting Flowchart, Date Codes Prior to 1240


INVERTER DRIVER TEST INDICATIONS INCORRECT.
ARE 10 KHZ 5-VOLT PULSES PRESENT AT THE COLLECTOR OF TRANSISTOR Q9 ON CARD A2 ?
YES
NO
IS +5 VDC PRESENT AT PINS 18,V OF CARD A2 ?
YES
NO
CHECK MU
CIRCUIT (T
Q9 AND Q1
ON CARD A
REFER
TROUB
FLOWC
FIGURI

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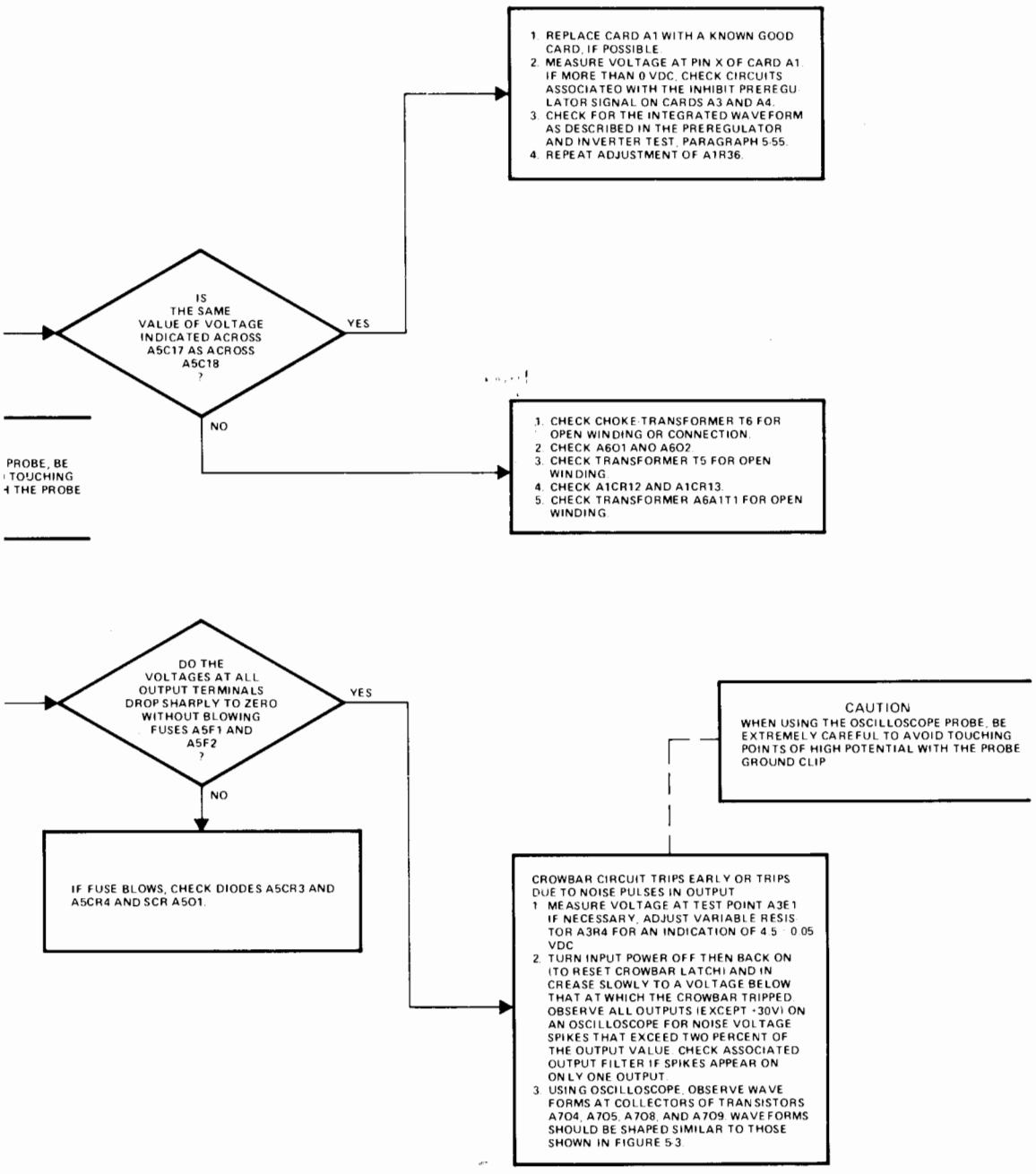
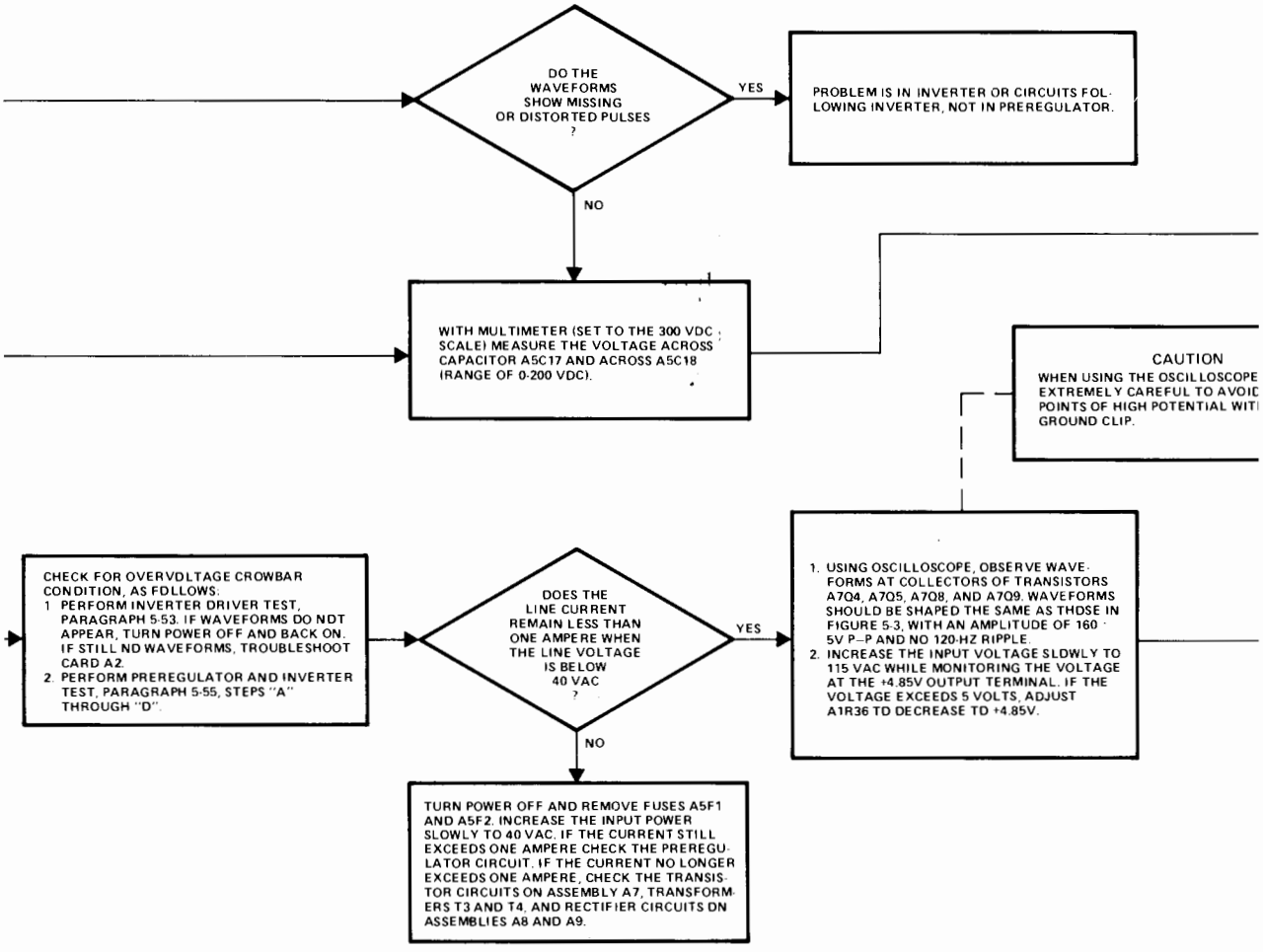
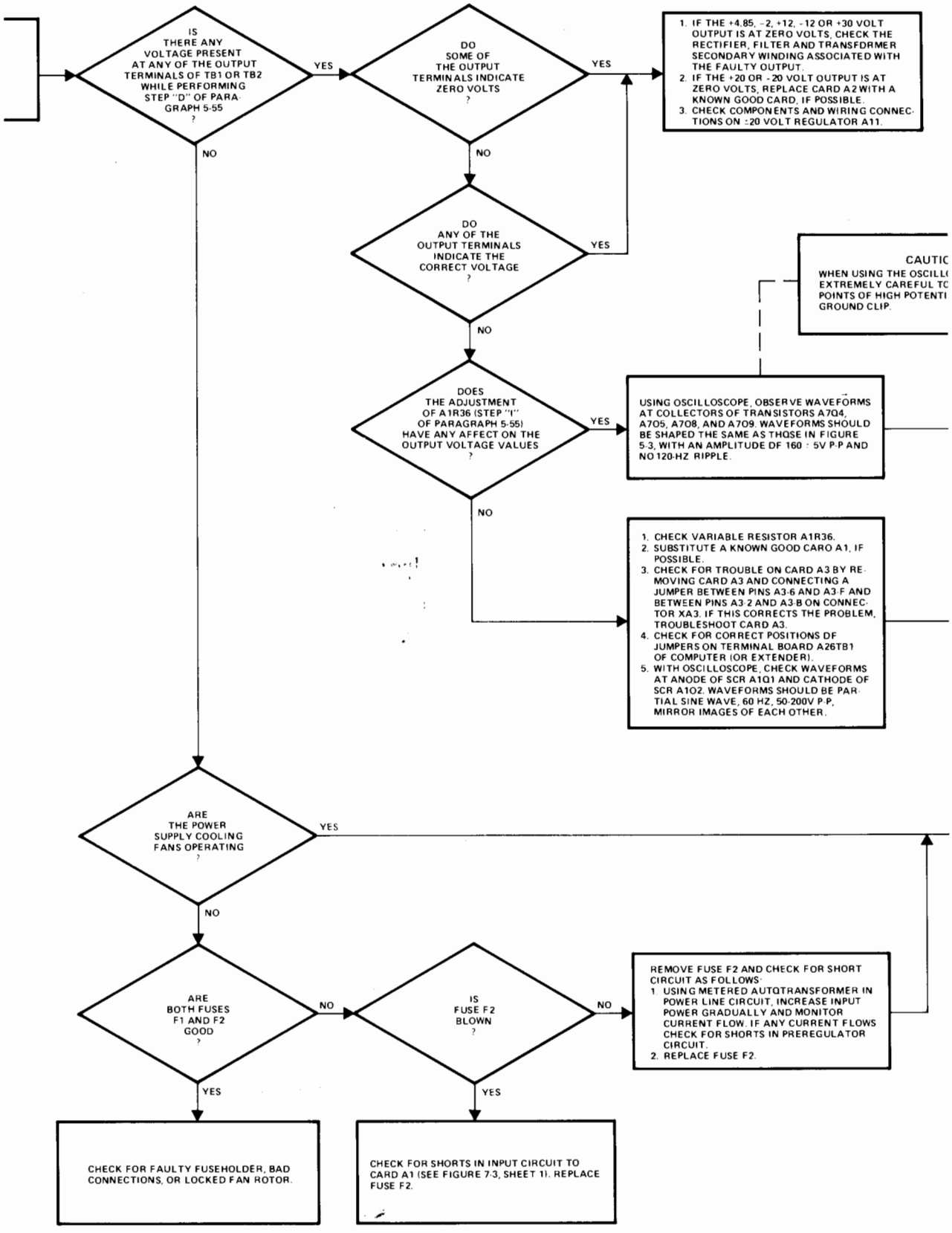


Figure 5-9. Preregulator and Inverter Test Troubleshooting Flowchart, Date Codes Prior to 1240

)N
)SCOPE PROBE, BE
AVOID TOUCHING
AL WITH THE PROBE




IS THERE ANY VOLTAGE PRESENT AT ANY OF THE OUTPUT TERMINALS OF TB1 OR TB2 WHILE PERFORMING STEP "D" OF PARAGRAPH 5-55 ?
YES
NO
DO SOME OF THE OUTPUT TERMINALS INDICATE ZERO VOLTS ?
YES
NO
1. IF THE +4.85, -2, +12, -12 OR +30 VOLT OUTPUT IS AT ZERO VOLTS, CHECK THE RECTIFIER, FILTER AND TRANSFORMER SECONDARY WINDING ASSOCIATED WITH THE FAULTY OUTPUT.
2. IF THE +20 OR -20 VOLT OUTPUT IS AT ZERO VOLTS, REPLACE CARD A2 WITH A KNOWN GOOD CARD, IF POSSIBLE.
3. CHECK COMPONENTS AND WIRING CONNECTIONS ON ±20 VOLT REGULATOR A11.
DO ANY OF THE OUTPUT TERMINALS INDICATE THE CORRECT VOLTAGE ?
YES
NO
CAUTIO
WHEN USING THE OSCILL
EXTREMELY CAREFUL TO
POINTS OF HIGH POTENTI
GROUND CLIP.
DOES THE ADJUSTMENT OF A1R36 (STEP "I" OF PARAGRAPH 5-55) HAVE ANY AFFECT ON THE OUTPUT VOLTAGE VALUES ?
YES
NO
USING OSCILLOSCOPE, OBSERVE WAVEFORMS AT COLLECTORS OF TRANSISTORS A7Q4, A7Q5, A7Q8, AND A7Q9. WAVEFORMS SHOULD BE SHAPED THE SAME AS THOSE IN FIGURE 5-3, WITH AN AMPLITUDE OF 160 ± 5V P-P AND NO 120-HZ RIPPLE.
1. CHECK VARIABLE RESISTOR A1R36.
2. SUBSTITUTE A KNOWN GOOD CARD A1, IF POSSIBLE.
3. CHECK FOR TROUBLE ON CARD A3 BY REMOVING CARD A3 AND CONNECTING A JUMPER BETWEEN PINS A3-6 AND A3-F AND BETWEEN PINS A3-2 AND A3-B ON CONNECTOR XA3. IF THIS CORRECTS THE PROBLEM, TROUBLESHOOT CARD A3.
4. CHECK FOR CORRECT POSITIONS OF JUMPERS ON TERMINAL BOARD A26TB1 OF COMPUTER (OR EXTENDER).
5. WITH OSCILLOSCOPE, CHECK WAVEFORMS AT ANODE OF SCR A1Q1 AND CATHODE OF SCR A1Q2. WAVEFORMS SHOULD BE PARTIAL SINE WAVE, 60 HZ, 50-200V P-P, MIRROR IMAGES OF EACH OTHER.
ARE THE POWER SUPPLY COOLING FANS OPERATING ?
YES
NO
ARE BOTH FUSES F1 AND F2 GOOD ?
NO
YES
IS FUSE F2 BLOWN ?
NO
YES
REMOVE FUSE F2 AND CHECK FOR SHORT CIRCUIT AS FOLLOWS:
1. USING METERED AUTOTRANSFORMER IN POWER LINE CIRCUIT, INCREASE INPUT POWER GRADUALLY AND MONITOR CURRENT FLOW. IF ANY CURRENT FLOWS CHECK FOR SHORTS IN PREREGULATOR CIRCUIT.
2. REPLACE FUSE F2.
CHECK FOR FAULTY FUSEHOLDER, BAD CONNECTIONS, OR LOCKED FAN ROTOR.
CHECK FOR SHORTS IN INPUT CIRCUIT TO CARD A1 (SEE FIGURE 7-3, SHEET 1). REPLACE FUSE F2.

PREREGULATOR AND INVERTER TEST
INDICATIONS INCORRECT.

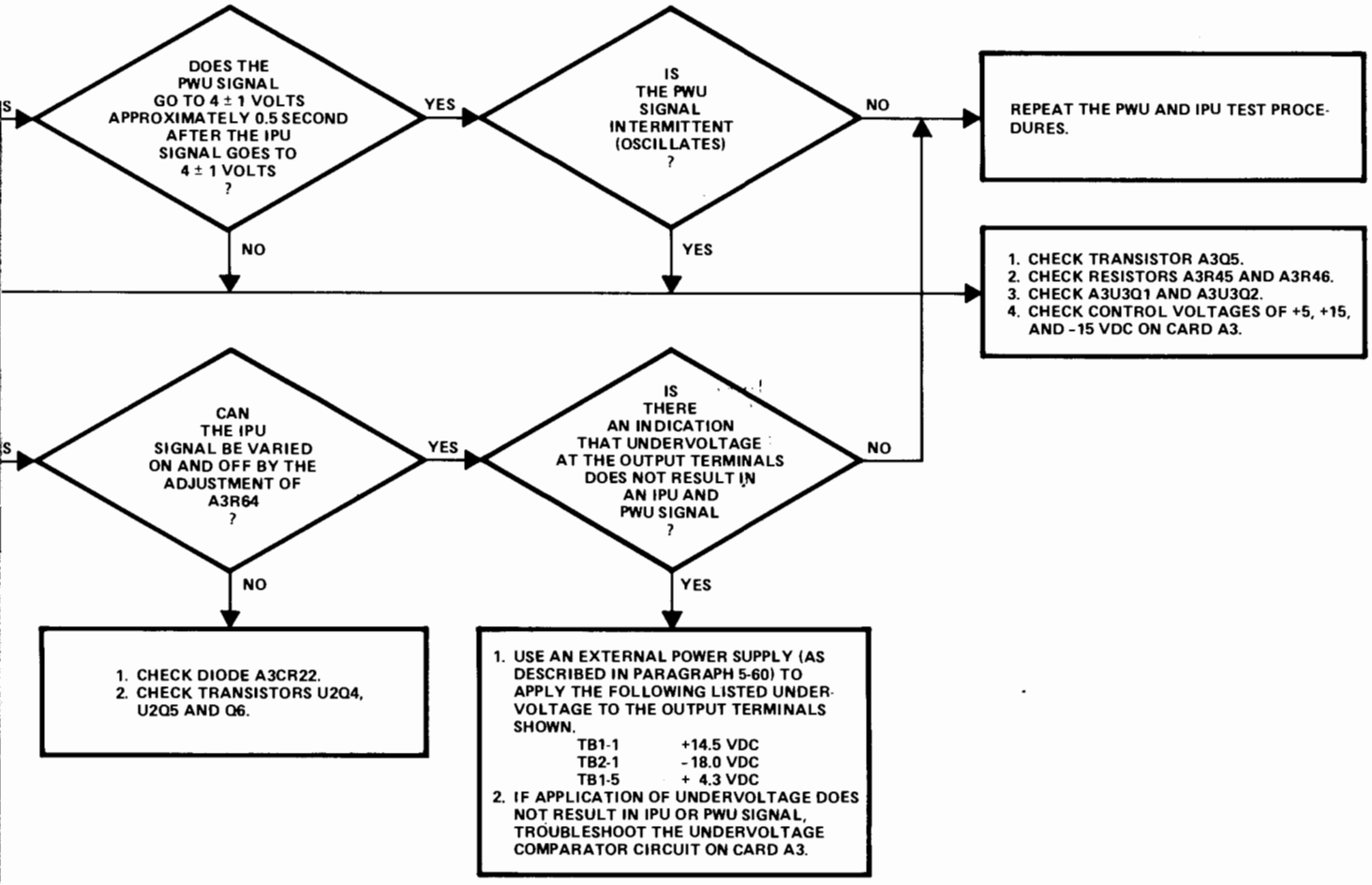
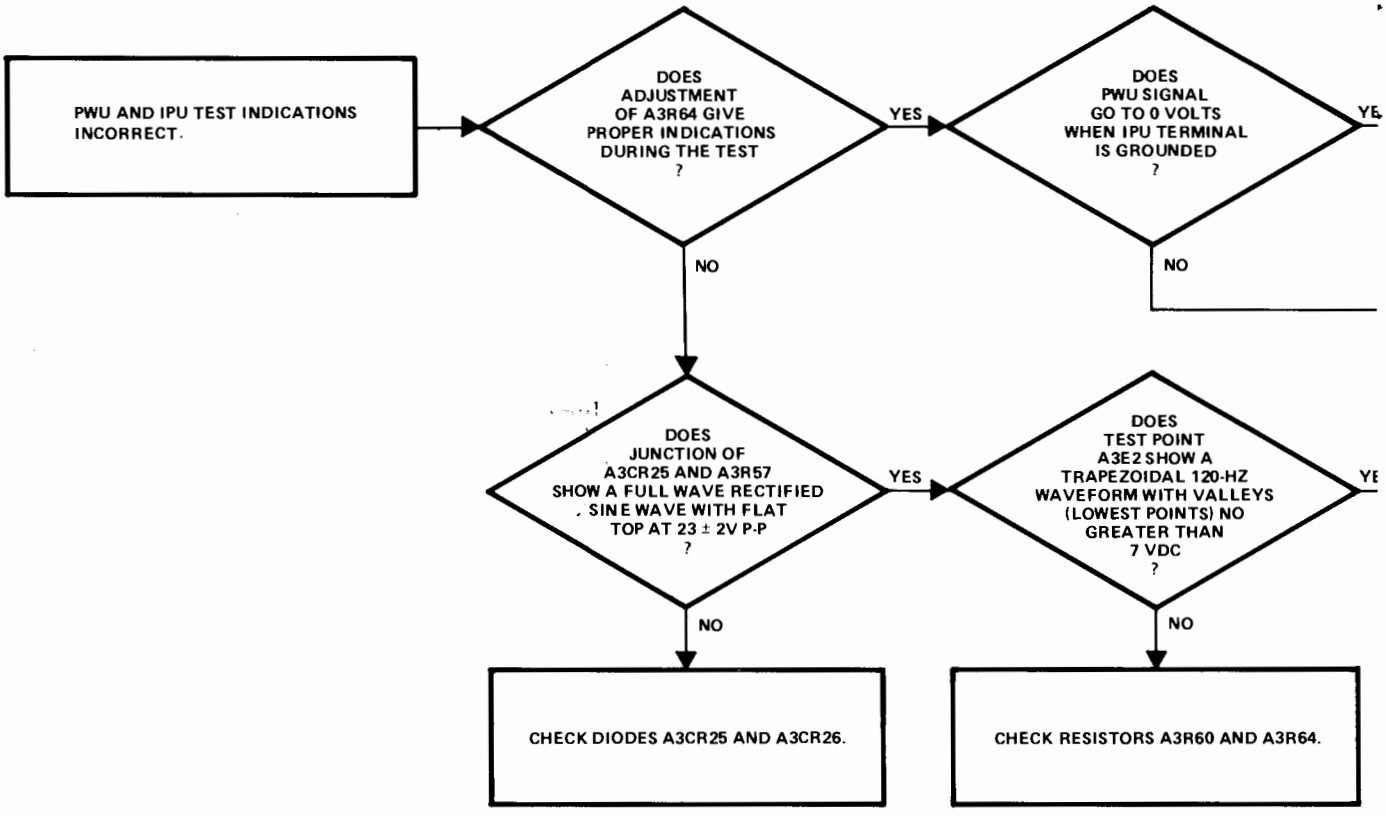


Figure 5-10. PWU and IPU Test Troubleshooting Flowchart, Date Codes Prior to 1240


PWU AND IPU TEST INDICATIONS INCORRECT.
DOES ADJUSTMENT OF A3R64 GIVE PROPER INDICATIONS DURING THE TEST ?
YES
DOES PWU SIGNAL GO TO 0 VOLTS WHEN IPU TERMINAL IS GROUNDED ?
YE
NO
NO
DOES JUNCTION OF A3CR25 AND A3R57 SHOW A FULL WAVE RECTIFIED SINE WAVE WITH FLAT TOP AT 23 ± 2V P-P ?
YES
DOES TEST POINT A3E2 SHOW A TRAPEZOIDAL 120-HZ WAVEFORM WITH VALLEYS (LOWEST POINTS) NO GREATER THAN 7 VDC ?
YE
NO
NO
CHECK DIODES A3CR25 AND A3CR26.
CHECK RESISTORS A3R60 AND A3R64.

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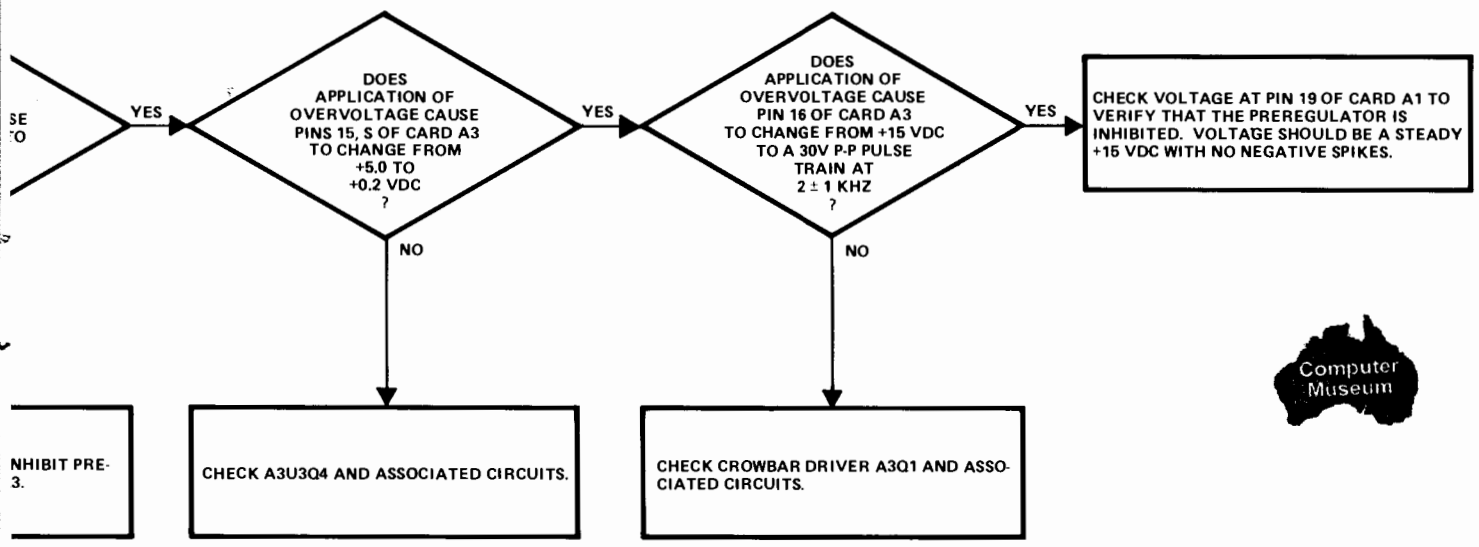
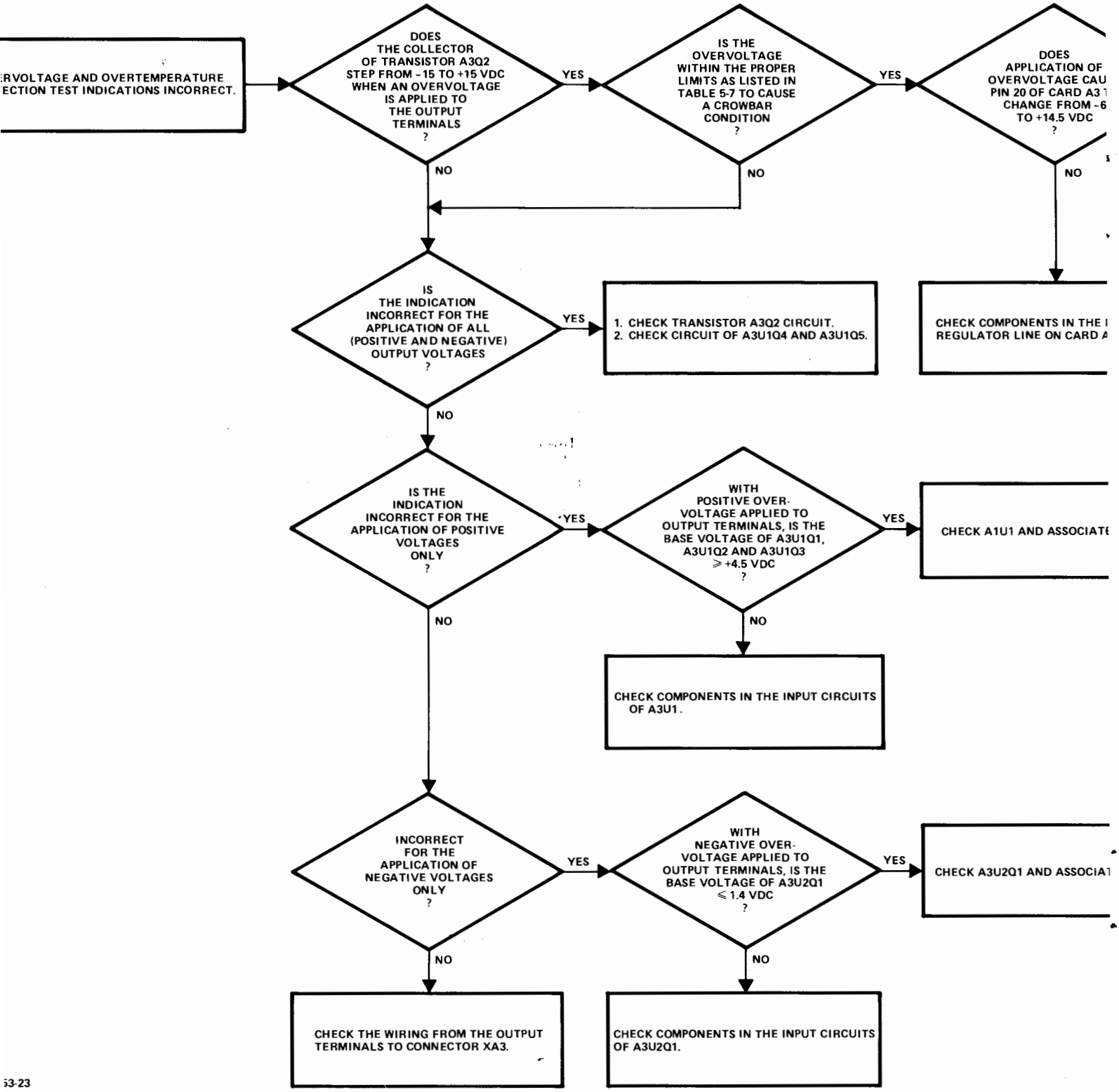


Figure 5-11. Overvoltage and Overtemperature Detection Test Troubleshooting Flowchart, Date Codes Prior to 1240


RVOLTAGE AND OVERTEMPERATURE
ECTION TEST INDICATIONS INCORRECT.
DOES THE COLLECTOR OF TRANSISTOR A3Q2 STEP FROM -15 TO +15 VDC WHEN AN OVERVOLTAGE IS APPLIED TO THE OUTPUT TERMINALS ?
YES
IS THE OVERVOLTAGE WITHIN THE PROPER LIMITS AS LISTED IN TABLE 5-7 TO CAUSE A CROWBAR CONDITION ?
YES
DOES APPLICATION OF OVERVOLTAGE CAU PIN 20 OF CARD A3 CHANGE FROM -6 TO +14.5 VDC ?
NO
NO
NO
IS THE INDICATION INCORRECT FOR THE APPLICATION OF ALL (POSITIVE AND NEGATIVE) OUTPUT VOLTAGES ?
YES
1. CHECK TRANSISTOR A3Q2 CIRCUIT.
2. CHECK CIRCUIT OF A3U1Q4 AND A3U1Q5.
CHECK COMPONENTS IN THE I REGULATOR LINE ON CARD A
NO
IS THE INDICATION INCORRECT FOR THE APPLICATION OF POSITIVE VOLTAGES ONLY ?
YES
WITH POSITIVE OVER-VOLTAGE APPLIED TO OUTPUT TERMINALS, IS THE BASE VOLTAGE OF A3U1Q1, A3U1Q2 AND A3U1Q3 ⩾ +4.5 VDC ?
YES
CHECK A1U1 AND ASSOCIATE
NO
NO
CHECK COMPONENTS IN THE INPUT CIRCUITS OF A3U1.
INCORRECT FOR THE APPLICATION OF NEGATIVE VOLTAGES ONLY ?
YES
WITH NEGATIVE OVER-VOLTAGE APPLIED TO OUTPUT TERMINALS, IS THE BASE VOLTAGE OF A3U2Q1 ⩽ 1.4 VDC ?
YES
CHECK A3U2Q1 AND ASSOCIAT
NO
NO
CHECK THE WIRING FROM THE OUTPUT TERMINALS TO CONNECTOR XA3.
CHECK COMPONENTS IN THE INPUT CIRCUITS OF A3U2Q1.

OV
DE

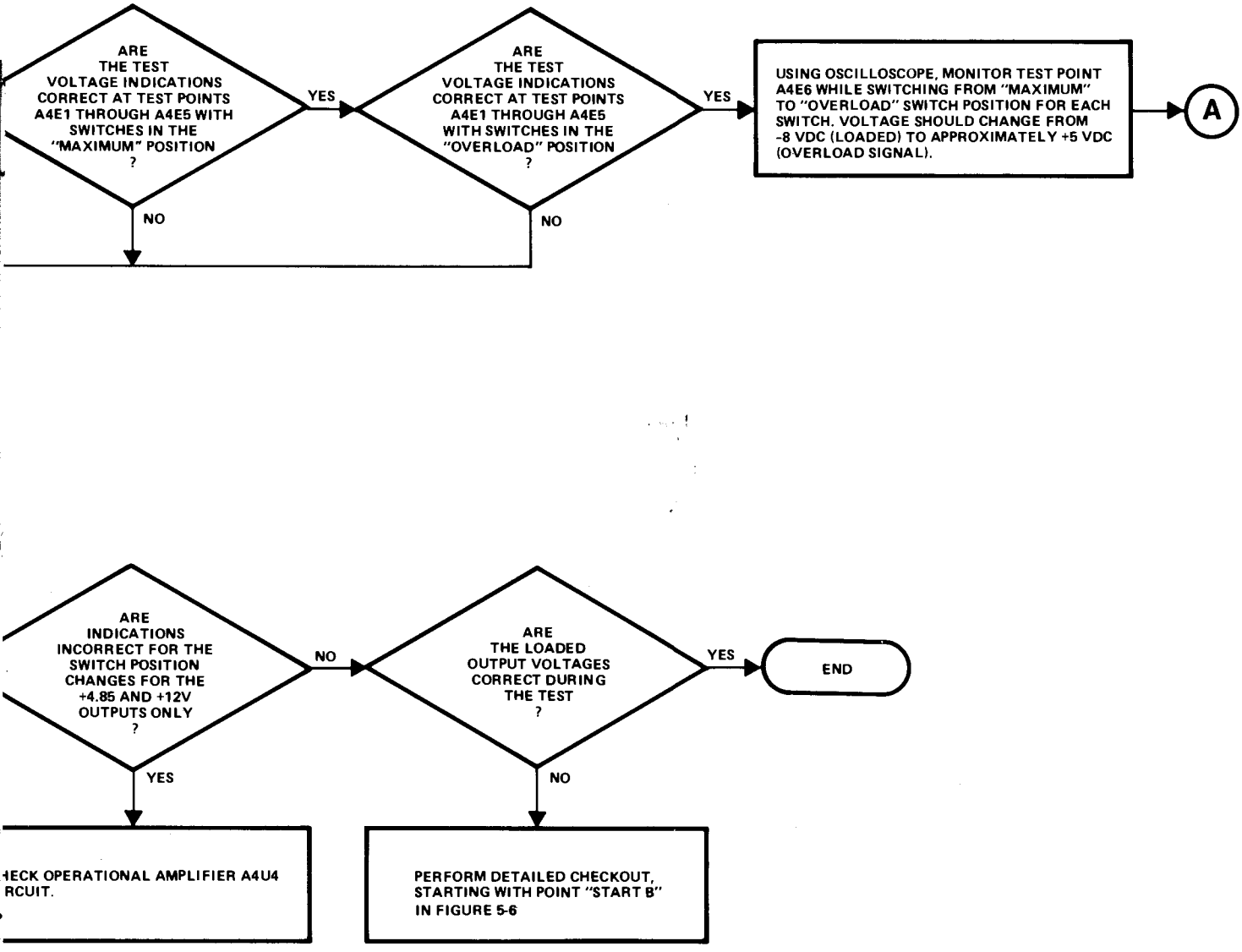
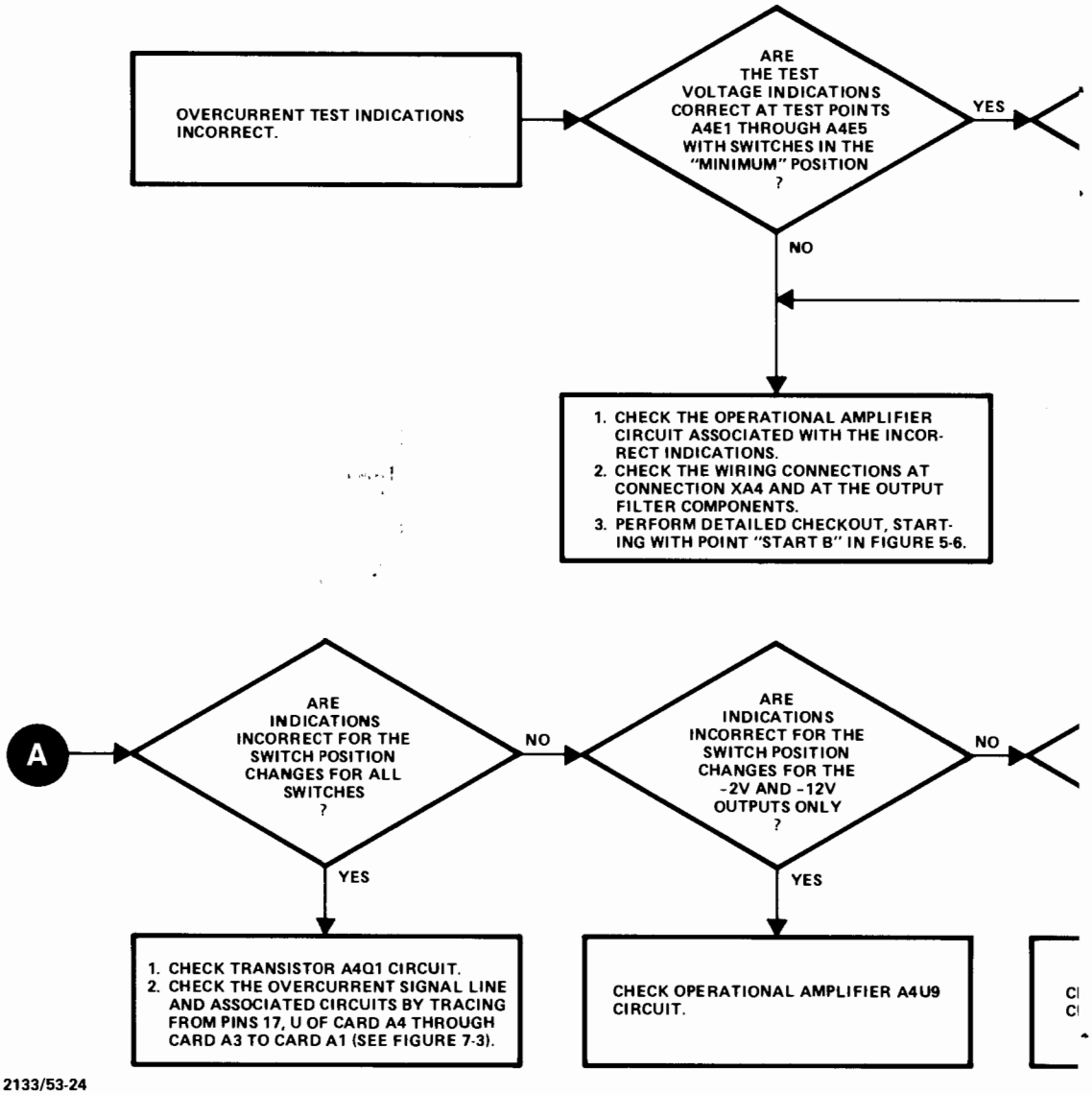


Figure 5-12. Overcurrent Test Troubleshooting Flowchart, Date Codes Prior to 1240


OVERCURRENT TEST INDICATIONS INCORRECT.
ARE THE TEST VOLTAGE INDICATIONS CORRECT AT TEST POINTS A4E1 THROUGH A4E5 WITH SWITCHES IN THE "MINIMUM" POSITION ?
YES
NO
1. CHECK THE OPERATIONAL AMPLIFIER CIRCUIT ASSOCIATED WITH THE INCORRECT INDICATIONS.
2. CHECK THE WIRING CONNECTIONS AT CONNECTION XA4 AND AT THE OUTPUT FILTER COMPONENTS.
3. PERFORM DETAILED CHECKOUT, STARTING WITH POINT "START B" IN FIGURE 5-6.
A
ARE INDICATIONS INCORRECT FOR THE SWITCH POSITION CHANGES FOR ALL SWITCHES ?
NO
YES
ARE INDICATIONS INCORRECT FOR THE SWITCH POSITION CHANGES FOR THE -2V AND -12V OUTPUTS ONLY ?
NO
YES
1. CHECK TRANSISTOR A4Q1 CIRCUIT.
2. CHECK THE OVERCURRENT SIGNAL LINE AND ASSOCIATED CIRCUITS BY TRACING FROM PINS 17, U OF CARD A4 THROUGH CARD A3 TO CARD A1 (SEE FIGURE 7-3).
CHECK OPERATIONAL AMPLIFIER A4U9 CIRCUIT.

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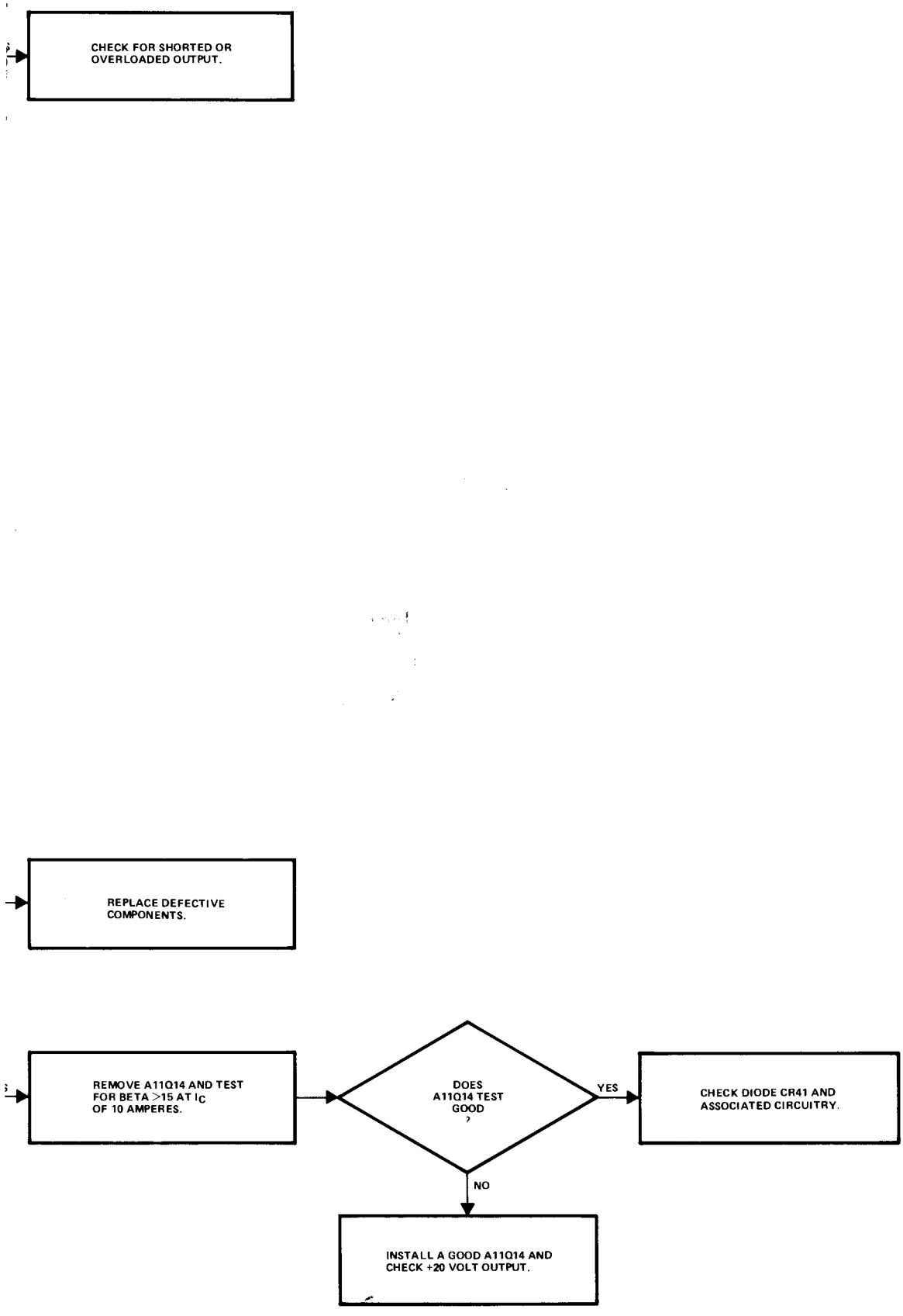
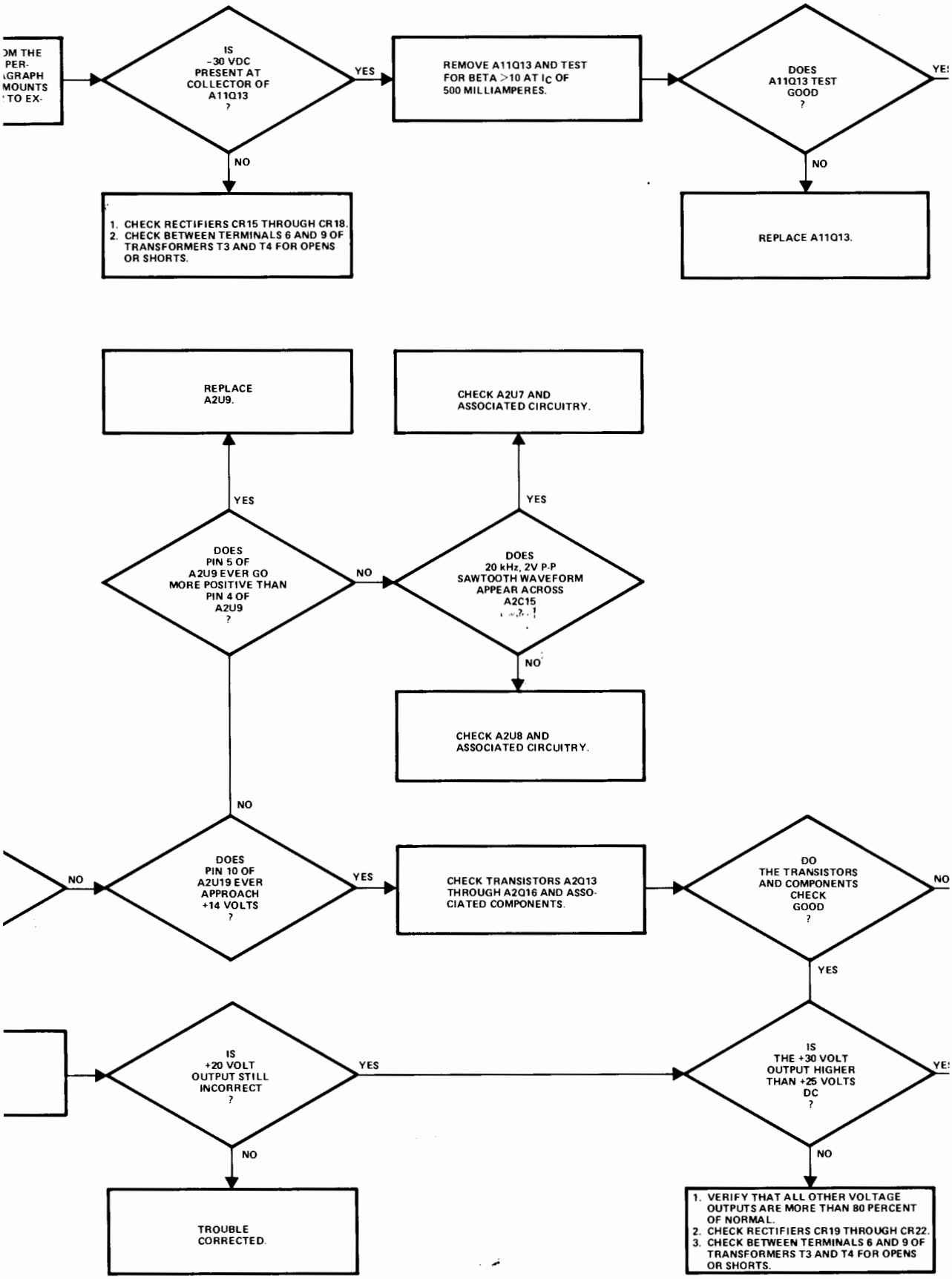
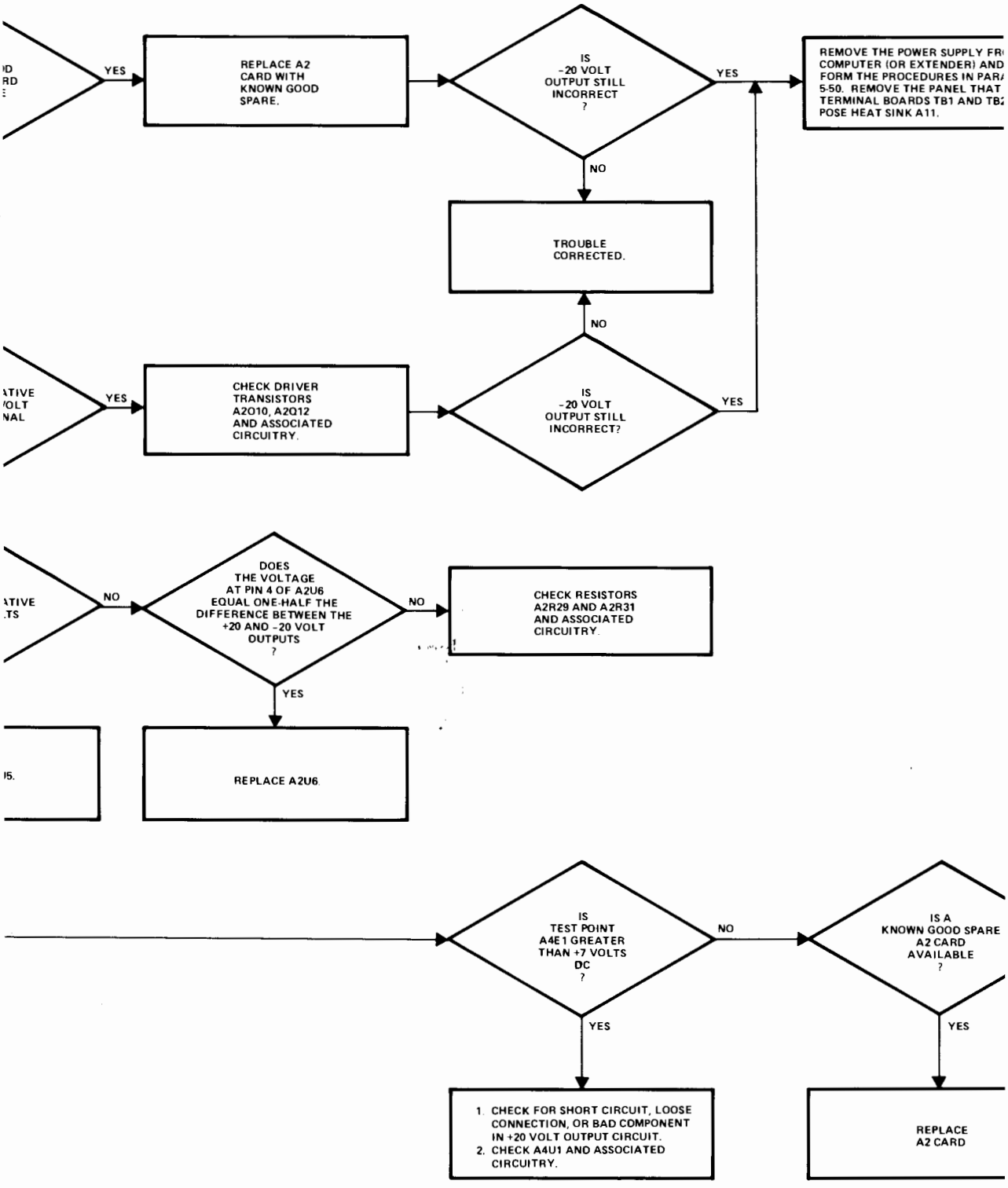
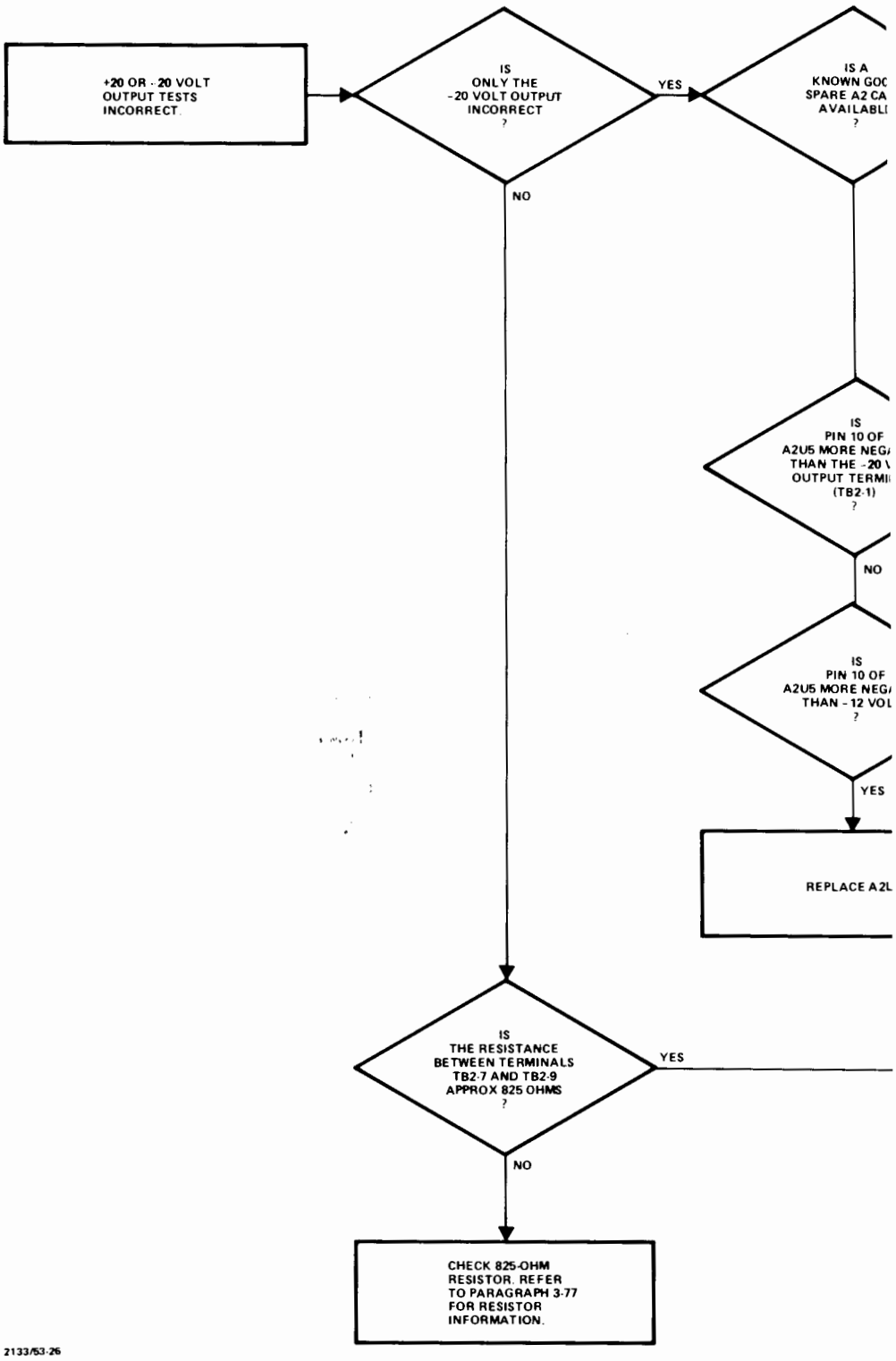


Figure 5-13. +20 and -20 Volt Output Test Troubleshooting Flowchart, Date Codes Prior to 1240


OM THE PER- GRAPH MOUNTS TO EX-
IS -30 VDC PRESENT AT COLLECTOR OF A11Q13 ?
YES
NO
REMOVE A11Q13 AND TEST FOR BETA >10 AT I_C OF 500 MILLIAMPERES.
DOES A11Q13 TEST GOOD ?
YES
NO
1. CHECK RECTIFIERS CR15 THROUGH CR18.
2. CHECK BETWEEN TERMINALS 6 AND 9 OF TRANSFORMERS T3 AND T4 FOR OPENS OR SHORTS.
REPLACE A11Q13.
REPLACE A2U9.
CHECK A2U7 AND ASSOCIATED CIRCUITRY.
YES
YES
DOES PIN 5 OF A2U9 EVER GO MORE POSITIVE THAN PIN 4 OF A2U9 ?
NO
DOES 20 kHz, 2V P-P SAWTOOTH WAVEFORM APPEAR ACROSS A2C15
NO
CHECK A2U8 AND ASSOCIATED CIRCUITRY.
NO
NO
DOES PIN 10 OF A2U19 EVER APPROACH +14 VOLTS ?
YES
CHECK TRANSISTORS A2Q13 THROUGH A2Q16 AND ASSOCIATED COMPONENTS.
DO THE TRANSISTORS AND COMPONENTS CHECK GOOD ?
NO
YES
IS +20 VOLT OUTPUT STILL INCORRECT ?
YES
IS THE +30 VOLT OUTPUT HIGHER THAN +25 VOLTS DC ?
YES
NO
NO
TROUBLE CORRECTED.
1. VERIFY THAT ALL OTHER VOLTAGE OUTPUTS ARE MORE THAN 80 PERCENT OF NORMAL.
2. CHECK RECTIFIERS CR19 THROUGH CR22.
3. CHECK BETWEEN TERMINALS 6 AND 9 OF TRANSFORMERS T3 AND T4 FOR OPENS OR SHORTS.


YES
REPLACE A2 CARD WITH KNOWN GOOD SPARE.
IS -20 VOLT OUTPUT STILL INCORRECT ?
YES
REMOVE THE POWER SUPPLY FR
COMPUTER (OR EXTENDER) AND
FORM THE PROCEDURES IN PAR
5-50. REMOVE THE PANEL THAT
TERMINAL BOARDS TB1 AND TB
POSE HEAT SINK A11.
NO
TROUBLE CORRECTED.
NO
YES
CHECK DRIVER TRANSISTORS A2Q10, A2Q12 AND ASSOCIATED CIRCUITRY.
IS -20 VOLT OUTPUT STILL INCORRECT?
YES
NO
DOES THE VOLTAGE AT PIN 4 OF A2U6 EQUAL ONE-HALF THE DIFFERENCE BETWEEN THE +20 AND -20 VOLT OUTPUTS ?
NO
CHECK RESISTORS A2R29 AND A2R31 AND ASSOCIATED CIRCUITRY.
YES
REPLACE A2U6.
IS TEST POINT A4E1 GREATER THAN +7 VOLTS DC ?
NO
IS A KNOWN GOOD SPARE A2 CARD AVAILABLE ?
YES
YES
1. CHECK FOR SHORT CIRCUIT, LOOSE CONNECTION, OR BAD COMPONENT IN +20 VOLT OUTPUT CIRCUIT.
2. CHECK A4U1 AND ASSOCIATED CIRCUITRY.
REPLACE A2 CARD


+20 OR - 20 VOLT OUTPUT TESTS INCORRECT.
IS ONLY THE -20 VOLT OUTPUT INCORRECT ?
YES
NO
IS A KNOWN GOC SPARE A2 CA AVAILABLI ?
IS PIN 10 OF A2U5 MORE NEG/ THAN THE -20 \ OUTPUT TERMI (TB2-1) ?
NO
IS PIN 10 OF A2U5 MORE NEG/ THAN -12 VOL ?
YES
REPLACE A2L
IS THE RESISTANCE BETWEEN TERMINALS TB2-7 AND TB2-9 APPROX 825 OHMS ?
YES
NO
CHECK 825-OHM RESISTOR. REFER TO PARAGRAPH 3-77 FOR RESISTOR INFORMATION.

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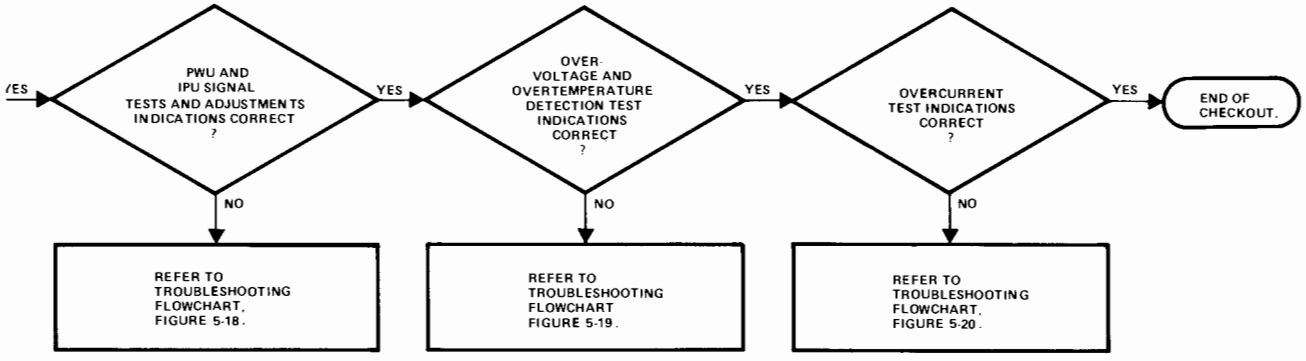
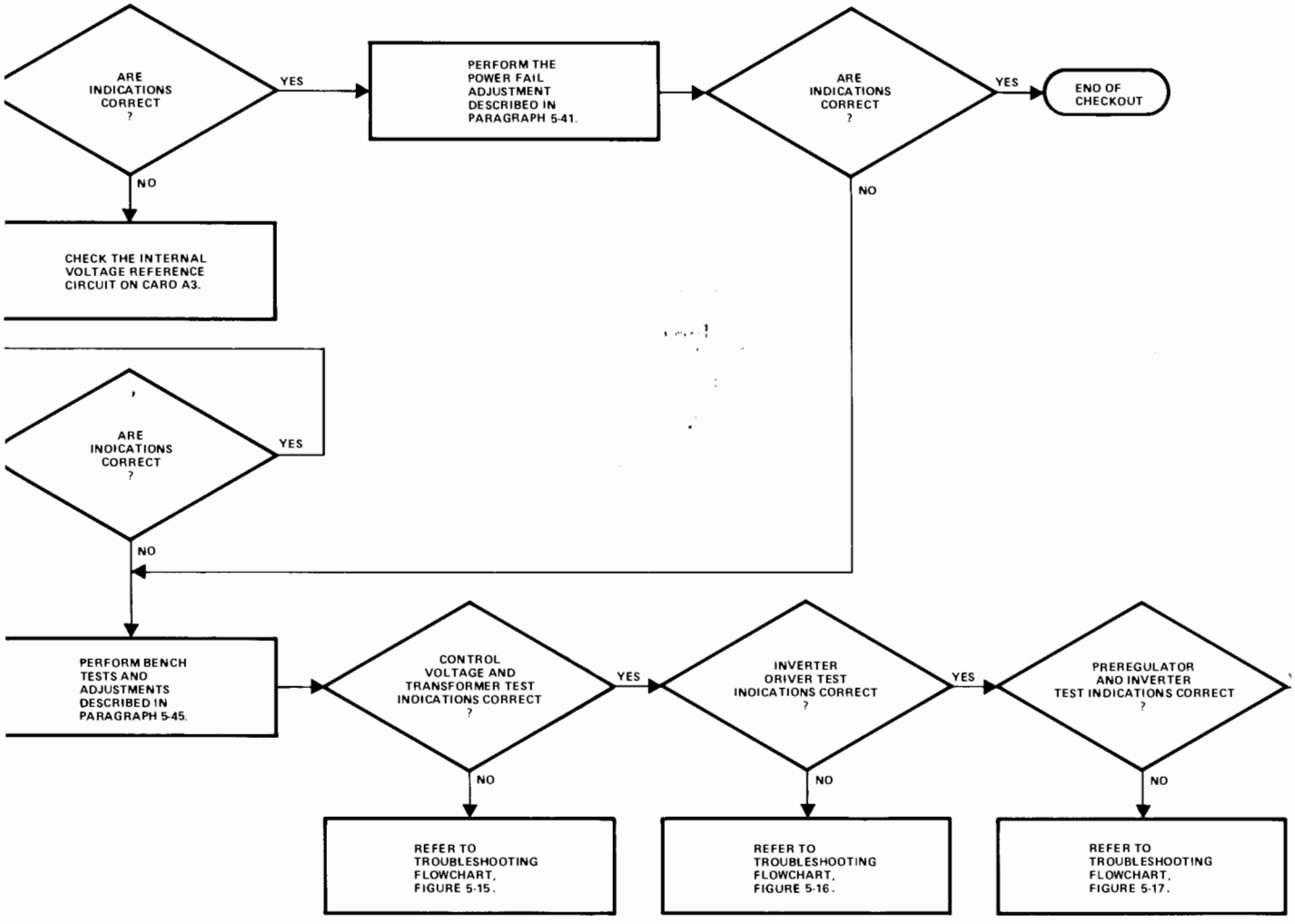
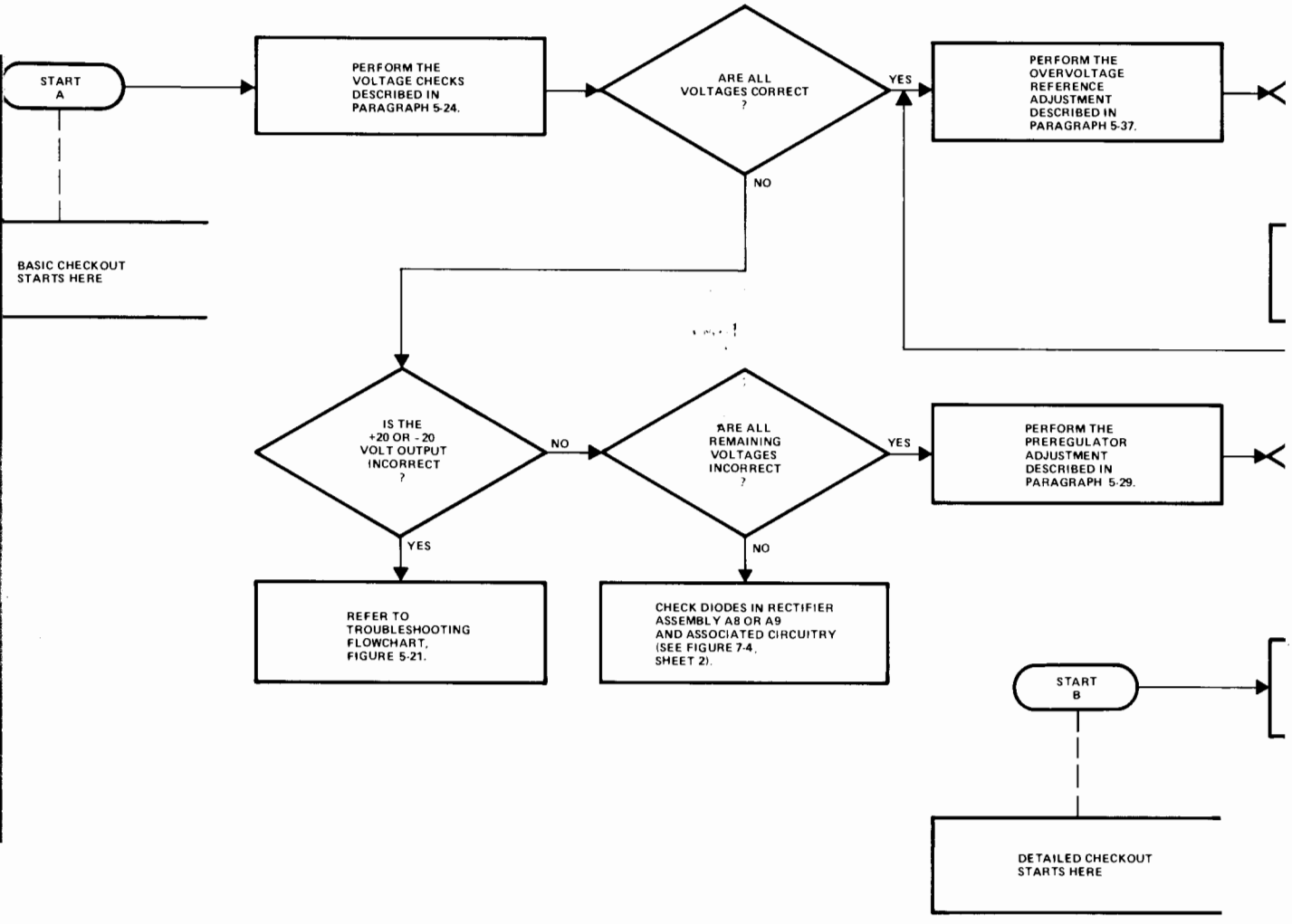


Figure 5-14. Basic Checkout Troubleshooting Flowchart, Date Codes 1240 and Higher


ARE INDICATIONS CORRECT ?
YES
PERFORM THE POWER FAIL ADJUSTMENT DESCRIBED IN PARAGRAPH 5-41.
ARE INDICATIONS CORRECT ?
YES
END OF CHECKOUT
NO
NO
CHECK THE INTERNAL VOLTAGE REFERENCE CIRCUIT ON CARD A3.
ARE INDICATIONS CORRECT ?
YES
NO
PERFORM BENCH TESTS AND ADJUSTMENTS DESCRIBED IN PARAGRAPH 5-45.
CONTROL VOLTAGE AND TRANSFORMER TEST INDICATIONS CORRECT ?
YES
INVERTER ORIVER TEST INDICATIONS CORRECT ?
YES
PREREGULATOR AND INVERTER TEST INDICATIONS CORRECT ?
NO
NO
NO
REFER TO TROUBLESHOOTING FLOWCHART, FIGURE 5-15.
REFER TO TROUBLESHOOTING FLOWCHART, FIGURE 5-16.
REFER TO TROUBLESHOOTING FLOWCHART, FIGURE 5-17.


START
A
PERFORM THE
VOLTAGE CHECKS
DESCRIBED IN
PARAGRAPH 5-24.
ARE ALL
VOLTAGES CORRECT
?
YES
PERFORM THE
OVERVOLTAGE
REFERENCE
ADJUSTMENT
DESCRIBED IN
PARAGRAPH 5-37.
NO
BASIC CHECKOUT
STARTS HERE
IS THE
+20 OR - 20
VOLT OUTPUT
INCORRECT
?
NO
ARE ALL
REMAINING
VOLTAGES
INCORRECT
?
YES
PERFORM THE
PREREGULATOR
ADJUSTMENT
DESCRIBED IN
PARAGRAPH 5-29.
YES
NO
REFER TO
TROUBLESHOOTING
FLOWCHART,
FIGURE 5-21.
CHECK DIODES IN RECTIFIER
ASSEMBLY A8 OR A9
AND ASSOCIATED CIRCUITRY
(SEE FIGURE 7-4,
SHEET 2).
START
B
DETAILED CHECKOUT
STARTS HERE

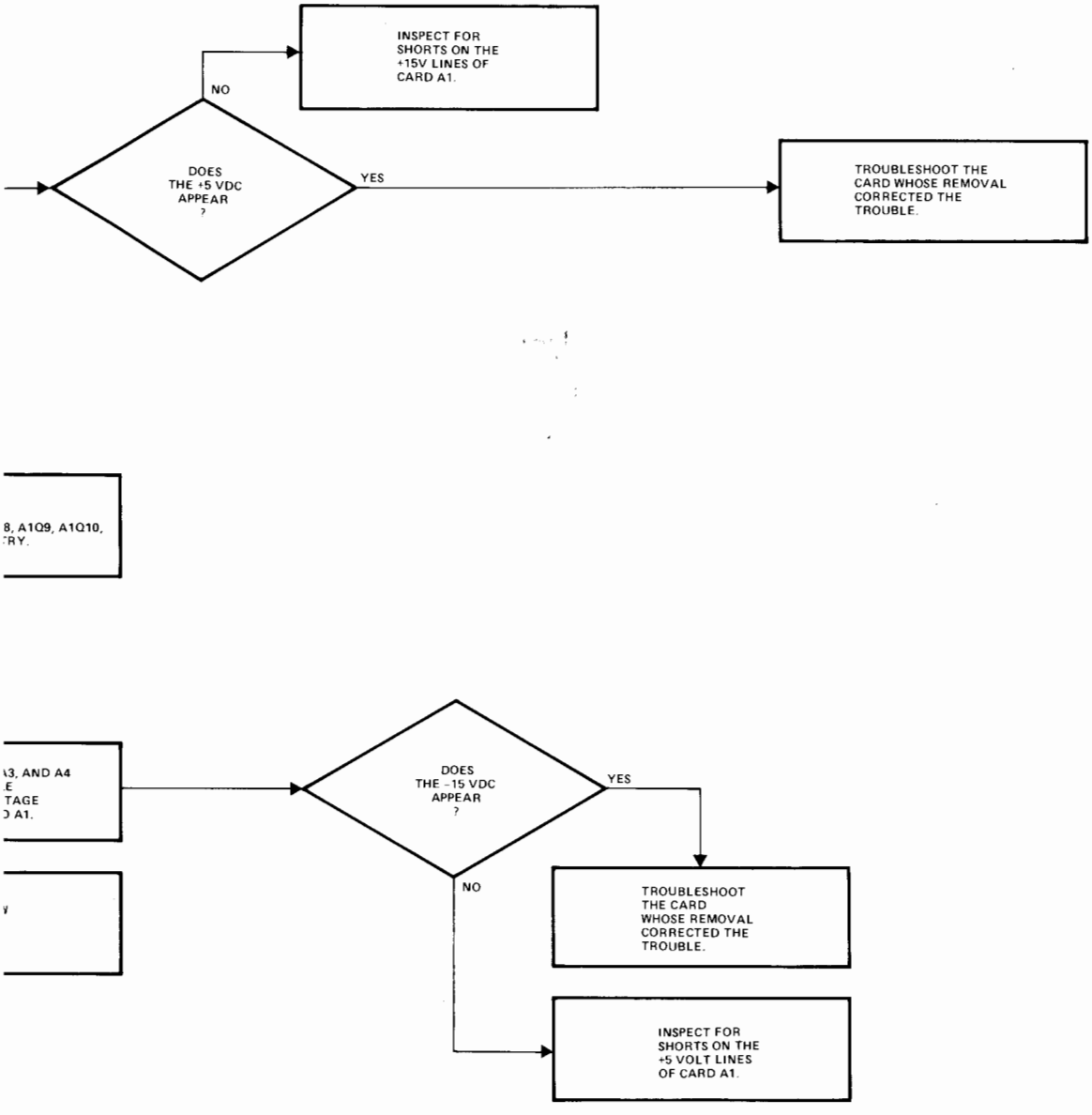
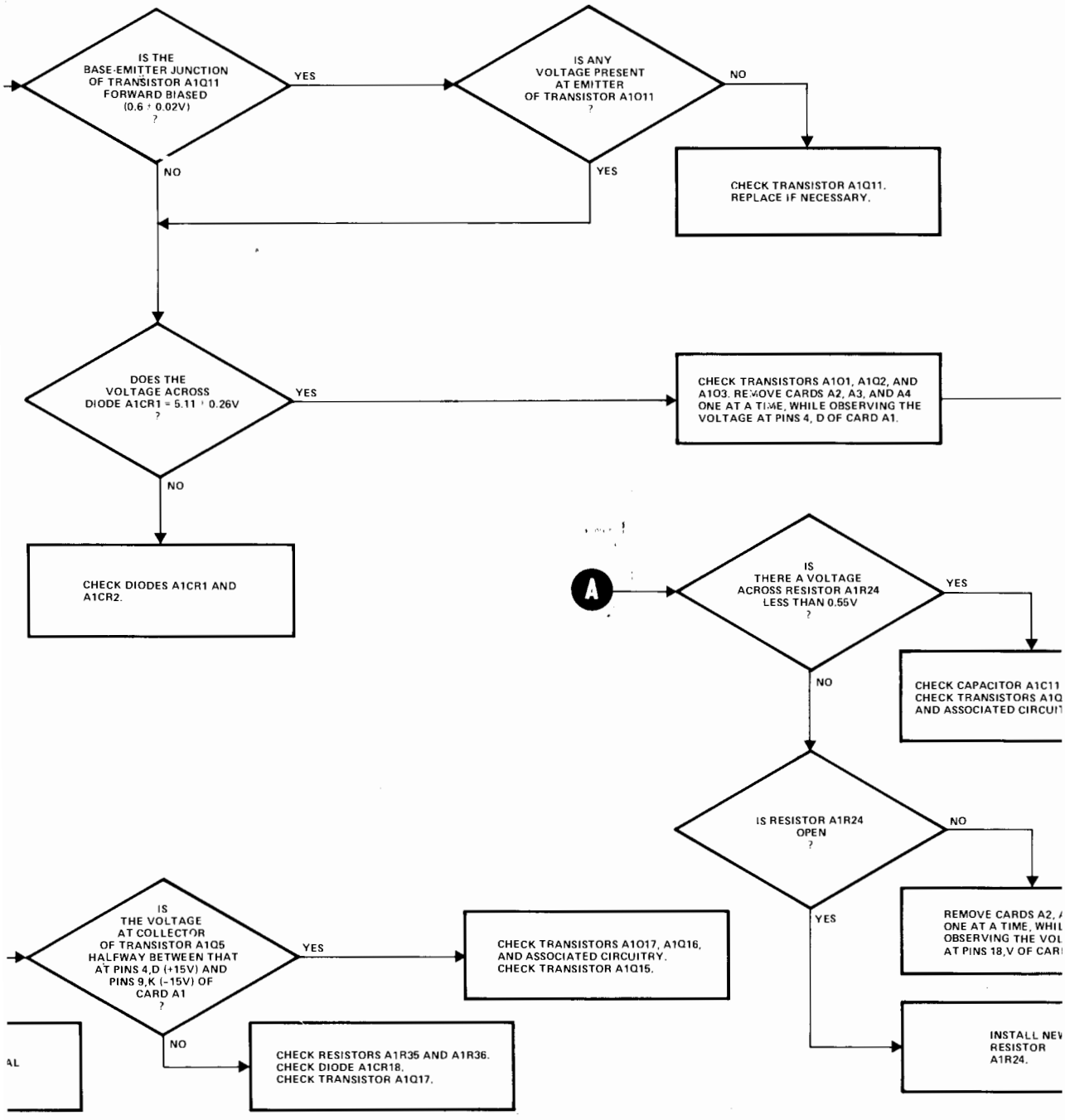
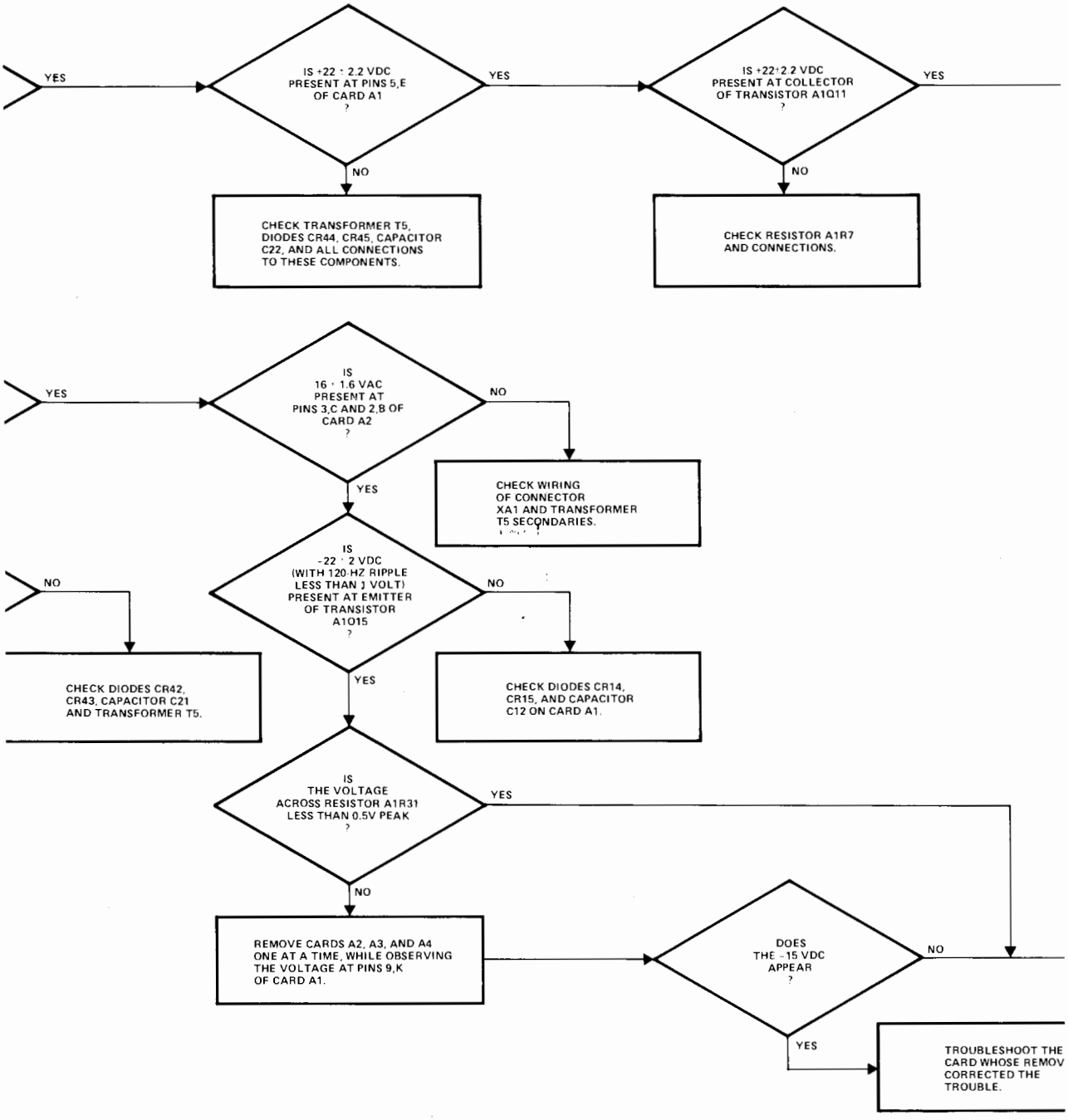
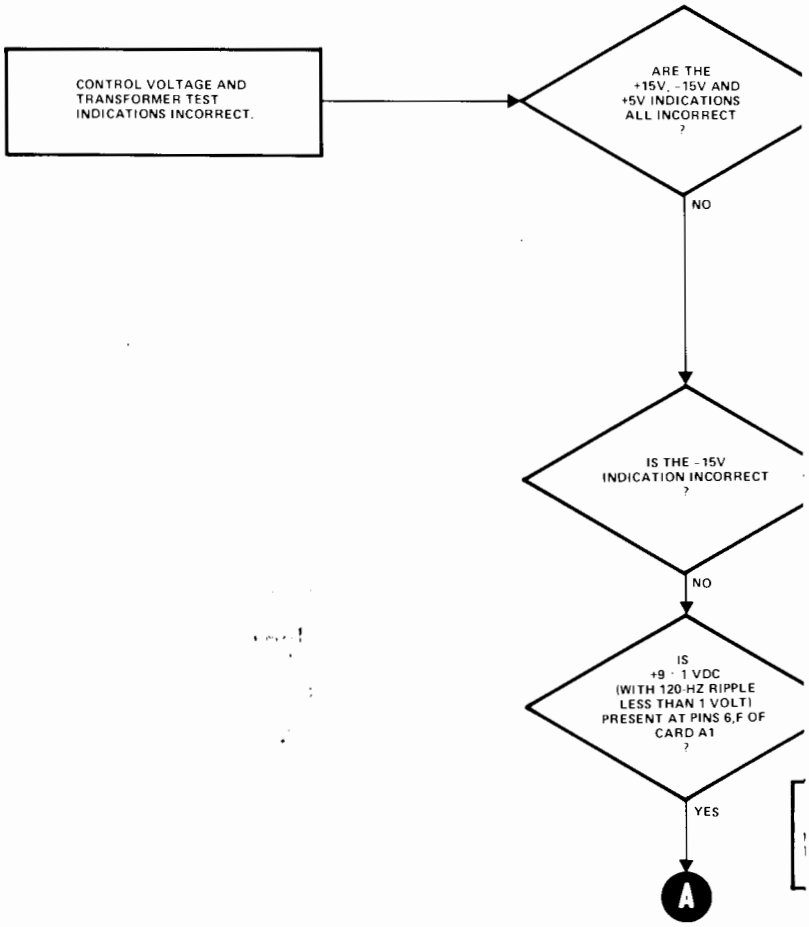


Figure 5-15. Control Voltage and Transformer Test Troubleshooting Flowchart, Date Codes 1240 and Higher


IS THE BASE-EMITTER JUNCTION OF TRANSISTOR A1Q11 FORWARD BIASED (0.6 ± 0.02V) ?
YES
IS ANY VOLTAGE PRESENT AT EMITTER OF TRANSISTOR A1Q11 ?
NO
YES
CHECK TRANSISTOR A1Q11. REPLACE IF NECESSARY.
NO
DOES THE VOLTAGE ACROSS DIODE A1CR1 = 5.11 ± 0.26V ?
YES
CHECK TRANSISTORS A1Q1, A1Q2, AND A1Q3. REMOVE CARDS A2, A3, AND A4 ONE AT A TIME, WHILE OBSERVING THE VOLTAGE AT PINS 4, D OF CARD A1.
NO
CHECK DIODES A1CR1 AND A1CR2.
A
IS THERE A VOLTAGE ACROSS RESISTOR A1R24 LESS THAN 0.55V ?
YES
CHECK CAPACITOR A1C11
CHECK TRANSISTORS A1Q
AND ASSOCIATED CIRCUI
NO
IS RESISTOR A1R24 OPEN ?
NO
REMOVE CARDS A2,
ONE AT A TIME, WHI
OBSERVING THE VOL
AT PINS 18,V OF CAR
YES
INSTALL NE
RESISTOR
A1R24.
IS THE VOLTAGE AT COLLECTOR OF TRANSISTOR A1Q5 HALFWAY BETWEEN THAT AT PINS 4,D (+15V) AND PINS 9,K (-15V) OF CARD A1 ?
YES
CHECK TRANSISTORS A1Q17, A1Q16, AND ASSOCIATED CIRCUITRY. CHECK TRANSISTOR A1Q15.
NO
CHECK RESISTORS A1R35 AND A1R36. CHECK DIODE A1CR18. CHECK TRANSISTOR A1Q17.
AL


YES
IS +22 ± 2.2 VDC PRESENT AT PINS 5,E OF CARD A1 ?
YES
IS +22±2.2 VDC PRESENT AT COLLECTOR OF TRANSISTOR A1Q11 ?
YES
NO
CHECK TRANSFORMER T5, DIODES CR44, CR45, CAPACITOR C22, AND ALL CONNECTIONS TO THESE COMPONENTS.
NO
CHECK RESISTOR A1R7 AND CONNECTIONS.
YES
IS 16 ± 1.6 VAC PRESENT AT PINS 3,C AND 2,B OF CARD A2 ?
NO
CHECK WIRING OF CONNECTOR XA1 AND TRANSFORMER T5 SECONDARIES.
YES
NO
IS -22 ± 2 VDC (WITH 120-HZ RIPPLE LESS THAN 1 VOLT) PRESENT AT EMITTER OF TRANSISTOR A1Q15 ?
NO
CHECK DIODES CR42, CR43, CAPACITOR C21 AND TRANSFORMER T5.
YES
CHECK DIODES CR14, CR15, AND CAPACITOR C12 ON CARD A1.
IS THE VOLTAGE ACROSS RESISTOR A1R31 LESS THAN 0.5V PEAK ?
YES
NO
REMOVE CARDS A2, A3, AND A4 ONE AT A TIME, WHILE OBSERVING THE VOLTAGE AT PINS 9,K OF CARD A1.
DOES THE -15 VDC APPEAR ?
NO
YES
TROUBLESHOOT THE CARD WHOSE REMOV CORRECTED THE TROUBLE.


CONTROL VOLTAGE AND TRANSFORMER TEST INDICATIONS INCORRECT.
ARE THE +15V, -15V AND +5V INDICATIONS ALL INCORRECT ?
NO
IS THE -15V INDICATION INCORRECT ?
NO
IS +9 ± 1 VDC (WITH 120-HZ RIPPLE LESS THAN 1 VOLT) PRESENT AT PINS 6,F OF CARD A1 ?
YES
A

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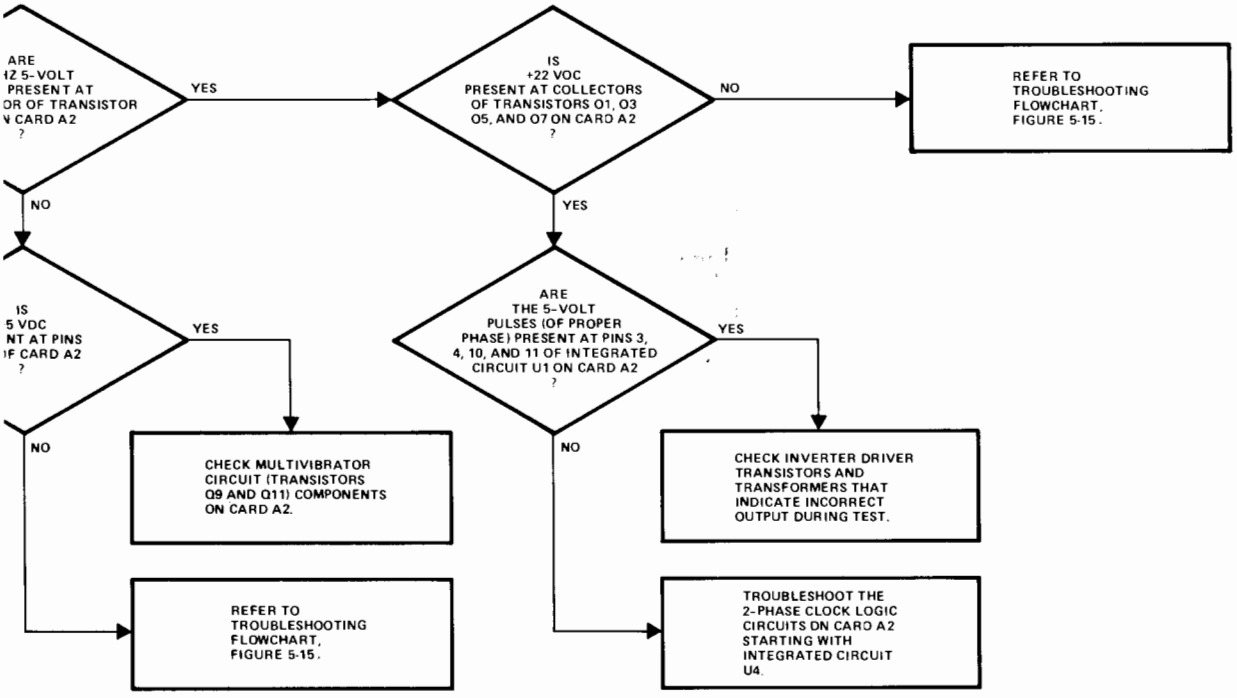
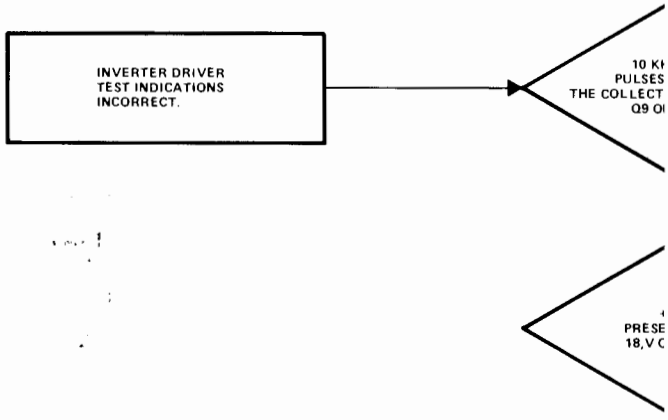


Figure 5-16. Inverter Driver Test Troubleshooting Flowchart, Date Codes 1240 and Higher


INVERTER DRIVER
TEST INDICATIONS
INCORRECT.
10 KH
PULSES
THE COLLECT
Q9 OI
PRESE
18,V C

2133/53-29

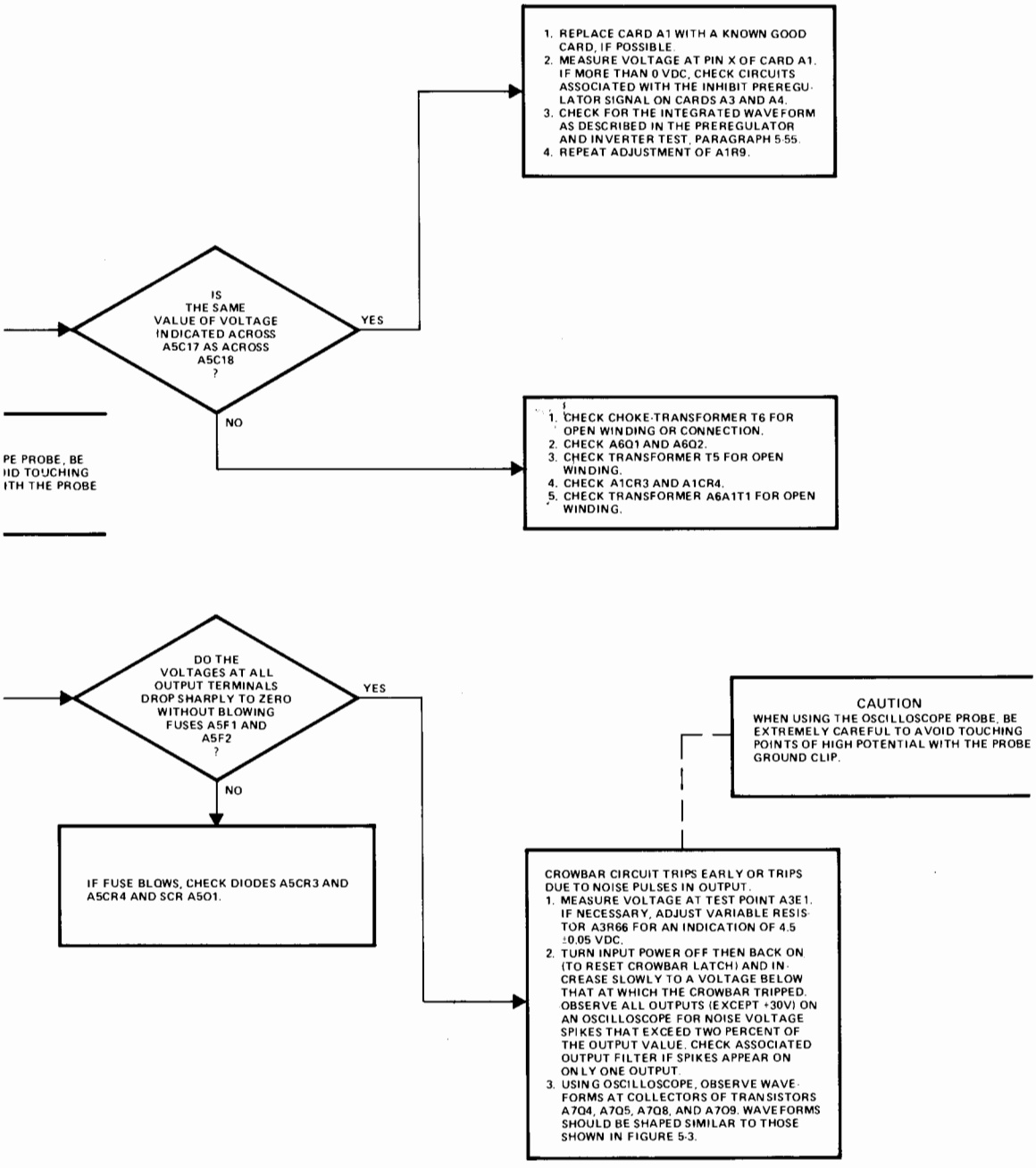
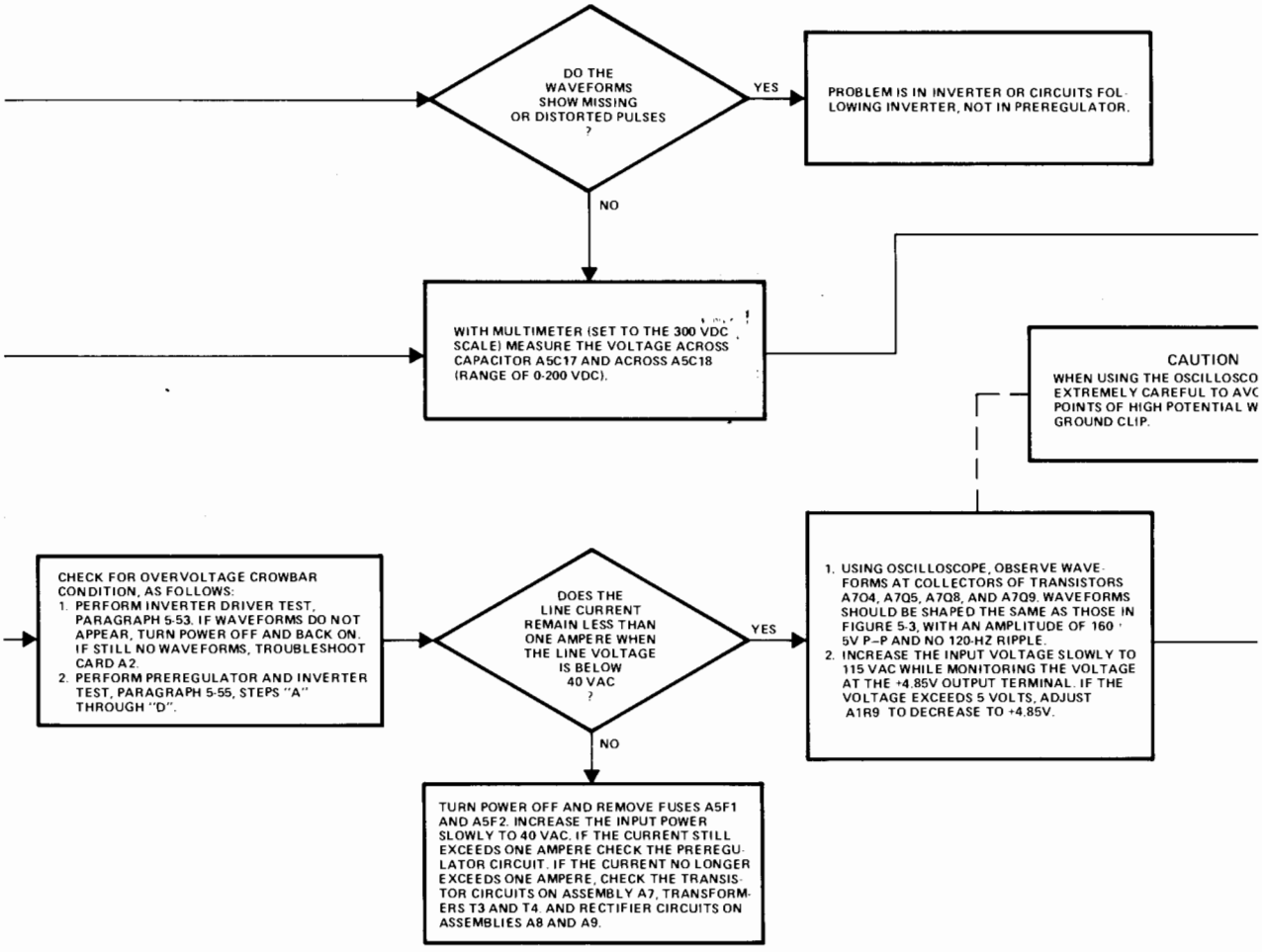
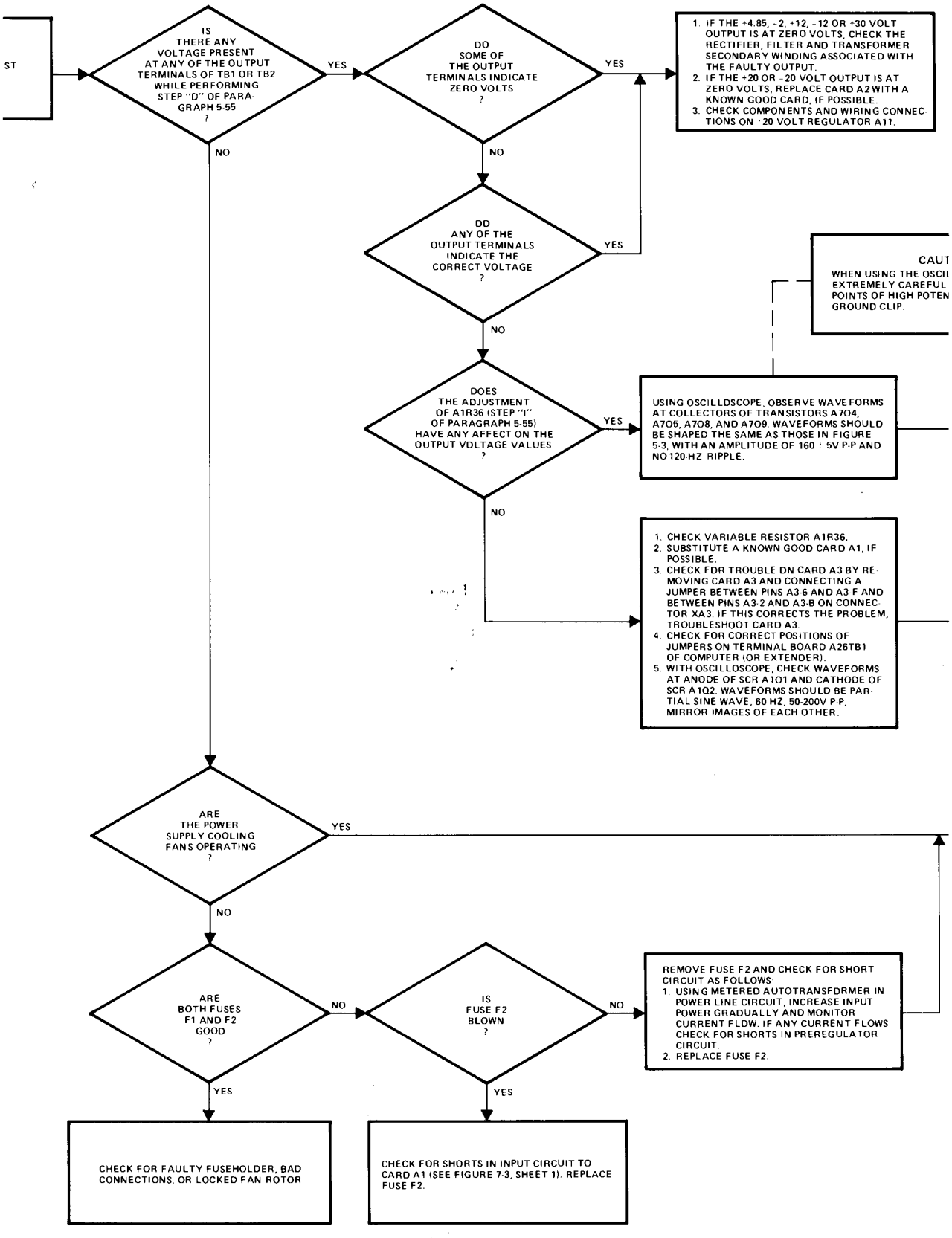


Figure 5-17. Preregulator and Inverter Test Troubleshooting Flowchart, Date Codes 1240 and Higher

ION
LOSCOPE PROBE, BE
TO AVOID TOUCHING
TIAL WITH THE PROBE




ST
IS THERE ANY VOLTAGE PRESENT AT ANY OF THE OUTPUT TERMINALS OF TB1 OR TB2 WHILE PERFORMING STEP "D" OF PARAGRAPH 5-55 ?
YES
NO
DO SOME OF THE OUTPUT TERMINALS INDICATE ZERO VOLTS ?
YES
NO
1. IF THE +4.85, -2, +12, -12 OR +30 VOLT OUTPUT IS AT ZERO VOLTS, CHECK THE RECTIFIER, FILTER AND TRANSFORMER SECONDARY WINDING ASSOCIATED WITH THE FAULTY OUTPUT.
2. IF THE +20 OR -20 VOLT OUTPUT IS AT ZERO VOLTS, REPLACE CARD A2 WITH A KNOWN GOOD CARD, IF POSSIBLE.
3. CHECK COMPONENTS AND WIRING CONNECTIONS ON +20 VOLT REGULATOR A11.
DD ANY OF THE OUTPUT TERMINALS INDICATE THE CORRECT VOLTAGE ?
YES
NO
CAUT
WHEN USING THE OSCIL
EXTREMELY CAREFUL
POINTS OF HIGH POTEN
GROUND CLIP.
DOES THE ADJUSTMENT OF A1R36 (STEP "I" OF PARAGRAPH 5-55) HAVE ANY AFFECT ON THE OUTPUT VOLTAGE VALUES ?
YES
NO
USING OSCILLOSCOPE, OBSERVE WAVEFORMS AT COLLECTORS OF TRANSISTORS A704, A705, A708, AND A709. WAVEFORMS SHOULD BE SHAPED THE SAME AS THOSE IN FIGURE 5-3, WITH AN AMPLITUDE OF 160 ± 5V P-P AND NO 120-HZ RIPPLE.
1. CHECK VARIABLE RESISTOR A1R36.
2. SUBSTITUTE A KNOWN GOOD CARD A1, IF POSSIBLE.
3. CHECK FOR TROUBLE ON CARD A3 BY REMOVING CARD A3 AND CONNECTING A JUMPER BETWEEN PINS A3-6 AND A3-F AND BETWEEN PINS A3-2 AND A3-B ON CONNECTOR XA3. IF THIS CORRECTS THE PROBLEM, TROUBLESHOOT CARD A3.
4. CHECK FOR CORRECT POSITIONS OF JUMPERS ON TERMINAL BOARD A26TB1 OF COMPUTER (OR EXTENDER).
5. WITH OSCILLOSCOPE, CHECK WAVEFORMS AT ANODE OF SCR A1Q1 AND CATHODE OF SCR A1Q2. WAVEFORMS SHOULD BE PARTIAL SINE WAVE, 60 HZ, 50-200V P-P, MIRROR IMAGES OF EACH OTHER.
ARE THE POWER SUPPLY COOLING FANS OPERATING ?
YES
NO
ARE BOTH FUSES F1 AND F2 GOOD ?
NO
YES
IS FUSE F2 BLOWN ?
NO
YES
REMOVE FUSE F2 AND CHECK FOR SHORT CIRCUIT AS FOLLOWS:
1. USING METERED AUTOTRANSFORMER IN POWER LINE CIRCUIT, INCREASE INPUT POWER GRADUALLY AND MONITOR CURRENT FLOW. IF ANY CURRENT FLOWS CHECK FOR SHORTS IN PREREGULATOR CIRCUIT.
2. REPLACE FUSE F2.
CHECK FOR FAULTY FUSEHOLDER, BAD CONNECTIONS, OR LOCKED FAN ROTOR.
CHECK FOR SHORTS IN INPUT CIRCUIT TO CARD A1 (SEE FIGURE 7-3, SHEET 1). REPLACE FUSE F2.

PREREGULATOR AND INVERTER TE
INDICATIONS INCORRECT.

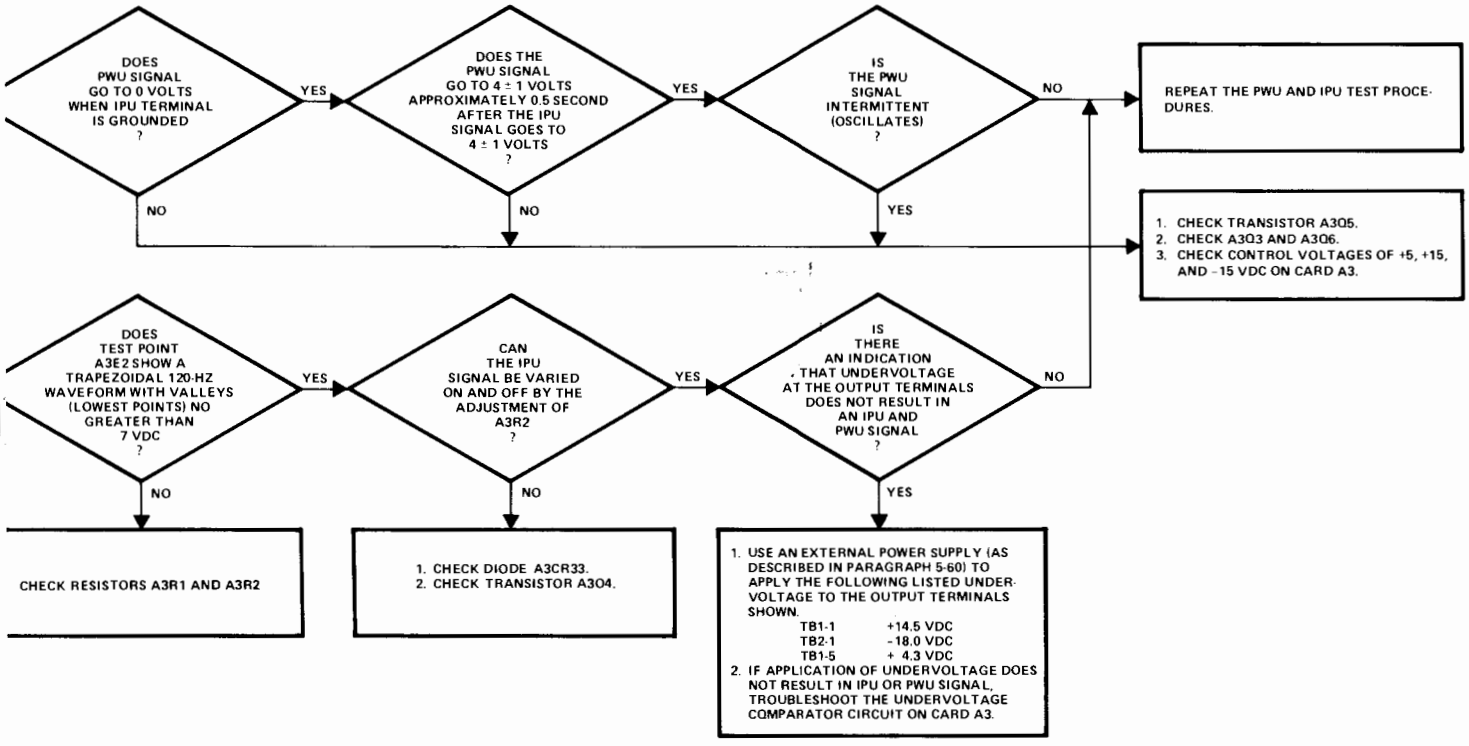
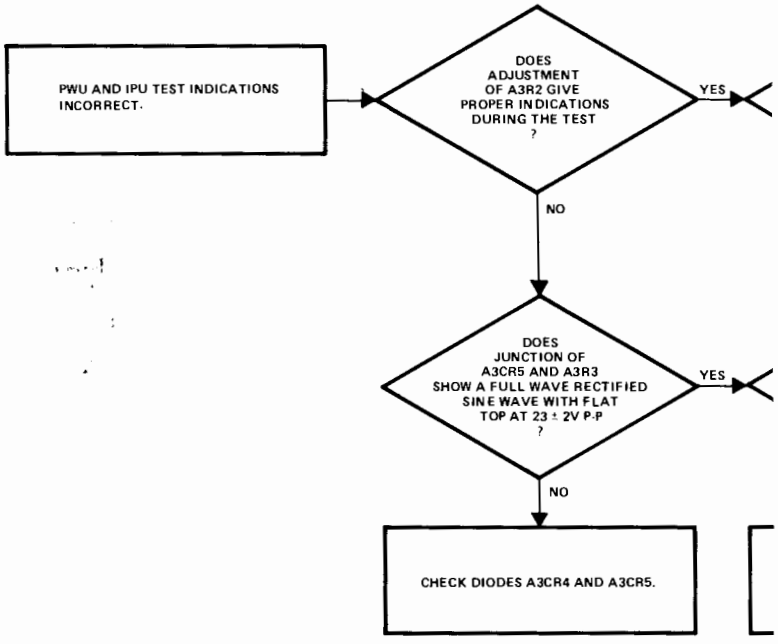


Figure 5-18. PWU and IPU Test Troubleshooting Flowchart, Date Codes 1240 and Higher


PWU AND IPU TEST INDICATIONS INCORRECT.
DOES ADJUSTMENT OF A3R2 GIVE PROPER INDICATIONS DURING THE TEST ?
YES
NO
DOES JUNCTION OF A3CR5 AND A3R3 SHOW A FULL WAVE RECTIFIED SINE WAVE WITH FLAT TOP AT 23 ± 2V P-P ?
YES
NO
CHECK DIODES A3CR4 AND A3CR5.

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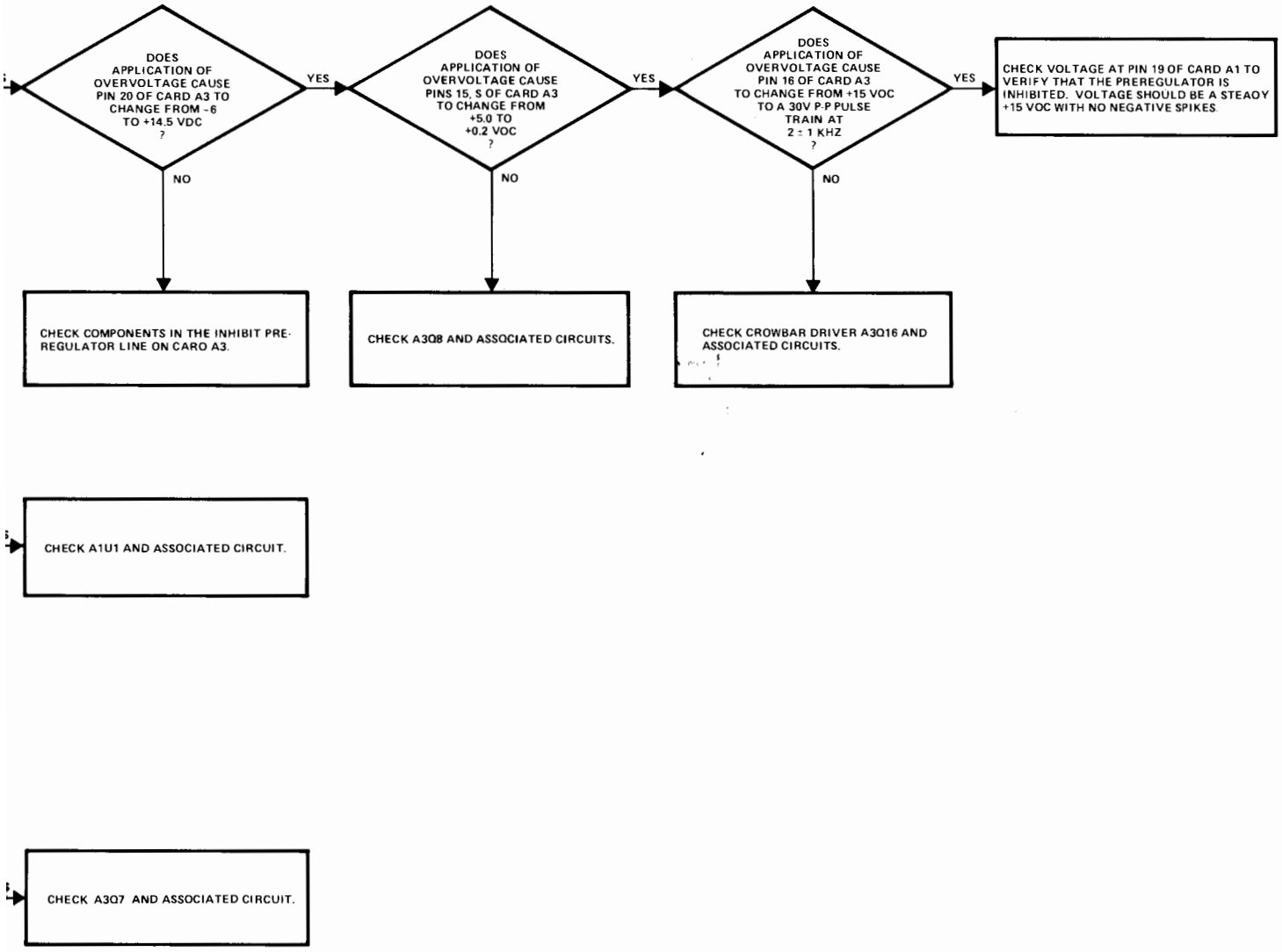
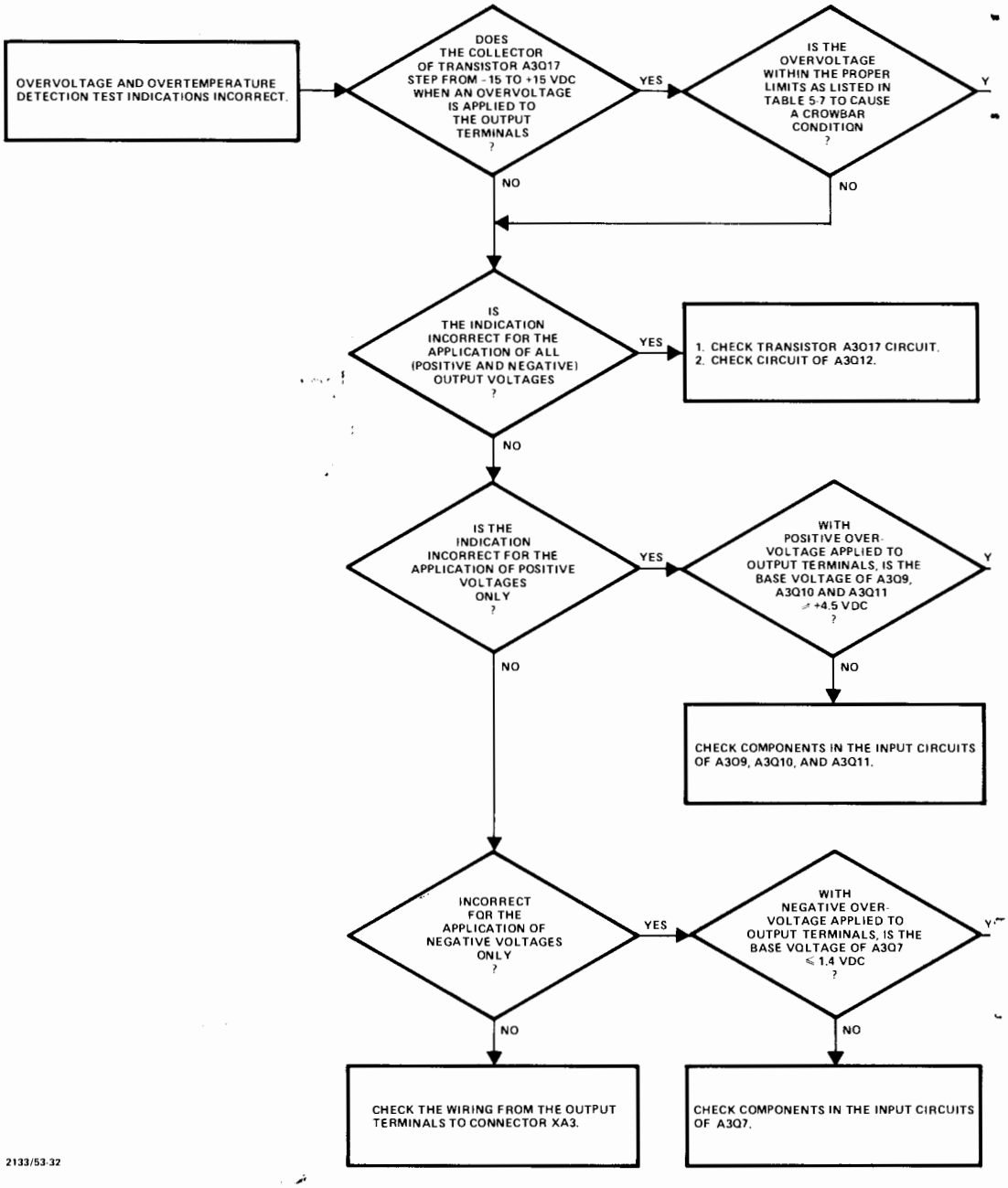


Figure 5-19. Overvoltage and Overtemperature Detection Test Troubleshooting Flowchart, Date Codes 1240 and Higher


OVERVOLTAGE AND OVERTEMPERATURE DETECTION TEST INDICATIONS INCORRECT.
DOES THE COLLECTOR OF TRANSISTOR A3Q17 STEP FROM -15 TO +15 VDC WHEN AN OVERVOLTAGE IS APPLIED TO THE OUTPUT TERMINALS ?
YES
IS THE OVERVOLTAGE WITHIN THE PROPER LIMITS AS LISTED IN TABLE 5-7 TO CAUSE A CROWBAR CONDITION ?
Y
NO
NO
IS THE INDICATION INCORRECT FOR THE APPLICATION OF ALL (POSITIVE AND NEGATIVE) OUTPUT VOLTAGES ?
YES
1. CHECK TRANSISTOR A3Q17 CIRCUIT.
2. CHECK CIRCUIT OF A3Q12.
NO
IS THE INDICATION INCORRECT FOR THE APPLICATION OF POSITIVE VOLTAGES ONLY ?
YES
WITH POSITIVE OVER-VOLTAGE APPLIED TO OUTPUT TERMINALS, IS THE BASE VOLTAGE OF A3Q9, A3Q10 AND A3Q11 ≥ +4.5 VDC ?
Y
NO
NO
CHECK COMPONENTS IN THE INPUT CIRCUITS OF A3Q9, A3Q10, AND A3Q11.
INCORRECT FOR THE APPLICATION OF NEGATIVE VOLTAGES ONLY ?
YES
WITH NEGATIVE OVER-VOLTAGE APPLIED TO OUTPUT TERMINALS, IS THE BASE VOLTAGE OF A3Q7 ≤ 1.4 VDC ?
Y
NO
NO
CHECK THE WIRING FROM THE OUTPUT TERMINALS TO CONNECTOR XA3.
CHECK COMPONENTS IN THE INPUT CIRCUITS OF A3Q7.

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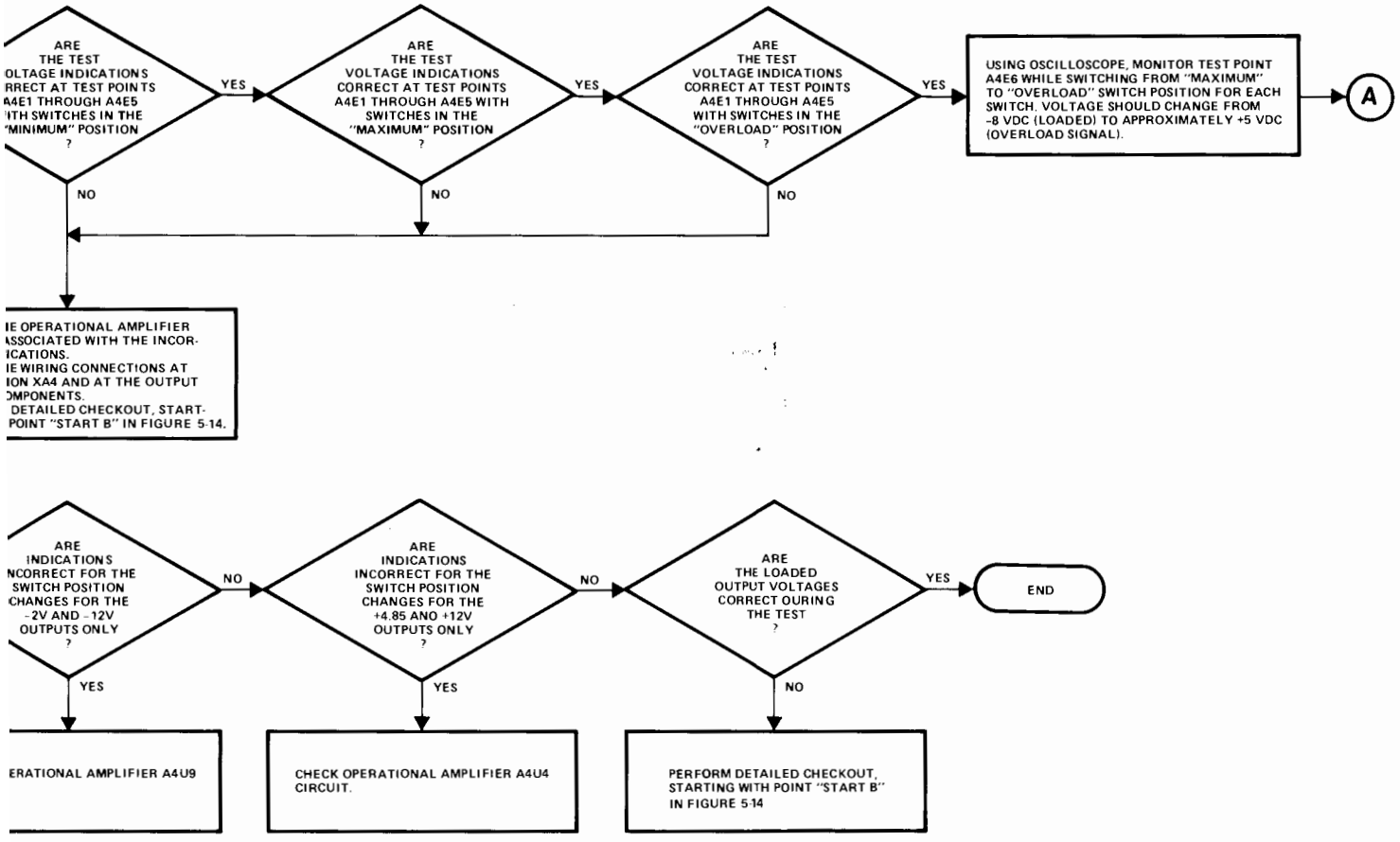
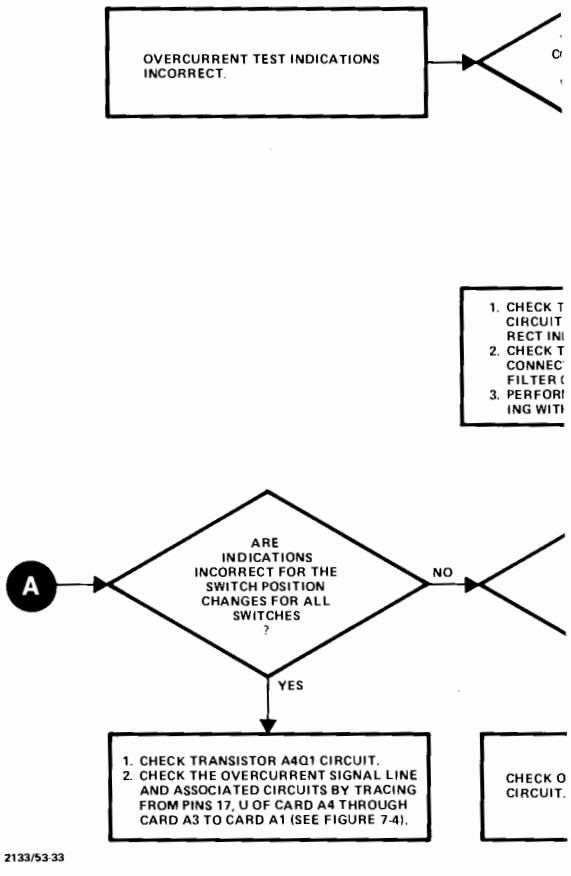


Figure 5-20. Overcurrent Test Troubleshooting Flowchart, Date Codes 1240 and Higher


OVERCURRENT TEST INDICATIONS INCORRECT.
1. CHECK T
CIRCUIT
RECT INI
2. CHECK T
CONNEC
FILTER (
3. PERFORI
ING WITI
A
ARE INDICATIONS INCORRECT FOR THE SWITCH POSITION CHANGES FOR ALL SWITCHES ?
NO
YES
1. CHECK TRANSISTOR A4Q1 CIRCUIT.
2. CHECK THE OVERCURRENT SIGNAL LINE AND ASSOCIATED CIRCUITS BY TRACING FROM PINS 17, U OF CARD A4 THROUGH CARD A3 TO CARD A1 (SEE FIGURE 7-4).
CHECK O
CIRCUIT.
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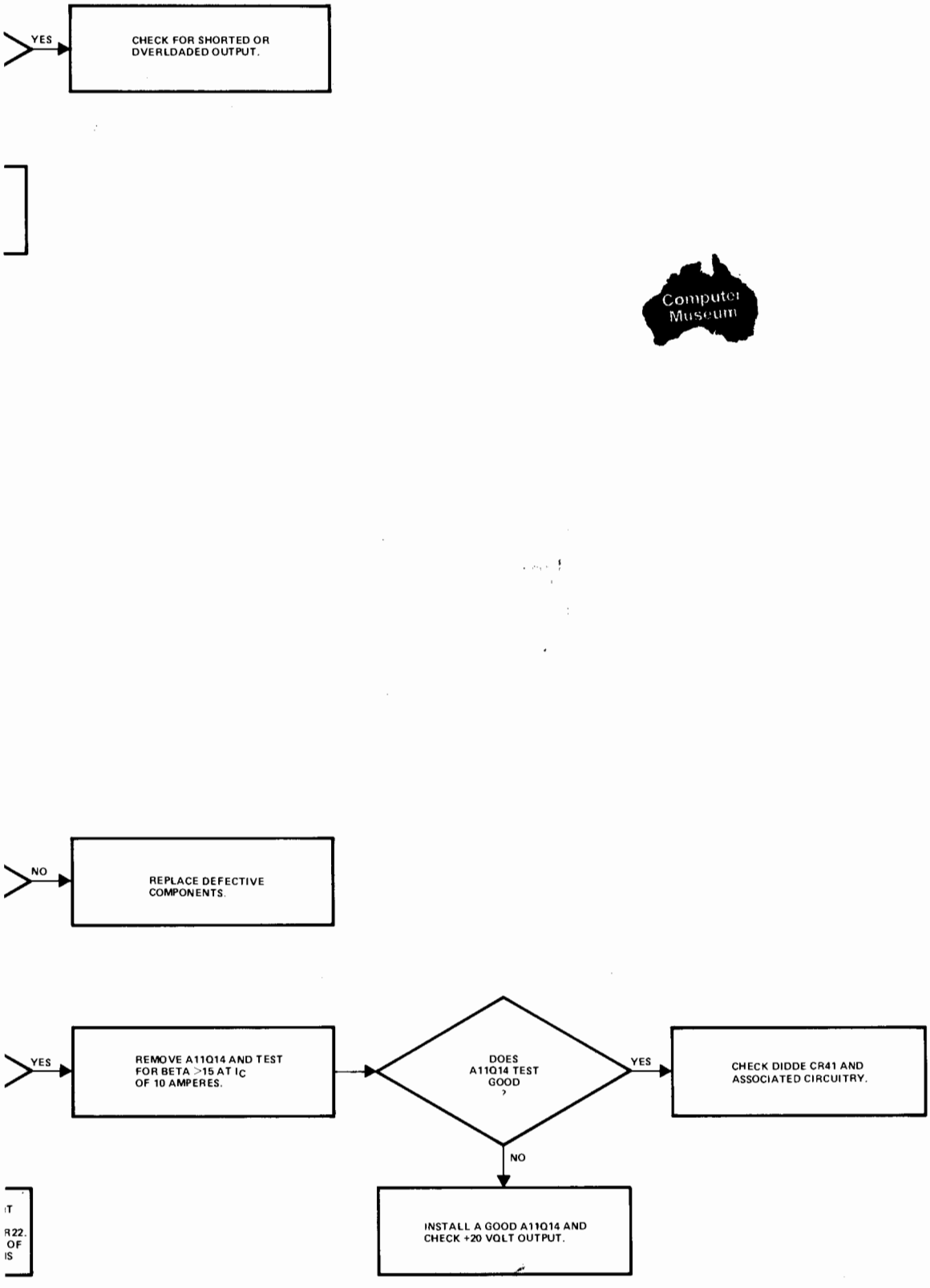
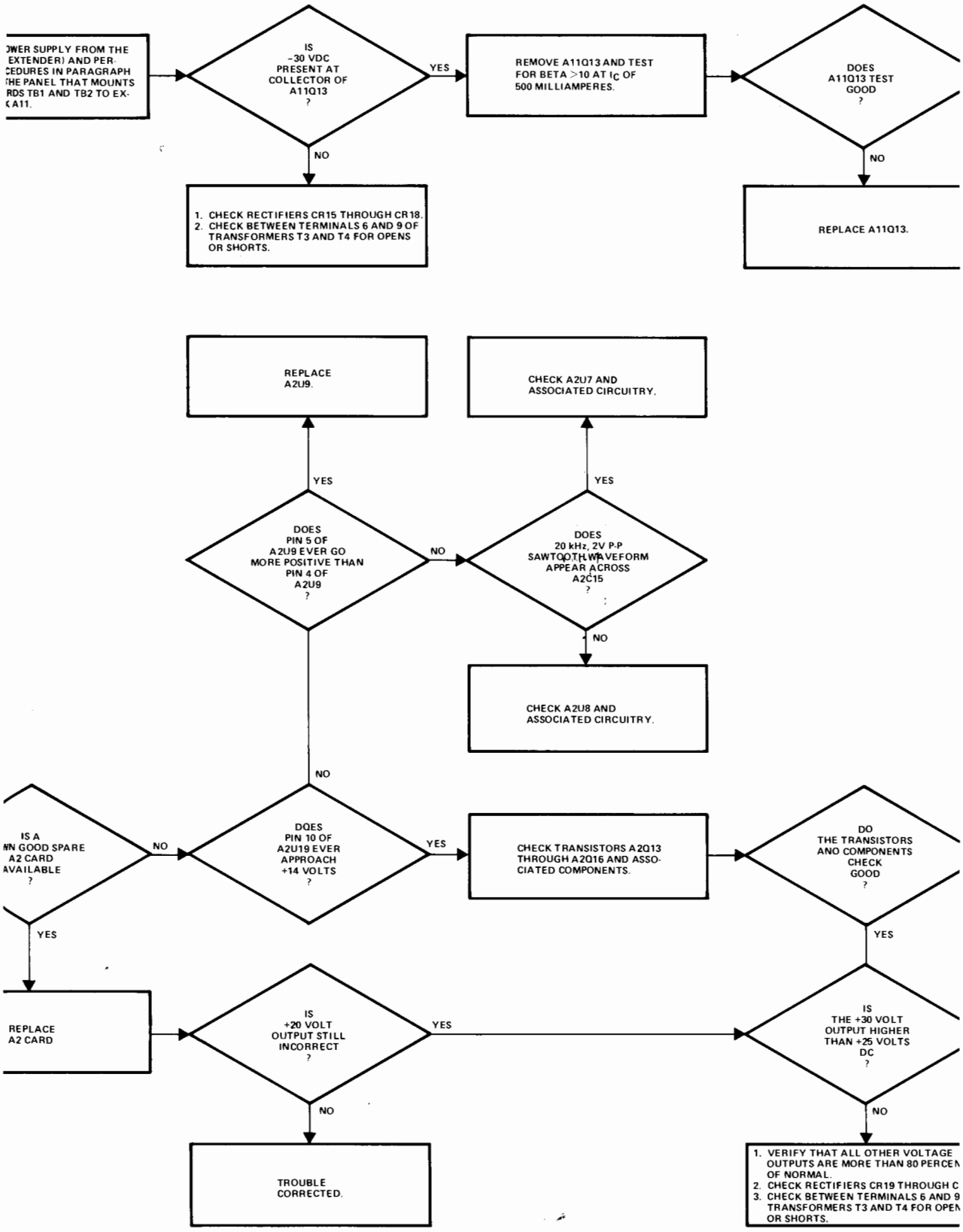
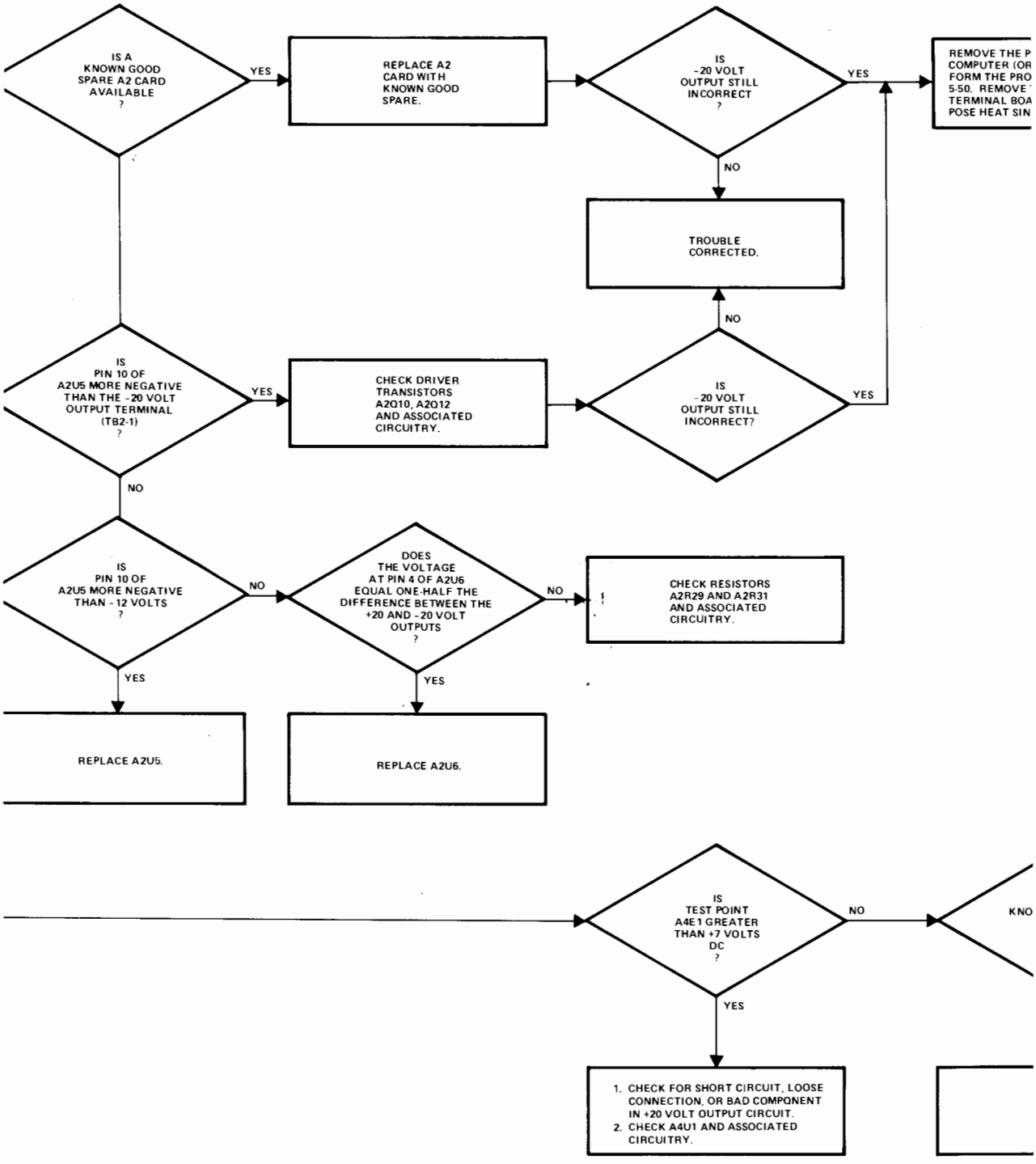
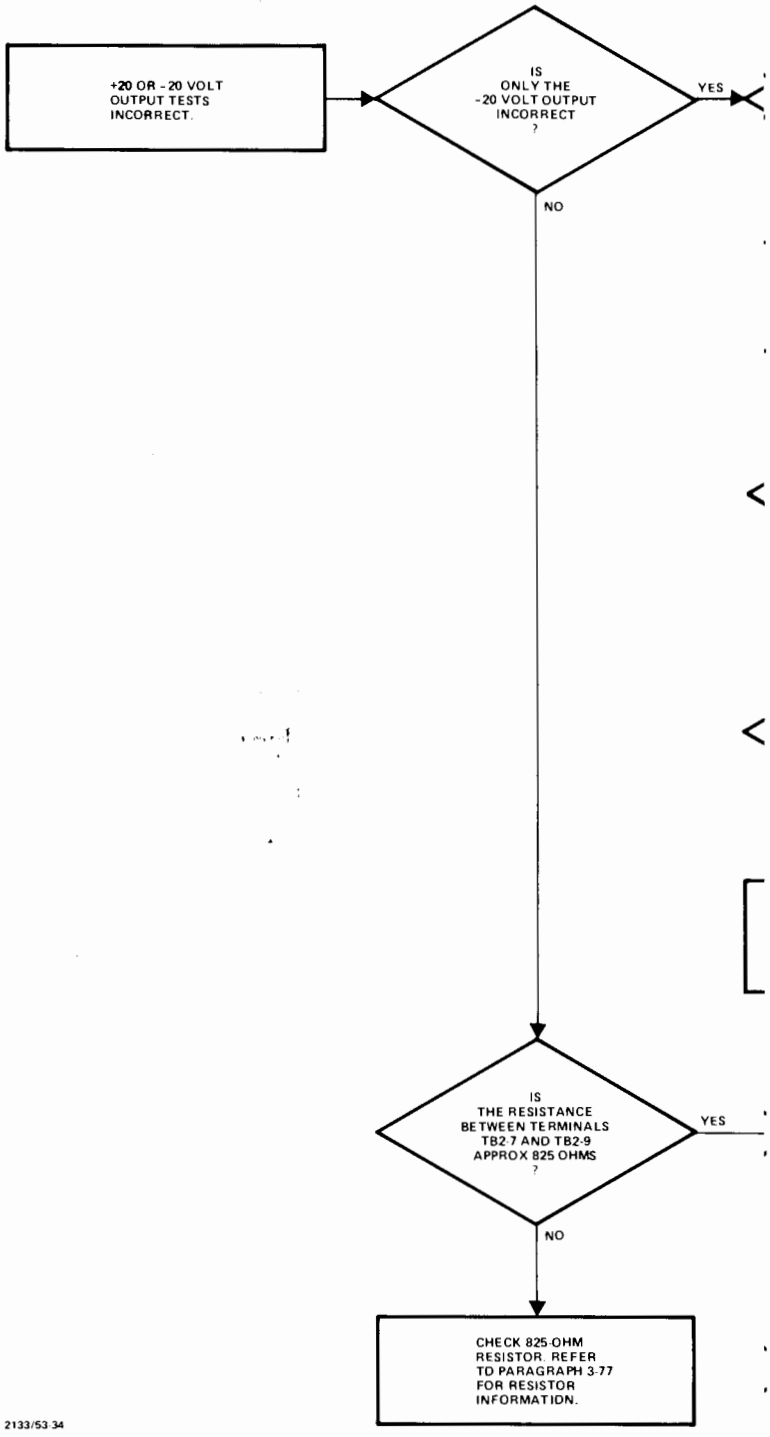


Figure 5-21. +20 and -20 Volt Output Test Troubleshooting Flowchart, Date Codes 1240 and Higher


OWER SUPPLY FROM THE EXTENDER) AND PER- CEDURES IN PARAGRAPH THE PANEL THAT MOUNTS RDS TB1 AND TB2 TO EX- A11.
IS -30 VDC PRESENT AT COLLECTOR OF A11Q13 ?
YES
NO
REMOVE A11Q13 AND TEST FOR BETA >10 AT I_C OF 500 MILLIAMPERES.
DOES A11Q13 TEST GOOD ?
NO
1. CHECK RECTIFIERS CR15 THROUGH CR18.
2. CHECK BETWEEN TERMINALS 6 AND 9 OF TRANSFORMERS T3 AND T4 FOR OPENS OR SHORTS.
REPLACE A11Q13.
REPLACE A2U9.
CHECK A2U7 AND ASSOCIATED CIRCUITRY.
YES
YES
DOES PIN 5 OF A2U9 EVER GO MORE POSITIVE THAN PIN 4 OF A2U9 ?
NO
DOES 20 kHz, 2V P-P SAWTOOTH WAVEFORM APPEAR ACROSS A2C15 ?
NO
CHECK A2U8 AND ASSOCIATED CIRCUITRY.
NO
IS A WN GOOD SPARE A2 CARD AVAILABLE ?
NO
DOES PIN 10 OF A2U19 EVER APPROACH +14 VOLTS ?
YES
CHECK TRANSISTORS A2Q13 THROUGH A2Q16 AND ASSO- CIATED COMPONENTS.
DO THE TRANSISTORS AND COMPONENTS CHECK GOOD ?
YES
YES
REPLACE A2 CARD
IS +20 VOLT OUTPUT STILL INCORRECT ?
YES
IS THE +30 VOLT OUTPUT HIGHER THAN +25 VOLTS DC ?
NO
NO
TROUBLE CORRECTED.
1. VERIFY THAT ALL OTHER VOLTAGE OUTPUTS ARE MORE THAN 80 PERCEN OF NORMAL.
2. CHECK RECTIFIERS CR19 THROUGH C
3. CHECK BETWEEN TERMINALS 6 AND 9 TRANSFORMERS T3 AND T4 FOR OPEN OR SHORTS.


IS A KNOWN GOOD SPARE A2 CARD AVAILABLE ?
YES
REPLACE A2 CARD WITH KNOWN GOOD SPARE.
IS -20 VOLT OUTPUT STILL INCORRECT ?
YES
REMOVE THE P
COMPUTER (OR
FORM THE PRO
5-50. REMOVE
TERMINAL BOA
POSE HEAT SIN
NO
TROUBLE CORRECTED.
NO
IS PIN 10 OF A2U5 MORE NEGATIVE THAN THE -20 VOLT OUTPUT TERMINAL (TB2-1) ?
YES
CHECK DRIVER TRANSISTORS A2Q10, A2Q12 AND ASSOCIATED CIRCUITRY.
IS -20 VOLT OUTPUT STILL INCORRECT?
YES
NO
IS PIN 10 OF A2U5 MORE NEGATIVE THAN -12 VOLTS ?
NO
DOES THE VOLTAGE AT PIN 4 OF A2U6 EQUAL ONE-HALF THE DIFFERENCE BETWEEN THE +20 AND -20 VOLT OUTPUTS ?
NO
CHECK RESISTORS A2R29 AND A2R31 AND ASSOCIATED CIRCUITRY.
YES
YES
REPLACE A2U5.
REPLACE A2U6.
IS TEST POINT A4E1 GREATER THAN +7 VOLTS DC ?
NO
KNO
YES
1. CHECK FOR SHORT CIRCUIT, LOOSE CONNECTION, OR BAD COMPONENT IN +20 VOLT OUTPUT CIRCUIT.
2. CHECK A4U1 AND ASSOCIATED CIRCUITRY.


+20 OR -20 VOLT OUTPUT TESTS INCORRECT.
IS ONLY THE -20 VOLT OUTPUT INCORRECT ?
YES
NO
IS THE RESISTANCE BETWEEN TERMINALS TB2-7 AND TB2-9 APPROX 825 OHMS ?
YES
NO
CHECK 825-OHM RESISTOR. REFER TO PARAGRAPH 3-77 FOR RESISTOR INFORMATION.

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REPLACEABLE PARTS

SECTION VI

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts for the power supply. Tables 6-1 through 6-10 are the replaceable parts lists for the assemblies and parts called out in figure 6-1 through 6-10. Table 6-11 is a total quantity listing of all the electrical parts in the power supply and table 6-12 is a total quantity listing of all the mechanical parts. The parts in tables 6-11 and 6-12 are listed in numerical order by part number.

6-3. A separate replaceable parts table and separate parts locations diagrams are provided for plug-in cards. These are located in Section VII of this manual, preceding the appropriate schematic diagram.

6-4. The parts tables in Section VII and tables 6-1 through 6-12 list the following information for each part:

a. Hewlett-Packard part number.

b. Description of the part. (Refer to table 6-13 for an explanation of abbreviations and reference designations used in the DESCRIPTION column.)

c. A five-digit code that corresponds to the manufacturer of the part. (Refer to table 6-14 for a listing of the manufacturers that correspond to the codes.)

d. Manufacturer's part number.

e. Total quantity of each part used in the respective assembly (tables 6-1 through 6-10).

f. Total quantity of each part used in the instrument (tables 6-11 and 6-12 only).

6-5. Items in the DESCRIPTION column of the replaceable parts lists are indented to indicate item relationships, as follows:

DESCRIPTION

MAJOR ASSEMBLY
*Subassembly
*Attaching Parts for Subassembly
**Subassembly Parts
**Attaching Parts for Subassembly Parts

6-6. ORDERING INFORMATION.

6-7. To order replacement parts, address the order or inquiry to the local Hewlett-Packard Sales and Service Office. (Refer to list at the end of this manual for addresses.) Specify the following information for each part ordered:

a. Power supply part number and date code.
b. Hewlett-Packard stock number for each part.
c. Description of each part.
d. Circuit reference designation (if applicable).

Table 6-1. Power Supply Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-	02100-60053	POWER SUPPLY ASSEMBLY	28480	02100-60053	1
1	02100-60096	* Rear Fan Panel Assembly (see figure 6-2)	28480	02100-60096	1
		(Attaching Parts)			
2	2360-0190	* Screw, Machine, flh, No. 6-32, 1/4 in.	00000	OBD	13
		— — — x — — —			
3	02100-00157	* Cover, Access, bottom	28480	02100-00157	1
		(Attaching Parts)			
4	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	8
5	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	8
		— — — x — — —			
6	♦02100-60046	* Preregulator Control Card (A1) (see figure 7-3, sheet 1) or	28480	02100-60046	1
	♦02100-60108	* Preregulator Control Card (A1) (see figure 7-4, sheet 1)	28480	02100-60108	1

NOTES: ♦ Indicates used on power supply date codes 1229 and prior.
♦ Indicates used on power supply date codes 1240 and later.

Table 6-1. Power Supply Assembly, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-					
7	02100-60058	* Inverter Driver Card (A2) (see figure 7-3, sheet 2 or figure 7-4, sheet 2)	28480	2100-60058	1
8	♦02100-60047	* Protection and Control Card (A3) (see figure 7-3, sheet 3) or	28480	02100-60047	1
	♣02100-60109	* Protection and Control Card (A3) (see figure 7-4, sheet 3)	28480	02100-60109	1
9	♦02100-60061	* Current Limit Card (A4) (see figure 7-3, sheet 4) or	28480	02100-60061	1
	♣02100-60110	* Current Limit Card (A4) (see figure 7-4, sheet 4)	28480	02100-60110	1
10	02100-0161	* Cover, Access, top	28480	02100-00161	1
		(Attaching Parts)			
11	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	12
12	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	12
		— — — x — — —			
13	02100-00164	* Cover, front	28480	02100-00164	1
		(Attaching Parts)			
14	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	6
15	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	6
		— — — x — — —			
16■	02100-60095	* Inverter Assembly (A7) (see figure 6-3)	28480	02100-60095	1
		(Attaching Parts)			
17■	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
18■	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
19■	3050-0227	* Washer, Flat, No. 6	00000	OBD	4
		— — — x — — —			
19A●	02100-60114	* Inverter Assembly (A7) (see figure 6-4)	28480	02100-60114	1
		(Attaching Parts)			
19B●	2360-0135	* Screw, Machine, ph, No. 6-32, 1-1/2 in.	00000	OBD	4
19C●	2190-0006	* Washer, Lock, split, No. 6	00000	OBD	4
19D●	3050-0228	* Washer, Flat, No. 6	00000	OBD	4
		— — — x — — —			
20■	02100-00141	* Bracket, Mounting	28480	02100-00141	2
		(Attaching Parts)			
21■	2360-0209	* Screw, Machine, flh, No. 10-32, 1 in.	00000	OBD	2
22■	0340-0089	* Grommet, plastic, 1/4 in. ID, 3/4 in. OD	28480	0340-0089	4
23■	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
24■	3050-0227	* Washer, Flat, No. 6	00000	OBD	2
25■	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		— — — x — — —			
25A●	02100-00143	* Bracket, Mounting	28480	02100-00143	2
		(Attaching Parts)			
25B●	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
25C●	2190-0006	* Washer, Lock, split, No. 6	00000	OBD	2
25D●	2420-0002	* Nut, Plain, Hexagon, No. 6	00000	OBD	2
		— — — x — — —			
26	02100-60094	* +160 Volt Output Assembly (A5) (see figure 6-5)	28480	02100-60094	1
		(Attaching Parts)			
27	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
28	2190-0851	* Washer, Lock, No. 6	00000	OBD	4
29	3050-0227	* Washer, Flat, No. 6	00000	OBD	4
		— — — x — — —			
30	02100-00142	* Bracket, Mounting	28480	02100-00142	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		— — — x — — —			
31	02100-00143	* Bracket, Mounting	28480	02100-00143	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		— — — x — — —			
32	02100-60097	* Preregulator Assembly (A6) (see figure 6-6)	28480	02100-60097	1
		(Attaching Parts)			
33	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
34	3050-0227	* Washer, Lock, split, No. 6	00000	OBD	4
35	2190-0851	* Washer, Flat, No. 6	00000	OBD	4
		— — — x — — —			

NOTES: ♦ Indicates used on power supply date codes 1229 and prior. ■ Indicates used on power supply date codes 1250 and prior.
♣ Indicates used on power supply date codes 1240 and later. ● Indicates used on power supply date codes 1314 and later.

Table 6-1. Power Supply Assembly, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-					
36	02100-00142	* Bracket, Mounting	28480	02100-00142	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		– – – x – – –			
37	02100-00143	* Bracket, Mounting	28480	02100-00143	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		– – – x – – –			
38	1901-0164	* Diode, Si, 200 PIV, 3A	04713	1N4721	4
	02100-60117#	* Terminal Board and Bracket Assembly	28480	02100-60117	1
		(Attaching Parts)			
39	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
40	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
		– – – x – – –			
41	0360-0563##	** Terminal Board (TB3)	28480	0360-0563	2
42	5020-0241	** Bracket	28480	5020-0241	2
43	02100-00148	* Bus Bar	28480	02100-00148	2
		(Attaching Parts)			
	2680-0099	* Screw, Machine, ph, No. 10-32, 1/4 in.	00000	OBD	2
	2190-0077	* Washer, Lock, split, No. 10	00000	OBD	2
		– – – x – – –			
44	2360-0201	* Screw, Machine, ph, No. 6-32, 1/2 in.	00000	OBD	2
45	0590-0077	* Nut, Self-Locking, Hexagon, No. 6-32	00000	OBD	2
46	0180-2417	* Capacitor, Fxd, Elect, 430 mF, –10 +50%, 200 VDCW (C19, C20)	14659	36D431F200AB2A	2
47	9100-2921	* Transformer, 8 mH (T6)	28480	9100-2921	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
		– – – x – – –			
48	9100-2922	* Transformer, Control (T5)	28480	9100-2922	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		– – – x – – –			
49	9100-2920	* Inductor, Choke, 1.6 mH (L9)	28480	9100-2920	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		– – – x – – –			
50	9100-2923	* Transformer, Inverter (T3, T4)	28480	9100-2923	2
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	4
		– – – x – – –			
	02100-60093	* Output Junction Assembly	28480	02100-60093	1
		(Attaching Parts)			
51	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
52	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
53	3050-0227	* Washer, Flat, No. 6	00000	OBD	4
		– – – x – – –			

NOTES: # Part no. 02100-60117 replaces 02100-60064.
Part no. 0360-0563 replaces 5020-0096.

Table 6-1. Power Supply Assembly, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-					
54	0360-1128	** Terminal Board (TB1)	71785	353-11-09-001	1
		(Attaching Parts)			
55	2360-0197	** Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
56	2190-0851	** Washer, Lock, split, No. 6	00000	OBD	2
57	3050-0227	** Washer, Flat, No. 6	00000	OBD	2
		– – – x – – –			
58	0360-1128	** Terminal Board (TB2)	28480	0360-1128	1
	0360-0578	** Strip Marker, Terminal	28480	0360-0578	1
		(Attaching Parts)			
59	2360-0203	** Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
60	2190-0851	** Washer, Lock, split, No. 6	00000	OBD	2
61	3050-0227	** Washer, Flat, No. 6	00000	OBD	2
		– – – x – – –			
62	No Number	** Output Crowbar Assembly (A10) (see figure 6-7)			1
		(Attaching Parts)			
63	2360-0196	** Screw, Machine, flh, No. 6-32, 3/8 in.	00000	OBD	1
64	2360-0197	** Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
65	2190-0851	** Washer, Lock, split, No. 6	00000	OBD	1
		– – – x – – –			
66	No Number	** ±20 Volt Regulator Assembly (A11) (see figure 6-8)			1
		(Attaching Parts)			
67	2190-0851	** Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
68	3050-0227	** Washer, Lock, split, No. 6	00000	OBD	2
		– – – x – – –			
69	05210-4001	** Guide, Printed-Circuit	28480	05210-4001	1
		(Attaching Parts)			
70	2360-0209	** Screw, Machine, ph, No. 6-32, 1 in.	00000	OBD	2
71	0380-0010	** Spacer, Sleeve, 1/4 in. OD, 5/8 in. long	28480	0380-0010	2
72	2420-0003	** Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		– – – x – – –			
73	02100-00156	** Plate, Terminal Board Mounting	28480	02100-00156	1
74	02100-60098	* +4.85 Volt Rectifier Assembly (A9) (see figure 6-9)	28480	02100-60098	1
		(Attaching Parts)			
75	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
76	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
77	3050-0227	* Washer, Flat, No. 6	00000	OBD	4
		– – – x – – –			
78	0380-0091	* Spacer, Hexagon, int-thread, No. 6-32, 3/4 in. long	28480	0380-0091	4
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	3050-0227	* Washer, Flat, No. 6	00000	OBD	2
		– – – x – – –			
79	02100-60099	* Rectifier Assembly (A8) (see figure 6-10)	28480	02100-60099	1
		(Attaching Parts)			
80	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	4
81	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	4
82	3050-0227	* Washer, Flat, No. 6	00000	OBD	4
		– – – x – – –			
83	02100-00143	* Bracket, Mounting	28480	02100-00143	2
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	3050-0227	* Washer, Flat, No. 6	00000	OBD	2
		– – – x – – –			
84▲	9100-2918	* Inductor, 8 uH (L7)	28480	9100-2918	1
		(Attaching Parts)			
85▲	2360-0133	* Screw, Machine, flh, No. 4-40, 1-1/4 in.	00000	OBD	1
86▲	3050-0760	* Plate, Electrical Shield, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0760	2
87▲	3050-0761	* Insulator, Neoprene, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0761	2
88▲	2190-0003	* Washer, Lock, split, No. 4	00000	OBD	1
89▲	2260-0001	* Nut, Plain, Hexagon, No. 4-40	00000	OBD	1
		– – – x – – –			

Table 6-1. Power Supply Assembly, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-					
89A★	9100-2932	* Inductor, 8 uH (L7)	28480	9100-2932	1
		(Attaching Parts)			
89B★	2680-0100	* Screw, Machine, flh, No. 10-32, 3/8 in.	00000	OBD	1
		– – – x – – –			
90▲	9100-2919	* Inductor, 9 uH (L8)	28480	9100-2919	1
		(Attaching Parts)			
91▲	2200-0155	* Screw, Machine, ph, No. 4-40, 1 in.	00000	OBD	1
92▲	3050-0760	* Plate, Electrical Shield, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0760	2
93▲	3050-0761	* Insulator, Neoprene, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0761	2
94▲	2190-0003	* Washer, Lock, split, No. 4	00000	OBD	1
95▲	2260-0001	* Nut, Plain, Hexagon, No. 4-40	00000	OBD	1
		– – – x – – –			
95A★	9100-2933	* Inductor, 9 uH (L8)	28480	9100-2933	1
		(Attaching Parts)			
95B★	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
95C★	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
		– – – x – – –			
96	02100-20052	* Standoff, ceramic	28480	02100-20052	1
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
		– – – x – – –			
97▲	9100-2917	* Inductor, 50 uH (L6)	28480	9100-2917	1
		(Attaching Parts)			
98▲	2200-0155	* Screw, Machine, flh, No. 4-40, 1 in.	00000	OBD	1
99▲	3050-0760	* Plate, Electrical Shield, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0760	2
100▲	3050-0761	* Insulator, Neoprene, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0761	2
101▲	2190-0003	* Washer, Lock, split, No. 4	00000	OBD	1
102▲	2260-0001	* Nut, Plain, Hexagon, No. 4-40	00000	OBD	1
		– – – x – – –			
102A★	9100-2931	* Inductor, 50 uH (L6)	28480	9100-2931	1
		(Attaching Parts)			
102B★	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
102C★	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
		– – – x – – –			
103▲	9100-2917	* Inductor, 50 uH (L5)	28480	9100-2917	1
		(Attaching Parts)			
104▲	2200-0155	* Screw, Machine, ph, No. 4-40, 1 in.	00000	OBD	1
105▲	3050-0760	* Plate, Electrical Shield, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0760	2
106▲	3050-0761	* Insulator, Neoprene, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0761	2
107▲	2190-0003	* Washer, Lock, split, No. 4	00000	OBD	1
108▲	2260-0001	* Nut, Plain, Hexagon, No. 4-40	00000	OBD	1
		– – – x – – –			
108A★	9100-2931	* Inductor, 50 uH (L5)	28480	9100-2931	1
		(Attaching Parts)			
108B★	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
108C★	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
		– – – x – – –			
109	02100-00153	* Strap, Bus Bar	28480	02100-00153	1
		(Attaching Parts)			
110	3030-0248	* Setscrew, Socket Head, No. 10-32, 3/4 in.	00000	OBD	1
111	2190-0077	* Washer, Lock, split, No. 10	00000	OBD	3
112	2740-0002	* Nut, Plain, Hexagon, No. 10-32	00000	OBD	1
113	2680-0099	* Screw, Machine, ph, No. 10-32, 3/8 in.	00000	OBD	2
114	2680-0128	* Screw, Machine, ph, No. 10-32, 1/4 in.	00000	OBD	1
115	2190-0074	* Washer, Lock, split, No. 10	00000	OBD	1
		– – – x – – –			

NOTES: ▲ Indicates non-encapsulated inductors and attaching parts used on original equipment. Replace with same part numbers.
★ Indicates encapsulated inductors and attaching parts used on later equipment. Replace with same part numbers.

Table 6-1. Power Supply Assembly, Replaceable Parts (Continued)

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-1-					
116	02100-00149	* Bus Bar	28480	02100-00149	1
		(Attaching Parts)			
117	3030-0248	* Setscrew, Socket Head, No. 10-32, 3/4 in.	00000	OBD	1
118	2190-0077	* Washer, Lock, split, No. 10	00000	OBD	3
119	2740-0002	* Nut, Plain, Hexagon, No. 10-32	00000	OBD	1
120	2680-0099	* Screw, Machine, ph, No. 10-32, 3/8 in.	00000	OBD	2
121	2680-0128	* Screw, Machine, ph, No. 10-32, 1/4 in.	00000	OBD	1
122	2190-0074	* Washer, Lock, split, No. 10	00000	OBD	1
		- - - x - - -			
123	02100-00152	* Terminal Strip, Grounding	28480	02100-00152	1
		(Attaching Parts)			
124	2360-0200	* Screw, Machine, flh, No. 6-32, 1/4 in.	00000	OBD	2
125	02100-00151	* Insulator, Sheet, electrical	28480	02100-00151	1
126	3050-0249	* Washer, Insulating, shoulder, 3/8 in. OD, 1/8 in. thick	28480	3050-0249	4
127	3050-0227	* Washer, Flat, No. 6	00000	OBD	2
128	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
129	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		- - - x - - -			
130	2680-0099	* Screw, Machine, ph, No. 10-32, 1/4 in.	00000	OBD	1
131	2190-0077	* Washer, Lock, split, No. 10	00000	OBD	1
132	0180-2412	* Capacitor, Fxd, Elect, 37000 mF, -10 +75%, 5VDCW (C25)	14659	60D20D373G5R0AF2A	1
133	2740-0002	* Nut, Plain, Hexagon, No. 10-32	00000	OBD	1
134	2190-0077	* Washer, Lock, split, No. 10	00000	OBD	1
135	3030-0248	* Setscrew, Socket Head, No. 10-32, 3/4 in.	00000	OBD	1
136	0180-2411	* Capacitor, Fxd, Elect, 22000 uF, -10+75%, 10 VDCW (C24)	14659	602D223G010AF2A	1
137	2680-0099	* Screw, Machine, ph, No. 10-32, 3/8 in.	00000	OBD	1
138	2190-0077	* Washer, Lock, split, No. 10	00000	OBD	1
139	0180-2416	* Capacitor, Fxd, Elect, 9900 uF, -10+75%, 30 VDCW (C16)	14659	602D992G030AF2A	1
140	3030-0248	* Setscrew, Socket Head, No. 10-32, 3/4 in.	00000	OBD	1
141	2680-0099	* Screw, Machine, ph, No. 10-32, 3/8 in.	00000	OBD	1
142	2190-0077	* Washer, Lock, split, No. 10	00000	OBD	2
143	2740-0002	* Nut, Plain, Hexagon, No. 10-32	00000	OBD	1
144	0180-2410	* Capacitor, Fxd, Elect, 18000 uF, -10+75%, 15 VDCW (C23,C26)	14659	602D183G015AF2A	2
145	3030-0248	* Setscrew, Socket Head, No. 10-32, 3/4 in.	00000	OBD	1
146	2740-0002	* Nut, Plain, Hexagon, No. 10-32	00000	OBD	1
147	2190-0077	* Washer, Lock, split, No. 10	00000	OBD	1
148	0180-2413	* Capacitor, Fxd, Elect, 7500 uF, -10+75%, 15 VDCW (C21)	14659	36D752G015AA2A	1
149	3030-0248	* Setscrew, Socket Head, No. 10-32, 3/4 in.	00000	OBD	1
150	2740-0002	* Nut, Plain, Hexagon, No. 10-32	00000	OBD	1
151	2190-0077	* Washer, Lock, split, No. 10	00000	OBD	2
152	2680-0099	* Screw, Machine, ph, No. 10-32, 3/8 in.	00000	OBD	1
153	0180-2414	* Capacitor, Fxd, Elect, 2900 uF, -10+75%, 40 VDCW (C22)	14659	36D292G040AA2A	1
154	1251-0233	* PC Card Connector, 44 Contact	76530	251-22-30-261	4
		(Attaching Parts)			
	2360-0203	* Screw, Machine, ph, No. 6-32, 1/2 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	3050-0010	* Washer, Flat, No. 6	00000	OBD	2
		- - - x - - -			
155	02100-20045	* Mounting Block, PC Connector	28480	02100-20045	2
		(Attaching Parts)			
	2360-0203	* Screw, Machine, ph, No. 6-32, 1/2 in.	00000	OBD	1
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
		- - - x - - -			
156	02100-00146	* Panel, left side	28480	02100-00146	1
		(Attaching Parts)			
157	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	3
158	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	3
		- - - x - - -			
159	02100-00145	* Panel, right side	28480	02100-00145	1
		(Attaching Parts)			
160	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	3
161	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	3
		- - - x - - -			
162	02100-00167	* Pad, foam rubber, 2-3/4 in. long, 2-3/4 in. wide	28480	02100-00167	2
163	02100-00144	* Plate, Mounting	28480	02100-00144	1

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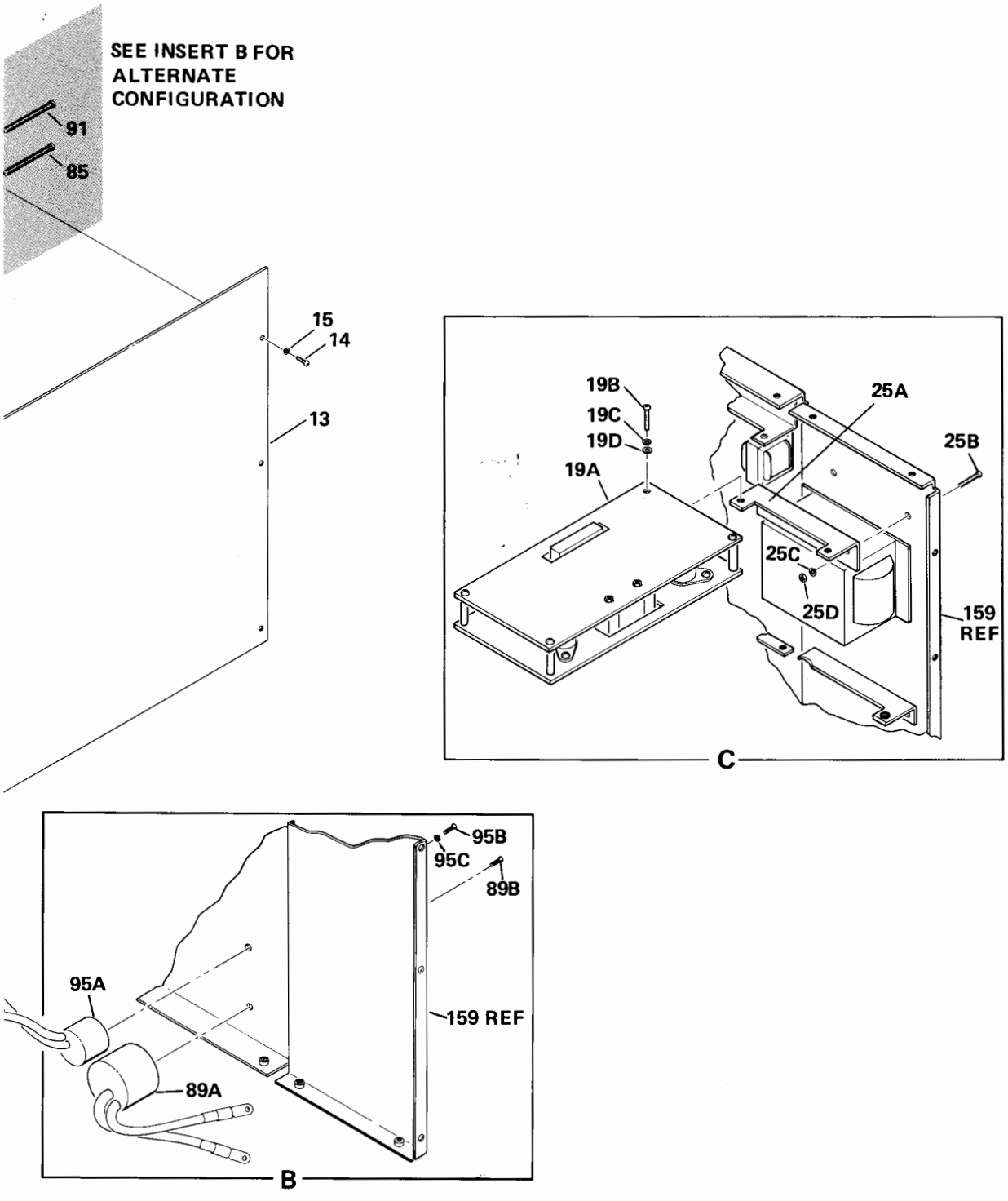
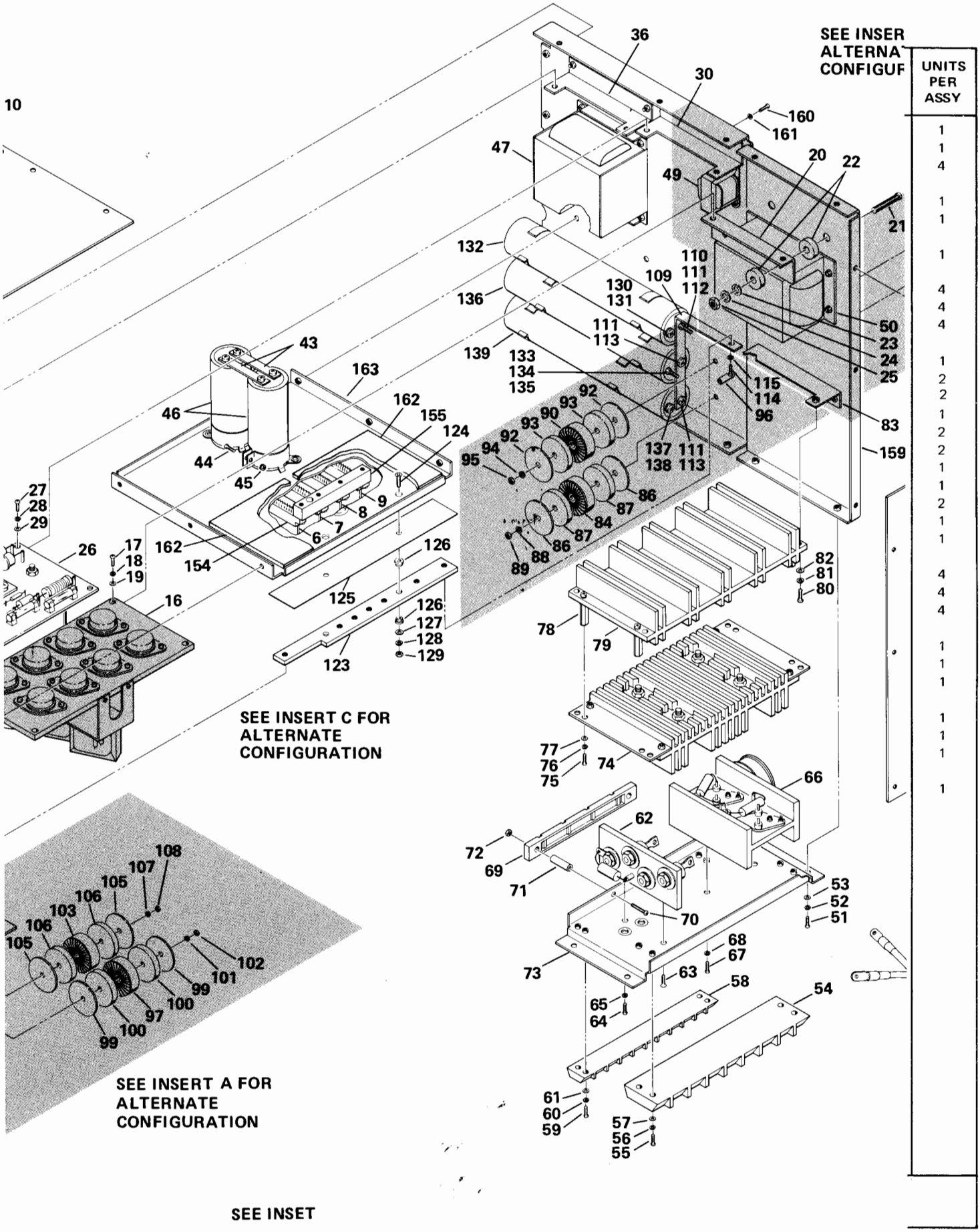


Figure 6-1. Power Supply Assembly, Exploded View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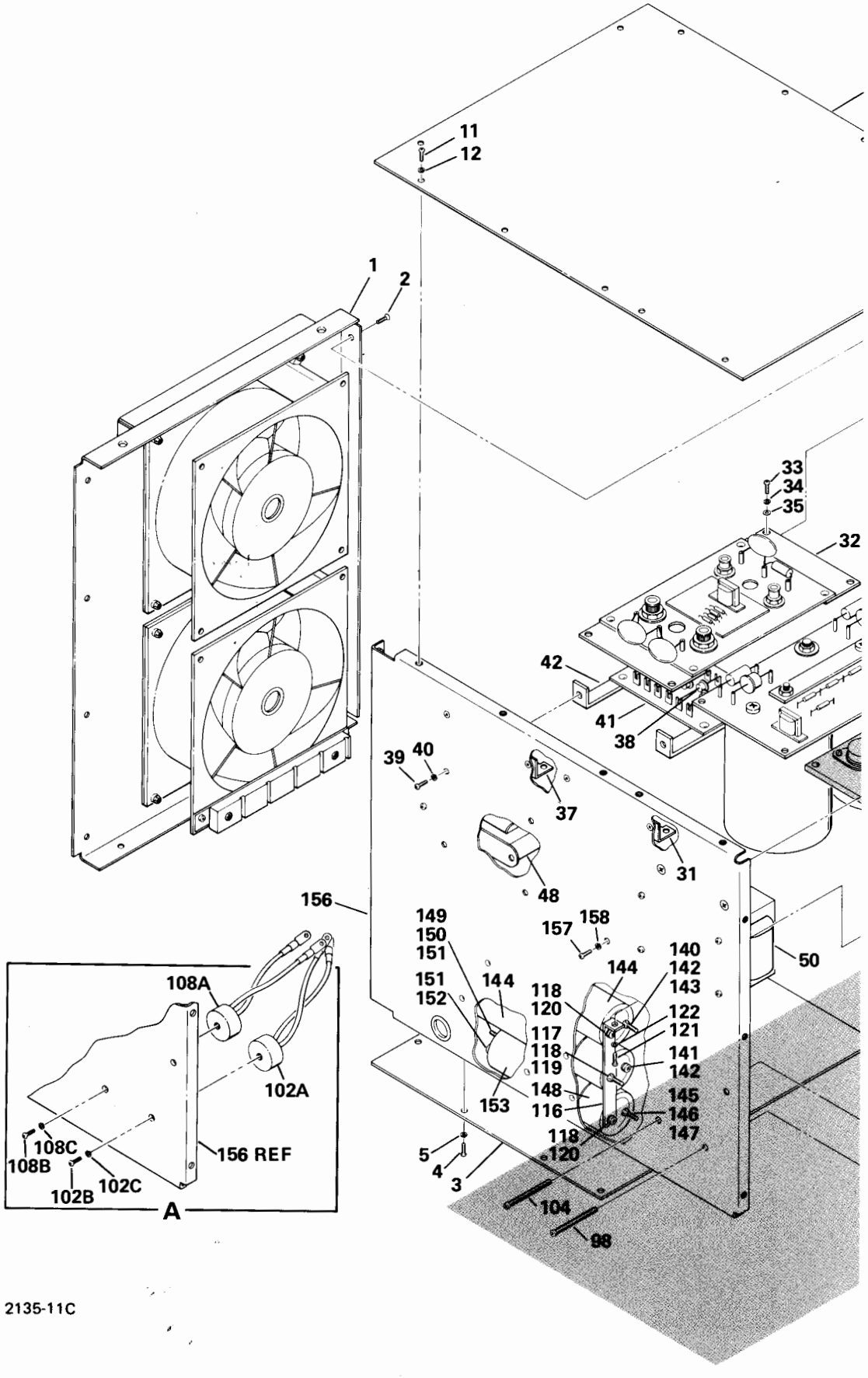
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102C
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Table 6-2. Rear Fan Panel Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-2-	02100-60096	REAR FAN PANEL ASSEMBLY (1, figure 6-1)	28480	02100-60096	1
1	02100-00021	* Filter, rear	28480	02100-00021	1
2	1251-0013	** Fastener, Spring Tension, Trim	78947	152239	4
		(Attaching Parts)			
3	2190-0006	** Washer, Lock, split, No. 6	00000	OBD	1
4	0570-1029	** Stud, threaded, 1/4 in. long	00000	OBD	1
		– – – x – – –			
5	3160-0224	* Fan, Tubeaxial (B1)	28480	3160-0224	1
		(Attaching Parts)			
	2360-0205	* Screw, Machine, ph, No. 6-32, 3/4 in.	00000	OBD	4
	2190-0006	* Washer, Lock, split, No. 6	00000	OBD	4
	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	4
		– – – x – – –			
6	5000-8015	* Guard, Fan	28480	5000-8015	1
7	2420-0001	* Nut, Assembled Washer, No. 6-32	00000	OBD	2
7A	3050-0228	* Washer, flat, No. 6	00000	OBD	2
8	2360-0205	* Screw, Machine, ph, No. 6-32, 3/4 in.	00000	OBD	1
9	2360-0196	* Screw, Machine, flh, No. 6-32, 3/8 in.	00000	OBD	2
10	2420-0003	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
11	05210-4001	* Guide, Printed-Circuit	28480	05210-4001	1
12	2360-0204	* Screw, Machine, flh, No. 6-32, 3/4 in.	00000	OBD	1
12A	3050-0228	* Washer, flat, No. 6	00000	OBD	2
13	02100-00154	* Bracket, Printed-Circuit Guide	28480	02100-00154	1
14	3160-0224	* Fan, Tubeaxial (B2)	28480	3160-0224	1
		(Attaching Parts)			
15■	2360-0205	* Screw, Machine, ph, No. 6-32, 3/4 in.	00000	OBD	4
16■	2190-0006	* Washer, Lock, split, No. 6	00000	OBD	4
17■	2420-0002	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	4
		– – – x – – –			
18	5000-8015	* Guard, Fan	28480	5000-8015	1
19	2110-0004	* Fuse, 1/4A, 250V (F5)	75915	3AC/CAT.312.250	1
20	1400-0084	* Fuseholder (XF5)	75915	34204	1
		(Attaching Parts)			
21	2950-0038	* Nut, Plain, Hexagon, No. 5-24, 11/16 in. OD	00000	OBD	1
22	2190-0068	* Washer, Lock, int-tooth	00000	OBD	1
23	1400-0090	* Gasket, Neoprene, 5/8 in. OD	00000	OBD	1
		– – – x – – –			
24	02100-00147	* Panel, rear fan	28480	02100-00147	1

NOTE: ■ Items 15, 16, and 17 may be replaced by a tapping screw, No. 8-32, 3/4 in.

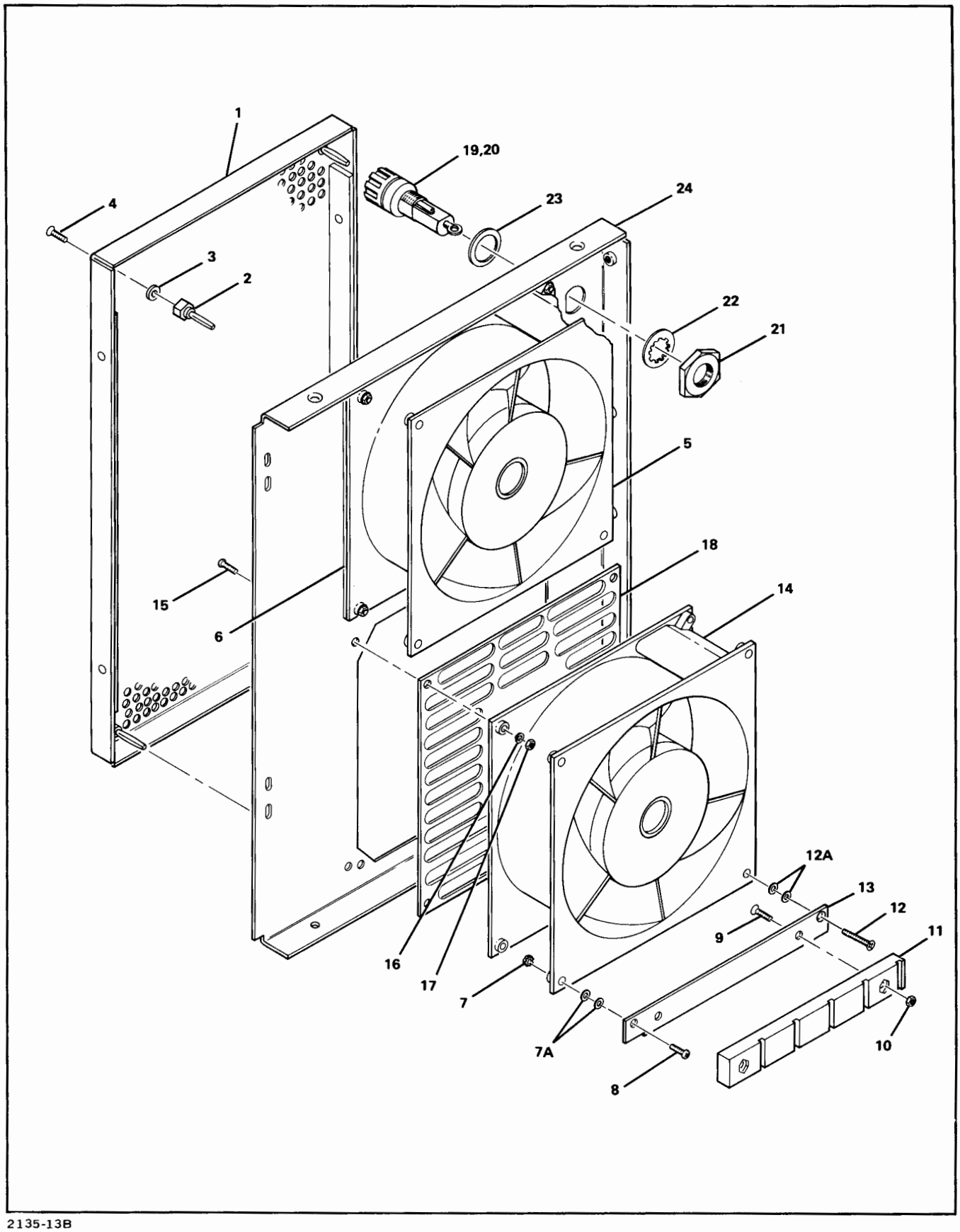
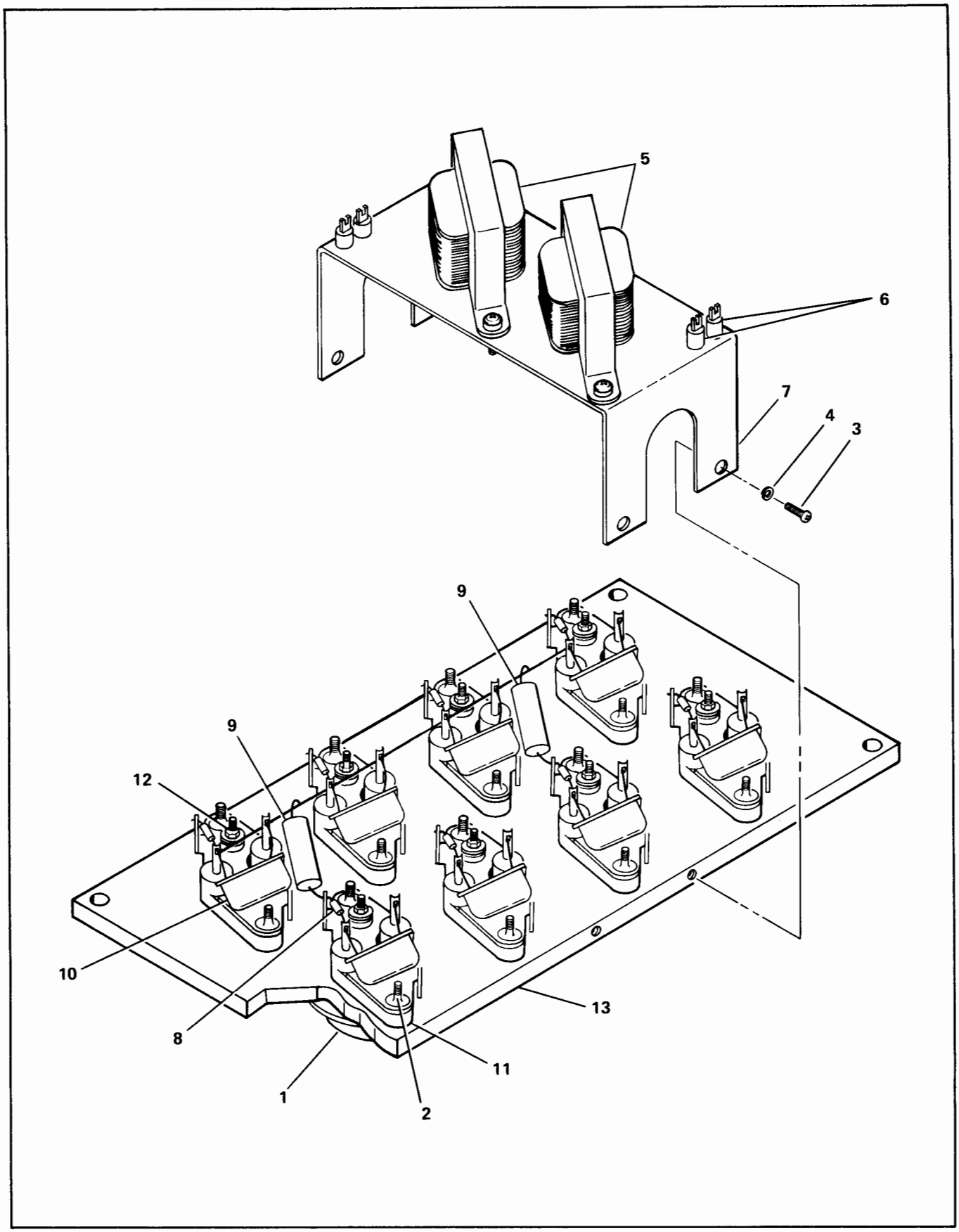


Figure 6-2. Rear Fan Panel Assembly, Exploded View

Table 6-3. Inverter Assembly (02100-60095), Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-3-	02100-60095	INVERTER ASSEMBLY (A7) (16, figure 6-1)		02100-60095	1
1	1854-0080	* Transistor, Si, NPN (Q3 thru Q10)	28480	1854-0080	8
		(Attaching Parts)			
2	2360-0205	* Screw, Machine, ph, No. 6-32, 3/4 in.	71785	293011	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	1200-0043	* Insulator, Transistor Mounting	00000	OBD	1
		– – – x – – –			
3	2200-0143	* Screw, Machine, ph, No. 4-40, 3/8 in.	00000	OBD	4
4	2190-0003	* Washer, Lock, split, No. 4	00000	OBD	4
5	9100-2924	* Transformer, Pulse (T1,T2)	28480	9100-2924	2
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
		– – – x – – –			
6	0340-0078	* Insulator, Standoff	83330	93-2001	2
7	02100-00155	* Bracket, Angle	28480	02100-00155	1
8	1901-1065	* Diode, Si (CR3 thru CR10)	04713	1N4936	8
9	0160-0303	* Capacitor, Fxd, My, 0.15 uF, 10%, 200 VDCW (C12,C13)	28480	0160-0303	2
10	0160-0174	* Capacitor, Fxd, Cer, 0.47 uF, +80 –20%, 25 VDCW	26289	5C11B7S-CML	8
		(C4 thru C11)			
11	1200-0452	* Socket, Transistor (XQ3 thru XQ10)	91506	8080-1G1	8
		(Attaching Parts)			
12	2200-0149	* Screw, Machine, ph, No. 4-40, 5/8 in.	00000	OBD	1
	2190-0003	* Washer, Lock, split, No. 4	00000	OBD	1
	3050-0229	* Washer, Flat, No. 4	00000	OBD	1
	2260-0002	* Nut, Plain, Hexagon, No. 4-40	00000	OBD	1
		– – – x – – –			
13	02100-20048	* Heat Sink	28480	02100-20048	1

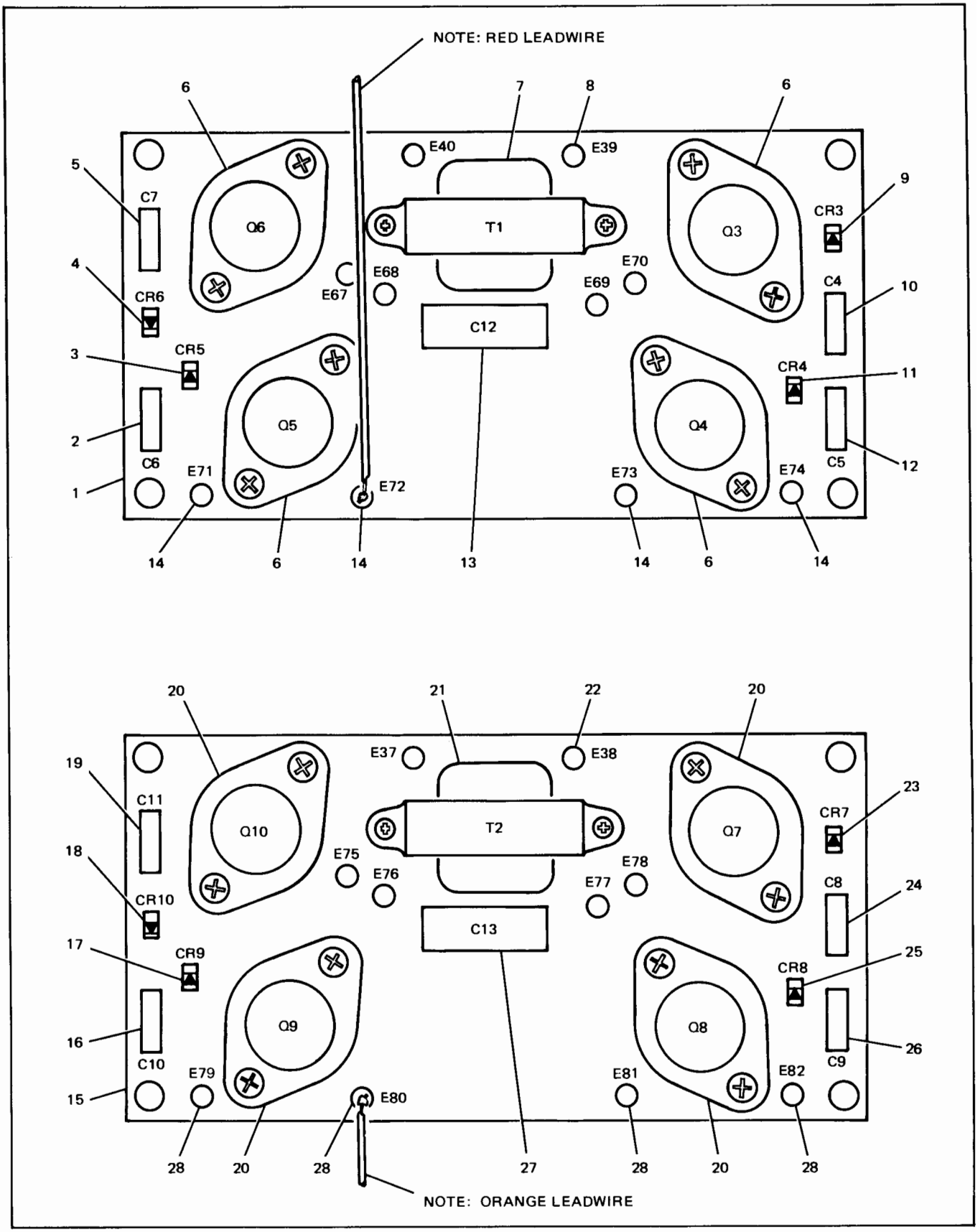


2135-4A

Figure 6-3. Inverter Assembly (02100-60095), Exploded View

Table 6-4. Inverter Assembly (02100-60114), Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-4-	02100-60114	Inverter Assembly (A7) (19A figure 6-1)	28480	02100-60114	1
1	02100-60113	* Inverter Board Assembly	28480	02100-60113	1
2	0160-0174	* * Capacitor, Fxd, Cer, 0.47 μF, +80 -20%, 25 VDCW (C6)	56289	SC11B7S-CML	1
3	1901-1065	* * Diode 1N4936 (CR5)	28480	1901-1065	1
4	1901-1065	* * Diode 1N4936 (CR6)	28480	1901-1065	1
5	0160-0174	* * Capacitor, Fxd, Cer, 0.47 μF, +80 -20%, 25 VDCW (C7)	56289	SC11B7S-CML	1
6	1854-0080	* * Transistor, Si, NPN (Q3, Q4, Q5, Q6)	28480	1854-0080	4
		(Attaching Parts)			
	2360-0115	* * Screw, Machine, ph, No. 6-32, 5/16 in.	00000	OBD	2
	2190-0851	* * Washer, Lock, split, No. 6	00000	OBD	2
		- - - x - - -			
7	9100-2924	* * Transformer, Pulse (T1)	28480	9100-2924	1
		(Attaching Parts)			
	2360-0115	* * Screw, Machine, ph, No. 6-32, 5/16 in.	00000	OBD	2
	3050-0228	* * Washer, Flat, No. 6	00000	OBD	2
	2420-0001	* * Nut, assembled washer, hexagon, No. 6	00000	OBD	2
		- - - x - - -			
8	0360-1149	* * Terminal, solder (E39, E40, E67, E68, E69, E70)	28480	0360-1149	6
9	1901-1065	* * Diode 1N4936 (CR3)	28480	1901-1065	1
10	0160-0174	* * Capacitor, Fxd, Cer, 0.47 μF, +80 -20%, 25 VDCW (C4)	56289	SC11B7S-CML	1
11	1901-1065	* * Diode 1N4936 (CR4)	28480	1901-1065	1
12	0160-0174	* * Capacitor, Fxd, Cer, 0.47 μF, +80 -20%, 25 VDCW (C5)	56289	SC11B7S-CML	1
13	0160-0303	* * Capacitor, Fxd, My, 0.15 μF, 10%, 200 VDCW (C12)	28480	0160-0303	1
14	0360-0295	* * Terminal, Solder (E71, E72, E73, E74)	28480	0360-0295	4
15	02100-60113	* Inverter Board Assembly	28480	02100-60113	1
16	0160-0174	* * Capacitor, Fxd, Cer, 0.47 μF, +80 -20%, 25 VDCW (C10)	56289	SC11B7S-CML	1
17	1901-1065	* * Diode 1N4936 (CR9)	28480	1901-1065	1
18	1901-1065	* * Diode 1N4936 (CR10)	28480	1901-1065	1
19	0160-0174	* * Capacitor, Fxd, Cer, 0.47 μF, +80 -20%, 25 VDCW (C11)	56289	SC11B7S-CML	1
20	1854-0080	* * Transistor, Si, NPN (Q7, Q8, Q9, Q10)	28480	1854-0080	4
		(Attaching Parts)			
	2360-0115	* * Screw, Machine, ph, No. 6-32, 5/16 in.	00000	OBD	2
	2190-0851	* * Washer, Lock, split, No. 6	00000	OBD	2
		- - - x - - -			
21	9100-2924	* * Transformer, Pulse (T2)	28480	9100-2924	1
		(Attaching Parts)			
	2360-0115	* * Screw, Machine, ph, No. 6-32, 5/16 in.	00000	OBD	2
	3050-0228	* * Washer, Flat, No. 6	00000	OBD	2
	2420-0001	* * Nut, assembled washer, hexagon, No. 6	00000	OBD	2
		- - - x - - -			
22	0360-1149	* * Terminal, Solder (E37, E38, E75, E76, E77, E78)	28480	0360-1149	6
23	1901-1065	* * Diode 1N4936 (CR7)	28480	1901-1065	1
24	0160-0174	* * Capacitor, Fxd, Cer, 0.47 μF, +80 -20%, 25 VDCW (C8)	56289	SC11B7S-CML	1
25	1901-1065	* * Diode 1N4936 (CR8)	28480	1901-1065	1
26	0160-0174	* * Capacitor, Fxd, Cer, 0.47 μF, +80 -20%, 25 VDCW (C9)	56289	SC11B7S-CML	1
27	0160-0303	* * Capacitor, Fxd, My, 0.15 μF, 10%, 200 VDCW (C13)	28480	0160-0303	1
28	0360-0295	* * Terminal, Solder (E79, E80, E81, E82)	28480	0360-0295	4



2135-100

Figure 6-4. Inverter Assembly (02100-60114), Exploded View

Table 6-5. +160 Volt Output Board, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-5-	02100-60094	+160 VOLT OUTPUT BOARD (A5) (26, figure 6-1)	28480	02100-60094	1
1	2110-0083	* Fuse, 2-1/2A, 250V, 3AG (F1,F2)	28480	2110-0083	2
2	0180-2418	* Capacitor, Fxd, Elect, 9800 uF, -10 +75%, 100 VDCW (C17,C18)	14659	36D982G100CC2A	2
		(Attaching Parts)			
	3030-0248	* Setscrew, Socket Head, No. 10-32, 3/4 in.	00000	OBD	1
	2740-0002	* Nut, Plain, Hexagon, No. 10-32	00000	OBD	1
	2680-0103	* Screw, Machine, ph, No. 10-32, 1/2 in.	00000	OBD	1
	2190-0034	* Washer, Lock, split, No. 10	00000	OBD	2
		- - - x - - -			
3	02100-00165	* Bus Bar	28480	02100-00165	1
	02100-60048	* Capacitor Board Assembly	28480	02100-60048	1
4	1884-0219	** Thyristor, scr, IF, 20A, 600V (Q1)	86684	2N3899	1
		(Attaching Parts)			
	2950-0036	** Nut, Plain, Hexagon, 1/4-28	00000	OBD	1
	0360-0040	** Terminal, Lug, 1/4 in. ID	00000	OBD	1
	3050-0225	** Washer, Flat, 1/4 in. ID	00000	OBD	1
		- - - x - - -			
5	9100-2927	** Transformer, Pulse (T1)	28480	9100-2927	1
		(Attaching Parts)			
	2200-0143	** Screw, Machine, ph, No. 4-40, 3/8 in.	00000	OBD	2
	2050-0229	** Washer, Flat, No. 4	00000	OBD	2
	2190-0004	** Washer, Lock, int-tooth, No. 4	00000	OBD	2
	2260-0001	** Nut, Plain, Hexagon, No. 4-40	00000	OBD	2
		- - - x - - -			
6	0764-0018	** Resistor, Fxd, Met Flm, 4700 ohms, 5%, 2W (R1,R2)	28480	0764-0018	2
7	1901-0164	** Diode, Si, 200 PIV, 3A (CR1, CR2)	04713	1N4721	2
8	0811-3108	** Resistor, Fxd, WW, 2.0 ohms, 10% (R7)	20940	R7-100	1
9	1902-3416	** Diode, Breakdown, 90.9V 5%, 400 mW (CR3,CR4) (used on card rev. 1125 only)	07910	CD35982	2
	1902-3428	** Diode, Breakdown, 100V, 5%, 400 mW (CR3,CR4) (first used on card rev. 1139)	07910	CD35994	2
10	0757-0316	** Resistor, Fxd, Met Flm, 4.2 ohms, 1%, 1/8W (R4,R6)	28480	0757-0316	2
11	0757-0284	** Resistor, Fxd, Met Flm, 150 ohms, 1%, 1/8W (R3)	28480	0757-0284	1
12	1901-0050	** Diode, Si, 200 mA at 1V (CR5)	07263	FDA6308	1
13	0689-0275	** Resistor, Fxd, Comp, 2.7 ohms, 5%, 1W (R5)	01121	GB27G5	1
14	0160-0127	** Capacitor, Fxd, Cer, 1.0 uF, 20%, 25 VDCW (C1)	56289	5C13CS-CML	1
15	2110-0257	** Fuseholder (XF1,XF2)	75915	121001	4
		(Attaching Parts)			
16	0361-1032	** Rivet, Tubular, 0.121 in. OD, 0.200 in. long	00000	OBD	1
		- - - x - - -			
17	0360-1529	** Stud, Terminal, fork style	71279	1025-4	15
18	0360-1656	** Stud, Terminal, single turret style	71279	1457-4	19
19	02100-80048	** Printed-Circuit Board	28480	02100-80048	1

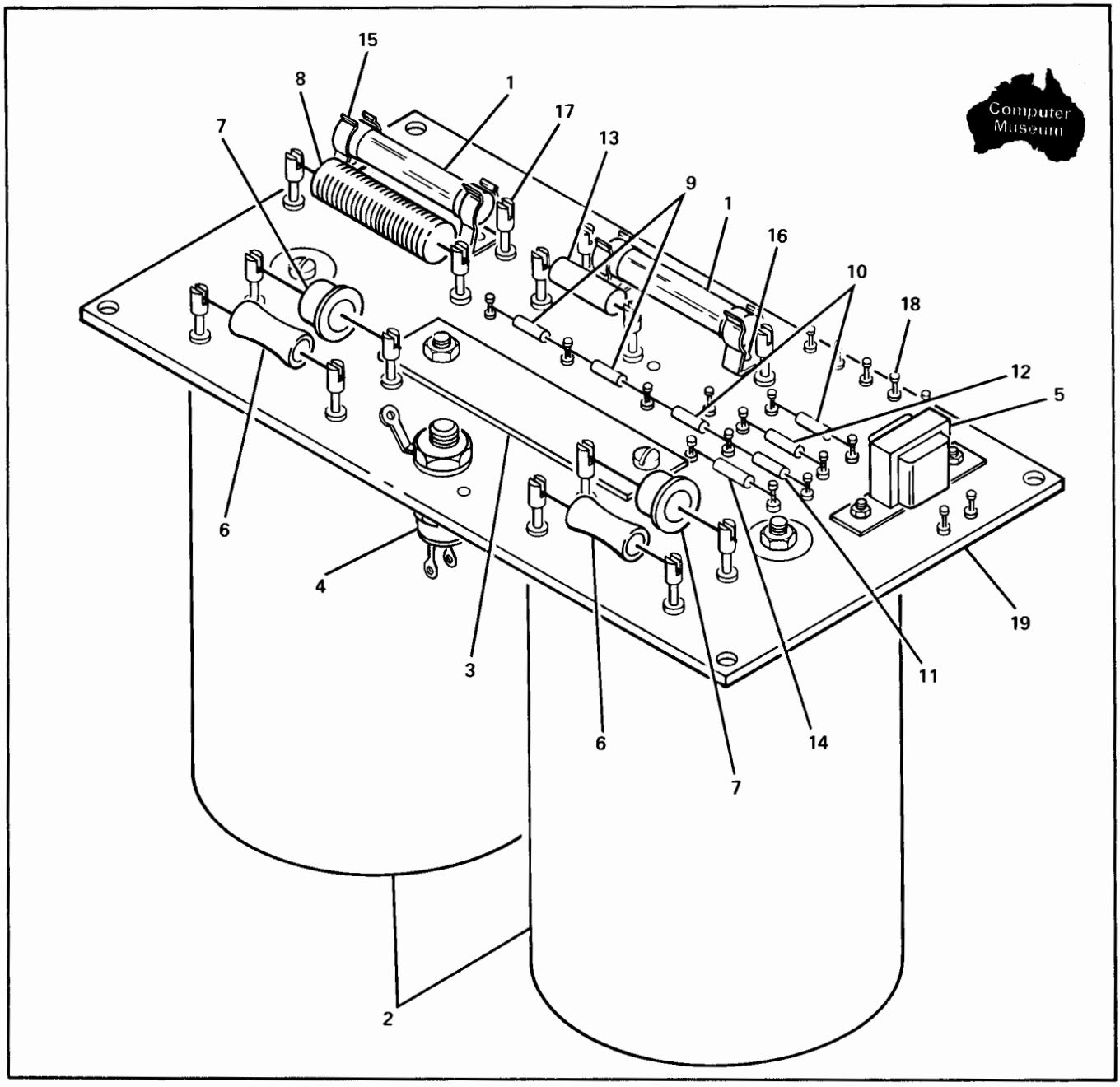


Figure 6-5. +160 Volt Output Board, Exploded View

Table 6-6. Preregulator Assembly, Replaceable Parts

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-6-	02100-60097	PREREGULATOR ASSEMBLY (A6) (32, figure 6-1)		02100-60097	1
1	0160-0904	* Capacitor, Fxd, Cer, 0.50 uF, 20%, 1000 VDCW (C1,C2,C3)	56289	169A4-CDH	3
2	0698-3402	* Resistor, Fxd, Met Flm, 316 ohms, 1%, 1/2W (R1)	28480	0698-3402	1
3	1884-0219	* Thyristor, scr, IF, 20A, 600V (Q1,Q2)	86684	2N3899	2
		(Attaching Parts)			
4	2950-0036	* Nut, Plain, Hexagon, 1/4-28	00000	OBD	1
5	0360-0040	* Lug, Terminal, 1/4 in. ID	00000	OBD	2
6	3050-0225	* Washer, Flat, 1/4 in. ID	00000	OBD	1
7	1200-0088	* Insulator, Diode	76530	293201	2
		- - - x - - -			
8	1901-1061	* Diode, Rectifier, 12A, 600V (CR1,CR2)	04713	MR886	2
		(Attaching Parts)			
9	2740-0002	* Nut, Plain, Hexagon, No. 10-32	00000	ODB	1
10	0360-0220	* Lug, Terminal, No. 10	00000	OBD	2
11	3050-0226	* Washer, Flat, No. 10	00000	OBD	1
12	1200-0080	* Insulator, Transistor Mounting	76530	294834	2
		- - - x - - -			
13	3103-0015	* Switch, Thermal (S1)	14604	3001	1
		(Attaching Parts)			
	2420-0003	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	1
		- - - x - - -			
14	0340-0078	* Insulator, Standoff	83330	93-2001	3
15	0340-0077	* Insulator. Feedthru	98291	FT-1000-SL	3
16	02100-00140	* Insulator, Heat Sink	28480	02100-00140	2
		(Attaching Parts)			
17	0361-0134	* Rivet, 9/64 in. dia, 1/4 in. long	00000	OBD	2
		- - - x - - -			
	02100-60059	* Preregulator Driver Board (A1)	28480	02100-60059	1
		(Attaching Parts)			
	2200-0149	* Screw, Machine, ph, No. 4-40, 5/8 in.	00000	OBD	4
18	2260-0001	* Nut, Plain, Hexagon, No. 4-40	00000	OBD	4
	2190-0003	* Washer, Lock, split, No. 4	00000	OBD	4
	3050-0229	* Washer, Flat, No. 4	00000	OBD	8
	0390-0019	* Spacer, Sleeve, 1/4 in. long	00000	OBD	4
		- - - x - - -			
19	0757-0316	** Resistor, Fxd, Met Flm, 42.2 ohms, 1%, 1/8W (R1,R3)	28480	0757-0316	2
20	0757-0284	** Resistor, Fxd, Met Flm, 150 ohms, 1%, 1/8W (R2,R4)	28480	0757-0284	2
21	9100-2925	** Power Transformer (T1)	28480	9100-2925	1
		(Attaching Parts)			
	2200-0139	** Screw, Machine, ph, No. 4-40, 1/4 in.	00000	OBD	2
	2190-0078	** Washer, Lock, split, No. 4	00000	OBD	2
	3050-0229	** Washer, Flat, No. 4	00000	OBD	4
	2260-0002	** Nut, Plain, Hexagon, No. 4-40	00000	OBD	2
		- - - x - - -			
22	02100-80059	** Printed-Circuit Board	28480	02100-80059	1
23	02100-20046	* Heat Sink	28480	02100-20046	1

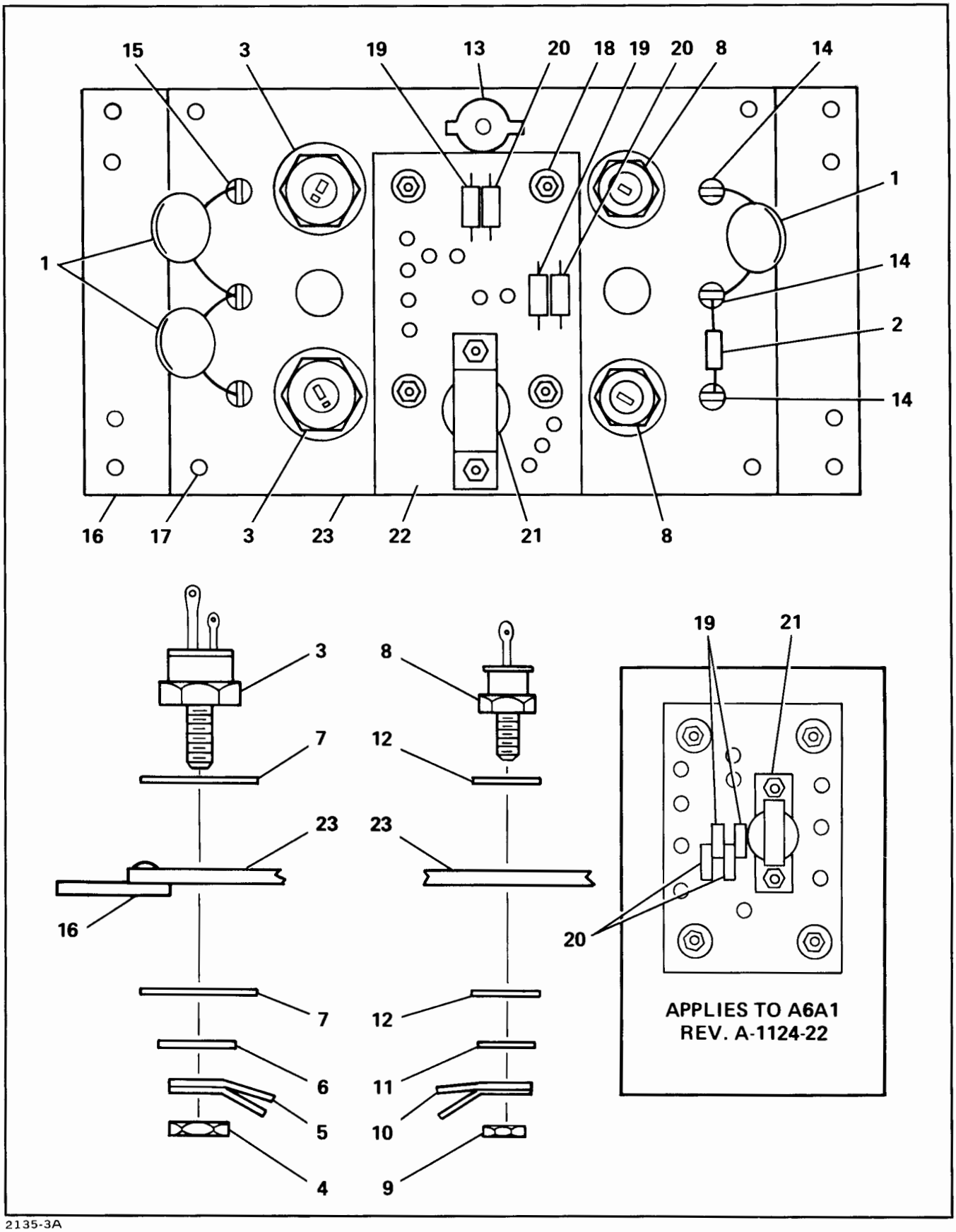
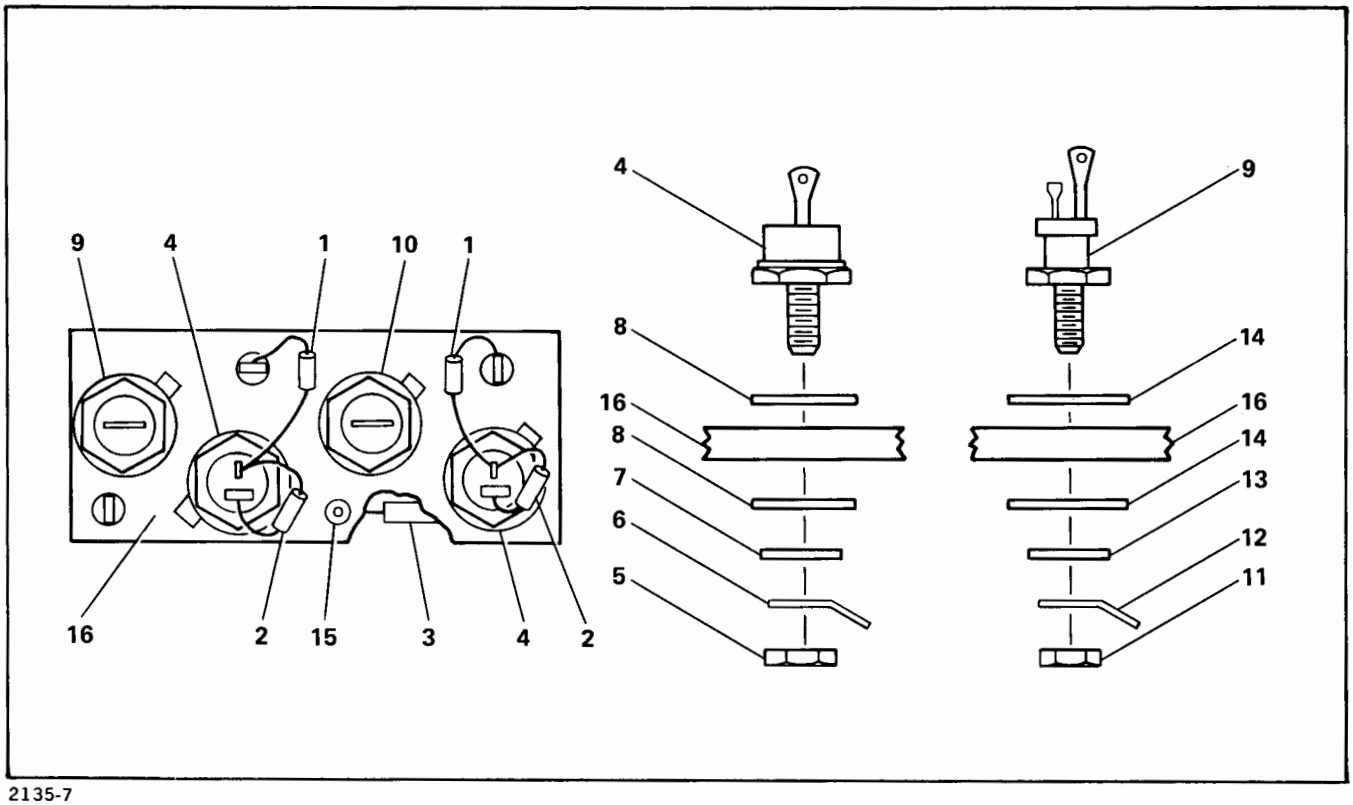


Figure 6-6. Preregulator Assembly, Exploded View

Table 6-7. Output Crowbar Assembly, Replaceable Parts

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-7-	No Number	OUTPUT CROWBAR ASSEMBLY (A10) (62, figure 6-1)		No Number	1
1	0757-0316	* Resistor, Fxd, Met Flm, 42.2 ohms, 1%, 1/8W (R3,R4)	28480	0757-0316	2
2	0757-0284	* Resistor, Fxd, Met Flm, 150 ohms, 1%, 1/8W (R2,R5)	28480	0757-0284	2
3	0698-3180	* Resistor, Fxd, Met Ox, 68 ohms, 2%, 2W (R6)	28480	0698-3180	1
4	1884-0208	* Thyristor, 35A rms, 100V (Q11,Q12)	12040	NL570A	2
		(Attaching Parts)			
5	2950-0036	* Nut, Plain, Hexagon, 1/4-28	00000	OBD	1
6	0360-0271	* Lug, Terminal, 1/4 in. ID	00000	OBD	1
7	3050-0226	* Washer, Flat, 1/4 in. ID	00000	OBD	1
8	1200-0088	* Insulator, Diode	76530	293201	2
		– – – x – – –			
9	1901-0315	* Diode, Si, 50 PIV, 40A, 150°C (CR40)	05277	1N1183A	1
10	1901-0496	* Diode, Rectifier, Si (CR39)	04713	SR2080-2	1
		(Attaching Parts for items 9 and 10)			
11	2950-0036	* Nut, Plain, Hexagon, 1/4-28	00000	OBD	1
12	0360-0271	* Lug, Terminal, 1/4 in. ID	00000	OBD	1
13	3050-0226	* Washer, Flat, 1/4 in. ID	00000	OBD	1
14	1200-0088	* Insulator, Diode	76530	293201	2
		– – – x – – –			
15	0340-0077	* Insulator, Feedthru	98291	FT-1000-SL	4
16	02100-20047	* Heat Sink	28480	02100-20047	1



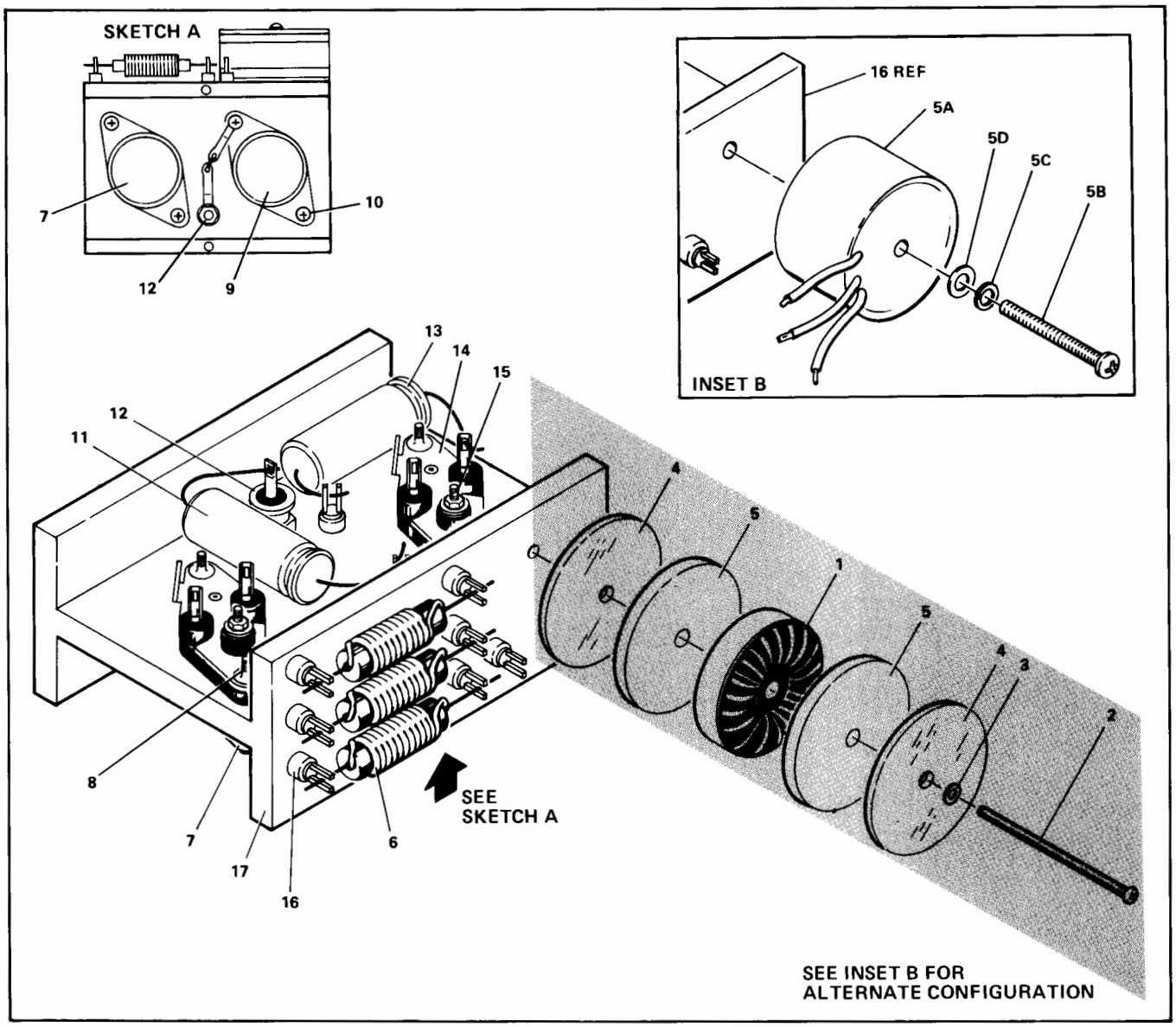
2135-7

Figure 6-7. Output Crowbar Assembly, Exploded View

Table 6-8. ±20 Volt Regulator Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-8-	No Number	±20 VOLT REGULATOR ASSEMBLY (A11) (66, figure 6-1)		No Number	1
1▲	9100-2926	* Inductor, 200 uH (L4)	28480	9100-2926	1
		(Attaching Parts)			
2▲	2360-0131	* Screw, Machine, ph, No. 6-32, 1-1/8 in.	00000	OBD	1
3▲	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
4▲	3050-0760	* Plate, Electrical Shield	00000	OBD	2
5▲	3050-0761	* Insulator, Neoprene	00000	OBD	2
		– – – x – – –			
5A★	9100-2934	* Inductor, 200 uH (L4)	28480	9100-2934	1
		(Attaching Parts)			
5B★	2360-0209	* Screw, Machine, ph, No. 6-32, 1 in.	00000	OBD	1
5C★	2190-0006	* Washer, Lock, split, No. 6	00000	OBD	1
5D★	3050-0227	* Washer, Flat, No. 6	00000	OBD	1
		– – – x – – –			
6◆	9100-2928	* Inductor, 4 uH (L1, L2, L3)	76493	5230	3
7	1835-0310	* Transistor, Si, PNP (Q13)	04713	2N4398	1
		(Attaching Parts)			
8	2360-0205	* Screw, Machine, ph, No. 6-32, 3/4 in.	00000	OBD	2
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	2
	1200-0043	* Insulator Plate, Transistor	71785	293011	1
		– – – x – – –			
9	1835-0310	* Transistor, Si, PNP (Q14)	04713	2N4398	1
		(Attaching Parts)			
10	2360-0205	* Screw, Machine, ph, No. 6-32, 3/4 in.	00000	OBD	2
	0360-0268	* Terminal, Lug, No. 6	00000	OBD	1
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
	1200-0043	* Insulator Plate, Transistor	71785	293011	1
		– – – x – – –			
11♦	0180-0141	* Capacitor, Fxd, Elect, 50 uF, +75 – 10%, 50 VDCW (C14)	56289	30D506G050DD2-DSM	1
12	1901-1036	* Diode, Rectifier, Si (CR41)	04713	MR881	1
		(Attaching Parts)			
	2740-0002	* Nut, Plain, Hexagon, No. 10-32, 3/8 in.	00000	OBD	1
	0360-0270	* Terminal, Lug, No. 10	00000	OBD	1
	3050-0226	* Washer, Flat, 1/4-in. ID	00000	OBD	1
	1200-0080	* Insulator, Transistor Mounting .	71785	294834	2
		– – – x – – –			
13■	0180-2546	* Capacitor, Fxd, Elect, 770 uF, –10 +75%, 40 VDCW (C15)	56289	601D777G040GP4-DAC	1
14	1200-0452	* Socket, Transistor	91506	8080-1G1	2
		(Attaching Parts)			
15	2200-0149	* Screw, Machine, ph, No. 4-40, 5/8 in.	00000	OBD	1
	2190-0003	* Washer, Lock, split, No. 4	00000	OBD	1
	3050-0229	* Washer, Flat, No. 4	00000	OBD	1
	2260-0002	* Nut, Plain, Hexagon, No. 4-40	00000	OBD	1
		– – – x – – –			
16	0340-0078	* Insulator, Standoff	83330	93-2001	9
17	02100-20049	* Heat Sink	28480	02100-20049	1

NOTES:
- ▲ Indicates non-encapsulated inductors and attaching parts used on original equipment. Replace with same part numbers.
- ★ Indicates encapsulated inductors and attaching parts used on later equipment. Replace with same part number.
- ◆ L1 and L3 not used on power supply date code 1229 and higher.
- ♦ C15 (see index no. 13) is part no. 0180-0141 on power supply date codes prior to 1229.
- ■ First used on power supply date code 1229.

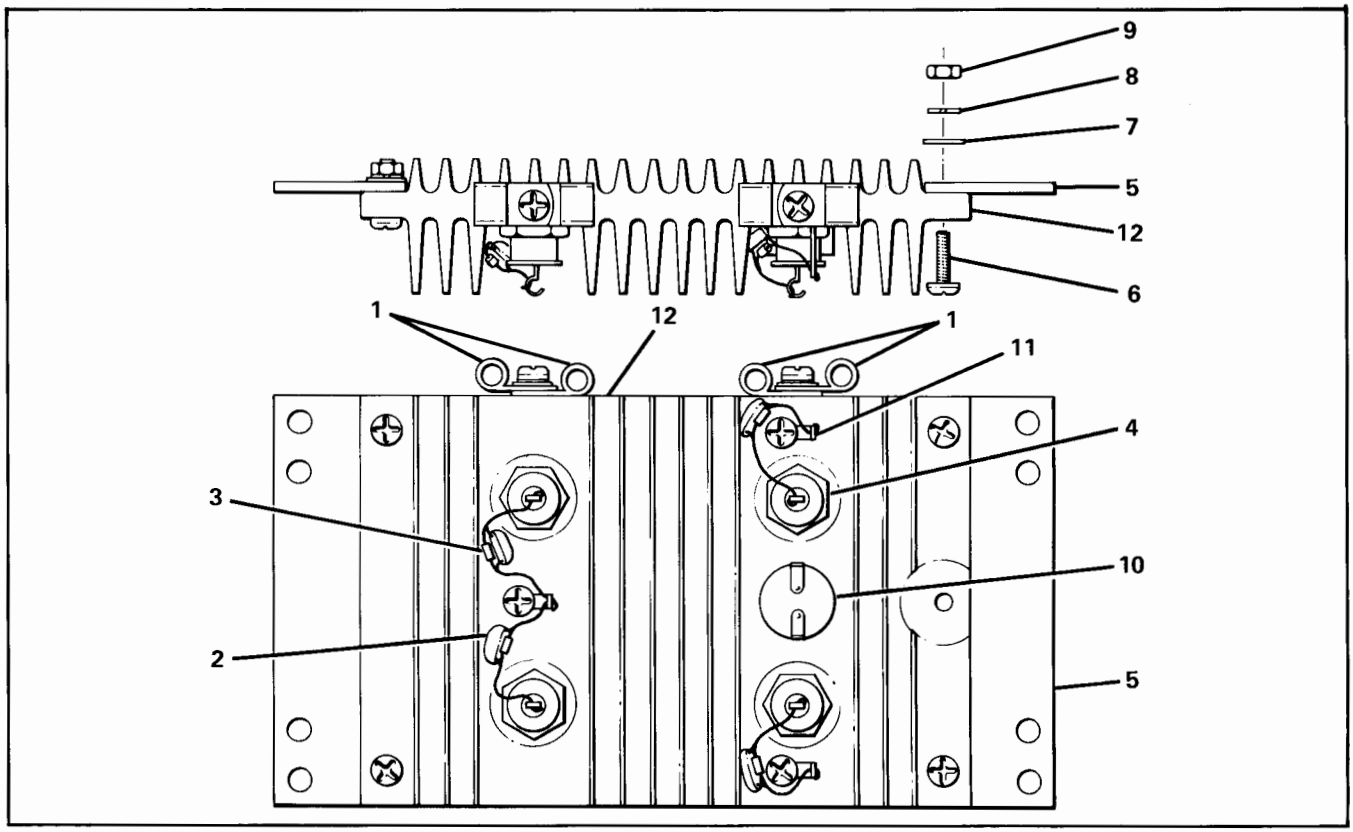


2135-5B

Figure 6-8. ±20 Volt Regulator Assembly, Exploded View

Table 6-9. +4.85 Volt Rectifier Assembly, Replaceable Parts

FIG & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-9-	02100-60098	+4.85 VOLT RECTIFIER ASSEMBLY (A9) (74, figure 6-1)		02100-60098	1
1	1400-0053	* Clamp, Cable	95987	WC-34NA	4
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
	2190-0851	* Washer, Lock, split, No. 6	00000	OBD	1
	3050-0228	* Washer, Flat, No. 6	00000	OBD	1
		- - - x - - -			
2	0150-0121	* Capacitor, Fxd, Cer, 0.1 uF, +80 -20%, 50 VDCW (C27 thru C30)	56289	5C50BIS-CML	4
3	1902-0202	* Diode, Breakdown, 15V, 5%, 1W (CR46 thru CR49)	28480	1902-0202	4
4	1901-1062	* Diode, Schottky Barrier (CR35 thru CR38)	04713	MBD-5400	4
		(Attaching Parts)			
	2740-0003	* Nut, Assembled Washer, No. 10-32	00000	OBD	1
		- - - x - - -			
5	02100-00140	* Insulator, Heat Sink	28480	02100-00140	2
		(Attaching Parts)			
6	2360-0003	* Screw, Machine, ph, No. 6-32, 1/2 in.	00000	OBD	2
7	3050-0228	* Washer, Flat, No. 6	00000	OBD	2
8	2360-0851	* Washer, Lock, split, No. 6	00000	OBD	2
9	2420-0003	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	2
		- - - x - - -			
10	3103-0015	* Switch, Thermal (S2)	14604	3001	1
		(Attaching Parts)			
	2420-0003	* Nut, Plain, Hexagon, No. 6-32	00000	OBD	1
		- - - x - - -			
11	0360-0042	* Terminal, Lug, No. 6	00000	OBD	3
		(Attaching Parts)			
	2360-0197	* Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	1
	2360-0851	* Washer, Lock, split, No. 6	00000	OBD	1
		- - - x - - -			
12	02100-20050	* Heat Sink	28480	02100-20050	1

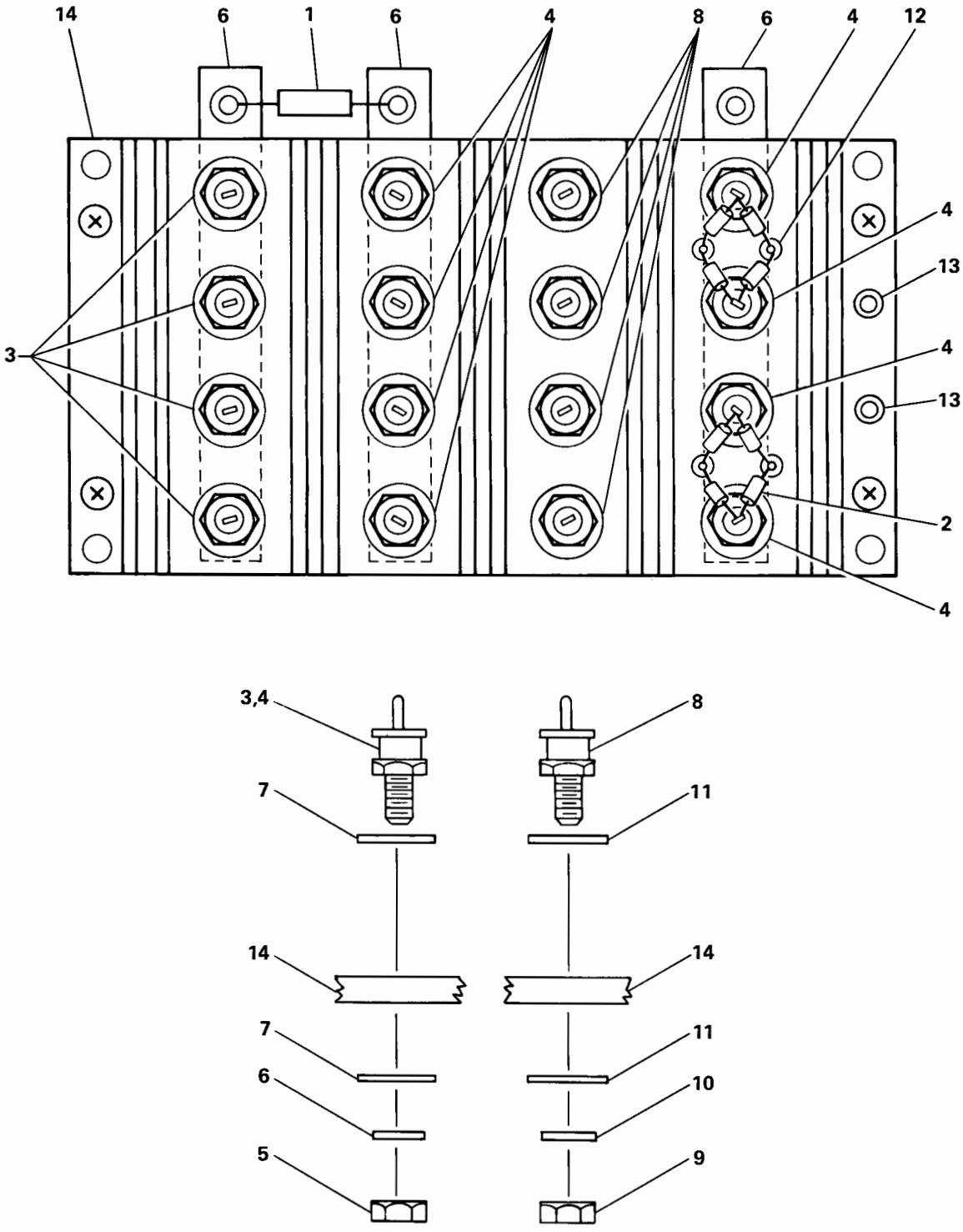


2135-6B

Figure 6-9. +4.85 Volt Rectifier Assembly, Exploded View

Table 6-10. Rectifier Assembly, Replaceable Parts

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
6-10-	02100-60099	RECTIFIER ASSEMBLY (A8) (79, figure 6-1)		02100-60099	1
1	0761-0021	* Resistor, Fxd, Met Ox, 1000 ohms, 5%, 1W (R7)	28480	0761-0021	1
2	1901-0159	* Diode, Si, 0.75A, 400 PIV (CR11 thru CR18)	04713	SR1358-4	8
3	1901-1035	* Diode, Rectifier, 12A, 100V (CR31 thru CR34)	28480	1901-1035	4
4	1901-1036	* Diode, Rectifier, 12A, 100V (CR19 thru CR26)	04713	MR881	8
		(Attaching Parts for items 3 and 4)			
5	2740-0003	* Nut, Assembled Washer, No. 10-32	00000	OBD	1
6	02100-00150	* Bus Bar	28480	02100-00150	3
7	1200-0080	* Insulator, Transistor Mounting	76530	294834	2
		– – – x – – –			
8	1901-1062	* Diode, Schottsky Barrier (CR27 thru CR30)	04713	MBD-5400	4
		(Attaching Parts)			
9	2740-0003	* Nut, Assembled Washer, No. 10-32	00000	OBD	1
10	3050-0225	* Washer, Flat, 1/4 in. ID	00000	OBD	1
11	1200-0088	* Insulator, Transistor Mounting	76530	294834	2
		– – – x – – –			
12	0340-0078	* Insulator, Standoff	83330	93-2001	4
13	0340-0077	* Insulator, Feedthru	98291	FT1000-SL	2
14	02100-20051	* Heat Sink	28480	02100-20051	1



2135-8

Figure 6-10. Rectifier Assembly, Exploded View

Table 6-11. Numerical Listing of Electrical Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0150-0050	C: Fxd Cer 1000 PF +80 -20% 1000 VDCW	56289	C067B102E1022S26-CDH	12
0150-0093■	C: Fxd Cer 0.01 uF +80 -20% 100 VDCW	72982	801-K800011	2
0150-0096	C: Fxd Cer 0.05 uF +80 -20%, 100 VDCW	91418	TA	5
0150-0121	C: Fxd Cer 0.1 uF +80 -20% 50 VDCW	56289	5C50BIS-CML	5
0160-0127	C: Fxd Cer 1.0 uF 20% 25 VDCW	56289	5C13CS-CML	1
0160-0153	C: Fxd My 0.001 uF 10% 200 VDCW	56289	192P10292-PTS	3
0160-0158	C: Fxd My 0.0056 uF 10% 200 VDCW	56289	192P56292-PTS	1
0160-0161	C: Fxd My 0.01 uF 10% 200 VDCW	56289	192P10392-PTS	3
0160-0162	C: Fxd My 0.22 uF 10% 200 VDCW	56289	192P22392-PTS	1
0160-0168	C: Fxd My 0.1 uF 10% 200 VDCW	56289	192P10492-PTS	3
0160-0174	C: Fxd Cer 0.47 uF +80 -20% 25 VDCW	56289	5C11B7S-CML	9
0160-0194	C: Fxd My 0.015 uF 10%	56289	192P15392-PTS	5
0160-0298	C: Fxd My 0.0015 uF 10% 200 VDCW	56289	192P15292-PTS	1
0160-0303	C: Fxd My 0.15 uF 10% 200 VDCW	28480	0160-0303	2
0160-0904	Capacitor, Fxd, Cer, 0.05 uF, 20%, 1000 VDCW	56289	169A4-CDH	3
0160-2055	C: Fxd Cer 0.01 uF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH	6
0160-2143	C: Fxd Cer 2000 PF +80 -20% 1000 VDCW	91418	Type B	3
0160-2940	C: Fxd Mica 470 PF 5% 300 VDCW	72136	RDM15F471J3C	1
0160-3456	C: Fxd Cer 1000 PF 10% 250 VDCW	56289	C067F251F102KS22-CD	1
0170-0024	C: Fxd My 0.022 uF 20% 200 VDCW	56289	192P22302	2
0170-0040	C: Fxd My 0.047 uF 10% 200 VDCW	56289	192P47392-PTS	2
0180-0049	C: Fxd Elect 20 uF +75 -10% 50 VDCW	56289	30D206G050CC2-DSM	4
0180-0097	C: Fxd Tant 47 uF 10% 35 VDCW	56289	150D476X9035S2-DYS	3
0180-0098	C: Fxd Elect 100 uF 20% 20 VDCW	56289	150D107X0020S2-DYS	1
0180-0100	C: Fxd Elect 4.7 uF 10% 35 VDCW	56289	150D475X9035B2-DYS	1
0180-0141	C: Fxd Elect 50 uF +75 -10% 50 VDCW	56289	30D506G050DD2-DSM	4
0180-0161	C: Fxd Elect 3.3 uF 20% 35 VDCW	56289	150D335X0035B2-DYS	1
0180-0197	C: Fxd Elect 2.2 uF 10% 20 VDCW	56289	150D225X9020A2-DYS	4
0180-0228	C: Fxd Elect 22 uF 10% 15 VDCW	56289	150D226X9015B2-DYS	2
0180-0291	C: Fxd Elect 1.0 uF 10% 35 VDCW	56289	150D105X9035A2-DYS	9
0180-0376	C: Fxd Elect 0.47 uF 10% 35 VDCW	56289	150D474X9035A2-DYS	1
0180-1746	C: Fxd Elect 15 uF 10% 20 VDCW	28480	0180-1746	7
0180-1794	C: Fxd Elect 22 uF 10% 35 VDCW	56289	150D226X9035R2-DYS	1
0180-2410	Capacitor, Fxd, Elect, 18000 uF, -10 +75%, 15 VDCW	14659	602D183G015AF2A	2
0180-2411	Capacitor, Fxd, Elect, 22000 uF, -10 +75%, 10 VDCW	14659	602D223G010AF2A	1
0180-2412	Capacitor, Fxd, Elect, 37000 uF, -10 +75%, 5 VDCW	14659	60D20D373G5R0AF2A	1
0180-2413	Capacitor, Fxd, Elect, 7500 uF, - 10 +75%, 15 VDCW	14659	36D752G015AA2A	1
0180-2414	Capacitor, Fxd, Elect, 2900 uF, -10 +75%, 40 VDCW	14659	36D292G040AA2A	1
0180-2415	C: Fxd Al Elect 200 uF +75 -10% 40 VDCW	56289	39D207G040EL4	1
0180-2416	Capacitor, Fxd, Elect, 9900 uF, -10 +75%, 10 VDCW	14659	602D992G030AF2A	1
0180-2417	Capacitor, Fxd, Elect, 430 uF, -10 +50%, 200 VDCW	14659	36D431F200AB2A	2
0180-2418	Capacitor, Fxd, Elect, 9800 uF, -10 +75%, 100 VDCW	14659	36D982G100CC2A	2
0683-0275	R: Fxd Comp 2.7 ohms 5% 1/4W	01121	CB27G5	3
0683-8245	R: Fxd Comp 820K ohms 5% 1/4W	01121	CB8245	1
0689-0275	Resistor, Fxd, Comp, 2.7 ohms, 5%, 1W	01121	GB27G5	1
0698-0082	R: Fxd Met Flm 464 ohms 1% 1/8W	28480	0698-0082	11
0698-0083	R: Fxd Met Flm 1.96K ohms 1% 1/8W	28480	0698-0083	1
0698-0084	R: Fxd Met Flm 2.15K ohms 1% 1/8W	28480	0698-0084	5
0698-3136	R: Fxd Met Flm 17.8K ohms 1% 1/8W	28480	0698-3136	1
0698-3150	R: Fxd Met Flm 2.37K ohms 1% 1/8W	28480	0698-3150	3
0698-3151	R: Fxd Met Flm 2.87K ohms 1% 1/8W	28480	0698-3151	1

■ See tables 7-2 and 7-3 for usage.

Table 6-11. Numerical Listing of Electrical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0698-3152	R: Fxd Met Flm 3.48K ohms 1% 1/8W	28480	0698-3152	1
0698-3155	R: Fxd Met Flm 4.64K ohms 1% 1/8W	28480	0698-3155	18
0698-3156	R: Fxd Met Flm 14.7 ohms 1% 1/8W	28480	0698-3156	1
0698-3157	R: Fxd Met Flm 19.6K ohms 1% 1/8W	28480	0698-3157	1
0698-3158	R: Fxd Met Flm 23.7K ohms 1% 1/8W	28480	0698-3158	4
0698-3159	R: Fxd Met Flm 26.1K ohms 1% 1/8W	28480	0698-3159	2
0698-3160	R: Fxd Met Flm 31.6K ohms 1% 1/8W	28480	0698-3160	6
0698-3161	R: Fxd Met Flm 38.3K ohms 1% 1/8W	28480	0698-3161	1
0698-3162	R: Fxd Met Flm 46.4K ohms 1% 1/8W	28480	0698-3162	13
0698-3180	R: Fxd Met Ox 68 ohms 2% 2W	28480	0698-3180	3
0698-3260	R: Fxd Met Flm 464K ohms 1% 1/8W	28480	0698-3260	3
0698-3266	R: Fxd Met Flm 237K ohms 1% 1/8W	28480	0698-3266	1
0698-3388	R: Fxd Met Flm 14.7 ohms 1% 1/2W	28480	0698-3388	1
0698-3398	R: Fxd Met Flm 46.4 ohms 1% 1/2W	28480	0698-3398	1
0698-3402	R: Fxd Met Flm 316 ohms 1% 1/2W	28480	0698-3402	9
0698-3410	R: Fxd Met Flm 3.16K ohms 1% 1/2W	28480	0698-3410	1
0698-3438	R: Fxd Met Flm 147 ohms 1% 1/8W	28480	0698-3438	5
0698-3441	R: Fxd Met Flm 215 ohms 1% 1/8W	28480	0698-3441	1
0698-3445	R: Fxd Met Flm 348 ohms 1% 1/8W	28480	0698-3445	2
0698-3447	R: Fxd Met Flm 422 ohms 1% 1/8W	28480	0698-3447	2
0698-3449	R: Fxd Met Flm 28.7K ohms 1% 1/8W	28480	0698-3449	1
0698-3450	R: Fxd Met Flm 42.2K ohms 1% 1/8W	28480	0698-3450	1
0698-3452	R: Fxd Met Flm 147K ohms 1% 1/8W	28480	0698-3452	3
0698-3454	R: Fxd Met Flm 215K ohms 1% 1/8W	28480	0698-3454	1
0698-3455	R: Fxd Met Flm 216K ohms 1% 1/8W	28480	0698-3455	2
0698-3456	R: Fxd Met Flm 287K ohms 1% 1/8W	28480	0698-3456	1
0698-3459	R: Fxd Met Flm 383K ohms 1% 1/8W	28480	0698-3459	2
0698-4037	R: Fxd Met Flm 46.4 ohms 1% 1/8W	28480	0698-4037	5
0698-4442	R: Fxd Met Flm 4.42K ohms 1% 1/8W	28480	0698-4442	1
0698-7398	R: Fxd Flm 6.124K ohms 0.1% 1/8W	28480	0698-7398	2
0757-0123	R: Fxd Met Flm 34.8K ohms 1% 1/8W	28480	0757-0123	2
0757-0198	R: Fxd Met Flm 100 ohms 1% 1/2W	28480	0757-0198	2
0757-0199	R: Fxd Met Flm 21.5K ohms 1% 1/8W	28480	0757-0199	7
0757-0200	R: Fxd Met Flm 5.62K ohms 1% 1/8W	28480	0757-0200	1
0757-0274	R: Fxd Met Flm 1.21K ohms 1% 1/8W	28480	0757-0274	5
0757-0279	R: Fxd Met Flm 3.16K ohms 1% 1/8W	28480	0757-0279	2
0757-0280	R: Fxd Flm 1K ohms 1% 1/8W	28480	0757-0280	9
0757-0284	R: Fxd Flm 150 ohms 1% 1/8W	28480	0757-0284	5
0757-0288	R: Fxd Met Flm 9.09K ohms 1% 1/8W	28480	0757-0288	1
0757-0290	R: Fxd Met Flm 6.19K ohms 1% 1/8W	28480	0757-0290	1
0757-0316	R: Fxd Met Flm 42.2 ohms 1% 1/8W	28480	0757-0316	6
0757-0346	R: Fxd Met Flm 10 ohms 1% 1/8W	28480	0757-0346	3
0757-0394	R: Fxd Met Flm 51.1 ohms 1% 1/8W	28480	0757-0394	2
0757-0401	R: Fxd Met Flm 100 ohms 1% 1/8W	28480	0757-0401	7
0757-0416	R: Fxd Met Flm 511 ohms 1% 1/8W	28480	0757-0416	1
0757-0418	R: Fxd Met Flm 619 ohms 1% 1/8W	28480	0757-0418	1
0757-0421	R: Fxd Met Flm 825 ohms 1% 1/8W	28480	0757-0421	1
0757-0422	R: Fxd Met Flm 909 ohms 1% 1/8W	28480	0757-0422	1
0757-0428	R: Fxd Met Flm 1.62K ohms 1% 1/8W	28480	0757-0428	3
0757-0438	R: Fxd Met Flm 5.11K ohms 1% 1/8W	28480	0757-0438	3

Table 6-11. Numerical Listing of Electrical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0757-0439	R: Fxd Met Flm 6.81K ohms 1% 1/8W	28480	0757-0439	1
0757-0440	R: Fxd Met Flm 7.50K ohms 1% 1/8W	28480	0757-0440	4
0757-0441	R: Fxd Met Flm 8.25K ohms 1% 1/8W	28480	0757-0441	2
0757-0442	R: Fxd Met Flm 10.0K ohms 1% 1/8W	28480	0757-0442	19
0757-0444	R: Fxd Met Flm 12.1K ohms 1% 1/8W	28480	0757-0444	1
0757-0446	R: Fxd Met Flm 15.0K ohms 1% 1/8W	28480	0757-0446	7
0757-0458	R: Fxd Met Flm 51.1K ohms 1% 1/8W	28480	0757-0458	2
0757-0459	R: Fxd Met Flm 58.2K ohms 1% 1/8W	28480	0757-0459	10
0757-0460	R: Fxd Met Flm 61.9K ohms 1% 1/8W	28480	0757-0460	2
0757-0461	R: Fxd Met Flm 68.1K ohms 1% 1/8W	28480	0757-0461	4
0757-0462	R: Fxd Met Flm 75.0K ohms 1% 1/8W	28480	0757-0462	2
0757-0463	R: Fxd Met Flm 82.5K ohms 1% 1/8W	28480	0757-0463	1
0757-0464	R: Fxd Met Flm 90.9K ohms 1% 1/8W	28480	0757-0464	1
0757-0465	R: Fxd Met Flm 100K ohms 1% 1/8W	28480	0757-0465	8
0757-1078	R: Fxd Met Flm 1.47K ohms 1% 1/2W	28480	0757-1078	1
0757-1094	R: Fxd Met Flm 1.47K ohms 1% 1/8W	28480	0757-1094	1
0761-0021	Resistor, Fxd, Met Ox, 1000 ohms, 5%, 1W	28480	0761-0021	1
0764-0018	Resistor, Fxd, Met Flm 4700 ohms, 5%, 2W	28480	0764-0018	2
0811-1668	R: Fxd WW 1.5 ohms 5% 2W	28480	0811-1668	1
0811-3108	Resistor, Fxd, WW, 2.0 ohms, 10%	20940	R7-100	1
1200-0452	Socket, Transistor	91506	8080-1G1	10
1251-0232	PC Card Connector, 44 contact	76530	251-22-30-261	4
1400-0084	Fuseholder	75915	342014	1
1820-0054	IC: TTL Quad 2-Inpt Nand Gate	01295	SN74004	1
1820-0141	IC: TTL Quad 2-Inpt And Gate	28480	1820-0141	1
1820-0256	IC: DTL Quad 2-Inpt Power Gate	04713	MC858P	1
1820-0449	IC: TTL Dual D F/F	04713	MC3060P	1
1821-0001	Transistor Array: Si NPN	02735	CA3045	3
1826-0049	IC: Voltage Regulator Programmable	07263	U6A7723393	1
1826-0069	IC: Linear Oper Ampl	12040	LM301AD	4
1826-0070	IC: Linear Oper Ampl	07263	U6A7741393	13
1853-0052	Tstr: Si PNP	80131	2N3740	2
1853-0281	Tstr: Si PNP	80131	2N2907A	12
1853-0310	Transistor, Si, PNP	04713	2N4398	2
1854-0039	Tstr: Si NPN	80131	2N3053	13
1854-0072	Tstr: SI NPN	80131	2N3054	2
1854-0080	Transistor, Si, NPN	28480	1854-0080	8
1854-0477	Tstr: Si NPN	80131	2N2222A	12
1855-0050	Tstr: Si FET Dual	28480	1855-0050	1
1855-0062	Tstr: Si FET 30V	01295	2N1595	1
1884-0208	Thyristor, 35A rms, 100V	12040	NL570A	2
1884-0219	Thyristor, scr, IF, 20A, 600V	86684	40576	3
1901-0033	Diode: Silicon 100 MA 180 WV	07263	FD3369	26
1901-0040	Diode: Silicon 30 MA 30 WV	07263	FDG1088	9
1901-0050	Diode: Si 200 MA 1V	07263	FDA6308	16
1901-0159	Diode: Silicon 0.75A 400 PIV	04713	SR1358-4	15
1901-0164	Diode: Si 200 PIV 3A	28480	1901-0164	6
1901-0315	Diode, Si, 50 PIV, 40A, 150°C	05277	1N1183A	2
1901-0496	Diode, Rectifier, Si	04713	SR2080-2	1
1901-1035	Diode, Rectifier, 12A, 100V	28480	1901-1035	4
1901-1036	Diode, Rectifier, 12A, 100V	04713	MR881	9

Table 6-11. Numerical Listing of Electrical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
1901-1061	Diode, Rectifier, 12A, 600V	04713	MR886	2
1901-1062	Diode, Schottsky Barrier	04713	MBD5400	8
1901-1065	Diode: 1N4936	28480	1901-1065	12
1902-0033	Diode: Breakdown	04713	1N823	2
1902-0041	Diode: Breakdown 5.11V 5%	04713	SZ10939-98	1
1902-0175	Diode: Breakdown Silicon 100V 5%	28480	1902-0175	2
1902-0202	Diode: Breakdown 15.0V 5% 1/8W	28480	1902-0202	4
1902-3139	Diode: Breakdown 8.25V 5%	04713	SZ10939-158	1
1902-3149	Diode: Breakdown 9.09V 5%	28480	1902-3149	1
1902-3171	Diode: Breakdown 11.0V 5%	28480	1902-3171	3
1902-3245	Diode: Breakdown Silicon 21.5V 5%	28480	1902-3245	1
1902-3290	Diode: Breakdown Silicon 31.6V 5%	28480	1902-3290	2
1902-3416	Diode: Breakdown, 90.9V, 5%, 400W	07910	CDB5982	2
2100-2413	R: Var Flm 200 ohms 10% lin 1/2W	28480	2100-2413	1
2100-2521	R: Var Flm 2000 ohms 10% lin 1/2W	28480	2100-2521	2
2100-2522	R: Var Cermet 10 ohms 10% lin 1/2W	28480	2100-2522	1
2100-2574	R: Var Cermet 500 ohms 10% lin 1/2W	28480	2100-2574	1
2110-0004	Fuse, 1/4A, 250V	75915	3AC/CAT.312.250	1
2110-0083	Fuse, 2-1/2A, 250V, 3 AG	28480	2110-0083	2
2110-0257	Fuseholder	75915	121001	4
3103-0015	Switch, Thermal	14604	3001	2
3160-0224	Fan: Tubeaxial	28480	3160-0224	2
9100-2917▲	Inductor, 50 uH	28480	9100-2917	2
9100-2918▲	Inductor, 8 uH	28480	9100-2918	1
9100-2919▲	Inductor, 9 uH	28480	9100-2919	1
9100-2920	Inductor, Choke, 16 mH	28480	9100-2920	1
9100-2921	Transformer, 8 mH	28480	9100-2921	1
9100-2922	Transformer, Control	28480	9100-2922	1
9100-2923	Transformer, inverter	28480	9100-2923	2
9100-2924	Transformer, Pulse	28480	9100-2924	2
9100-2925	Power Transformer	28480	9100-2925	1
9100-2926★	Inductor, 200 uH	28480	9100-2926	1
9100-2927	Transformer, Pulse	28480	9100-2927	1
9100-2928	Inductor, 4 uH	76493	5230	3
9100-2931▲	Inductor, 50 uH	28480	9100-2931	2
9100-2932▲	Inductor, 8 uH	28480	9100-2932	1
9100-2933▲	Inductor, 9 uH	28480	9100-2933	1
9100-2934★	Inductor, 200 uH	28480	9100-2931	1
9140-0098	Coil/Choke 2.20 uH 10%	99800	1537-20	1
9140-0131	Coil: Fxd RF 10 MH	28480	9140-0131	2
9140-0210	Coil/Choke 100 uH 5%	82142	15-1315-12J	1
02100-60046▲	Pregulator Control Card	28480	02100-60046	1
02100-60047▲	Protection and Control Card	28480	02100-60047	1
02100-60048	+160 Volt Output Board	28480	02100-60048	1
02100-60058	Inverter Driver Card	28480	02100-60058	1
02100-60059	Preregulator Driver Board	28480	02100-60059	1
02100-60061▲	Current Limit Card	28480	02100-60061	1
02100-60093	Output Junction Assembly	28480	02100-60093	1
02100-60094	+160 Volt Output Assembly	28480	02100-60094	1
02100-60095■	Inverter Assembly	28480	02100-60095	1
02100-60096	Rear Fan Panel Assembly	28480	02100-60096	1
02100-60097	Preregulator Assembly	28480	02100-60097	1
02100-60098	+4.85 Volt Rectifier Assembly	28480	02100-60098	1
02100-60099	Rectifier Assembly	28480	02100-60099	1
02100-60108▲	Preregulator Control Card	28480	02100-60108	1
02100-60109▲	Protection and Control Card	28480	02100-60109	1
02100-60110▲	Current Limit Card	28480	02100-60110	1
02100-60113●	Inverter Assembly	28480	02100-60113	2
02100-60114●	Inverter Assembly	28480	02100-60114	1

NOTES: ▲ See table 6-1 for usage.
★ See table 6-7 for usage.
■ Used on power supply date codes 1250 and prior.
● Used on power supply date codes 1314 and later.

Table 6-12. Numerical Listing of Mechanical Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0340-0077	Insulator, Feedthru	98291	FT-1000-SL	9
0340-0078	Insulator, Standoff	83330	93-2001	18
0340-0089	Grommet, Plastic, 1/4 in. ID, 3/4 in. OD	28480	0340-0089	4
0360-0040	Terminal, Lug, 1/4 in. ID	00000	OBD	3
0360-0042	Terminal, Lug, No. 6	00000	OBD	2
0360-0220	Terminal, Lug, No. 10	00000	OBD	2
0360-0268	Terminal, Lug, No. 6	00000	OBD	1
0360-0270	Terminal, Lug, No. 10	00000	OBD	1
0360-0271	Terminal, Lug, 1/4 in. ID	00000	OBD	2
0360-1128	Terminal Board	71785	353-11-09-001	1
0360-1529	Stud, Terminal, Fork style	71279	1025-4	15
0360-1656	Stud, Terminal, single turret style	71279	1457-4	19
0360-1699	Terminal Board	98410	39007	1
0361-0134	Rivet, 9/64 in. dia, 1/4 in. long	00000	OBD	4
0361-1032	Rivet, Tubular, 0.121 in. OD, 0.200 in. long	00000	OBD	4
0380-0010	Spacer, Sleeve, 1/4 in. OD, 5/8 in. long	28480	0380-0010	2
0380-0091	Spacer, Hexagon, int-thread, No. 6-32, 3/4 in. long	28480	0380-0091	4
0390-0019	Spacer, Sleeve, 1/4 in. long	00000	OBD	4
0570-1029	Stud, threaded, 1/4 in. long	00000	OBD	4
0590-0077	Nut, Self-Locking, Hexagon, No. 6-32	00000	OBD	2
1200-0043	Insulator Plate, Transistor	71785	293011	10
1200-0080	Insulator, Transistor Mounting	76530	294834	32
1200-0088	Insulator, Diode	76530	293201	16
1251-0013	Fastener, Spring Tension, trim	78947	152239	4
1400-0053	Clamp, Cable	95987	WC-34NA	4
1400-0090	Gasket, Neoprene, 5/8 in. OD	00000	OBD	1
2190-0003	Washer, Lock, split, No. 4	00000	OBD	14
2190-0004	Washer, Lock, int-tooth, No. 4	00000	OBD	2
2190-0006	Washer, Lock, split, No. 6	00000	OBD	17
2190-0034	Washer, Lock, split, No. 6	00000	OBD	2
2190-0068	Washer, Lock, int-tooth, 1/2 in. ID	00000	OBD	1
2190-0074	Washer, Lock, split, No. 10	00000	OBD	2
2190-0077	Washer, Lock, split, No. 10	00000	OBD	16
2190-0078	Washer, Lock, split, No. 4	00000	OBD	2
2190-0851	Washer, Lock, split, No. 6	00000	OBD	123
2200-0139	Screw, Machine, ph, No. 4-40, 1/4 in.	00000	OBD	2
2200-0143	Screw, Machine, ph, No. 4-40, 3/8 in.	00000	OBD	6
2200-0149	Screw, Machine, ph, No. 4-40, 5/8 in.	00000	OBD	6
2200-0155	Screw, Machine, flh, No. 4-40, 1 in.	00000	OBD	3
2260-0001	Nut, Plain, Hexagon, No. 4-40	00000	OBD	10
2260-0002	Nut, Plain, Hexagon, No. 4-40	00000	OBD	5
2360-0003	Screw, Machine, ph, No. 6-32, 1/2 in.	00000	OBD	2
2360-0131	Screw, Machine, ph, No. 6-32, 1-1/8 in.	00000	OBD	1
2360-0133	Screw, Machine, ph, No. 4-40, 1-1/4 in.	00000	OBD	1
2360-0190	Screw, Machine, flh, No. 6-32, 1/4 in.	00000	OBD	13
2360-0115	Screw, Machine, flh, No. 6-32, 5/16 in.	00000	OBD	20
2360-0135	Screw, Machine, ph, No. 6-32, 1-1/2 in.	00000	OBD	4
2360-0196	Screw, Machine, flh, No. 6-32, 3/8 in.	00000	OBD	3
2360-0197	Screw, Machine, ph, No. 6-32, 3/8 in.	00000	OBD	97
2360-0200	Screw, Machine, flh, No. 6-32, 1/2 in.	00000	OBD	2
2360-0201	Screw, Machine, ph, No. 6-32, 1/2 in.	00000	OBD	2
2360-0203	Screw, Machine, ph, No. 6-32, 5/8 in.	00000	OBD	2

Table 6-12. Numerical Listing of Mechanical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
2360-0204	Screw, Machine, flh, No. 6-32, 3/4 in.	00000	OBD	1
2360-0205	Screw, Machine, ph, No. 6-32, 3/4 in.	00000	OBD	15
2360-0209	Screw, Machine, flh, No. 10-32, 1 in.	00000	OBD	4
2420-0001	Nut, Assembled Washer, No. 6-32	00000	OBD	6
2420-0002	Nut, Plain, Hexagon, No. 6-32	00000	OBD	32
2420-0003	Nut, Plain, Hexagon, No. 6-32	00000	OBD	8
2680-0099	Screw, Machine, ph, No. 10-32, 3/8 in.	00000	OBD	10
2680-0103	Screw, Machine, ph, No. 10-32, 1/2 in.	00000	OBD	1
2680-0128	Screw, Machine, ph, No. 10-32, 1/4 in.	00000	OBD	2
2740-0002	Nut, Plain, Hexagon, No. 10-32	00000	OBD	9
2740-0003	Nut, Assembled Washer, No. 10-32	00000	OBD	20
2950-0036	Nut, Plain, Hexagon, 1/4-28	00000	OBD	7
2950-0038	Nut, Plain, Hexagon, 1/2-24	00000	OBD	1
3030-0248	Setscrew, Socket Head, No. 10-32, 3/4 in.	00000	OBD	7
3050-0010	Washer, Flat, No. 6	00000	OBD	4
3050-0225	Washer, Flat, 1/4 in. ID	00000	OBD	9
3050-0226	Washer, Flat, No. 10	00000	OBD	5
3050-0227	Washer, Lock, split, No. 6	00000	OBD	38
3050-0228	Washer, Flat, No. 6	00000	OBD	18
3050-0229	Washer, Flat, No. 4	00000	OBD	32
3050-0760	Plate, Electrical Shield, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0760	10
3050-0761	Insulator, Neoprene, 1/8 in. ID, 1-1/4 in. OD	28480	3050-0761	10
5000-8015	Guard, Fan	28480	5000-8015	2
5020-0096	Terminal Board	28480	5020-0096	1
5020-0241	Bracket	28480	5020-0241	2
02100-00021	Filter, Rear	28480	02100-00021	1
02100-00140	Insulator, Heat Sink	28480	02100-00140	4
02100-00141	Bracket, Mounting	28480	02100-00141	2
02100-00142	Bracket, Mounting	28480	02100-00142	2
02100-00143	Bracket, Mounting	28480	02100-00143	6
02100-00144	Plate, Mounting	28480	02100-00144	1
02100-00145	Panel, right side	28480	02100-00145	1
02100-00146	Panel, left side	28480	02100-00146	1
02100-00147	Panel, rear fan	28480	02100-00147	1
02100-00148	Bus Bar	28480	02100-00148	2
02100-00149	Bus Bar	28480	02100-00149	1
02100-00150	Bus Bar	28480	02100-00150	3
02100-00151	Insulator, Sheet, electrical	28480	02100-00151	1
02100-00152	Terminal Strip, Grounding	28480	02100-00152	1
02100-00153	Strap, Bus Bar	28480	02100-00153	1
02100-00154	Bracket, Printed-Circuit Guide	28480	02100-00154	1
02100-00155	Bracket, Angle	28480	02100-00155	1
02100-00156	Plate, Terminal Board Mounting	28480	02100-00156	1
02100-00157	Cover, Access, bottom	28480	02100-00157	1
02100-00161	Cover, Access, top	28480	02100-00161	1
02100-00164	Cover, front	28480	02100-00164	1
02100-00165	Bus Bar	28480	02100-00165	1
02100-00167	Pad, foam rubber, 2-3/4 in. long, 2-1/2 in. wide	28480	02100-00167	2
02100-20045	Mounting Block, PC Connector	28480	02100-20045	2
02100-20046	Heat Sink	28480	02100-20046	1

Table 6-12. Numerical Listing of Mechanical Parts (Continued)

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
02100-20047	Heat Sink	28480	02100-20047	1
02100-20048	Heat Sink	28480	02100-20048	1
02100-20049	Heat Sink	28480	02100-20049	1
02100-20050	Heat Sink	28480	02100-20050	1
02100-20051	Heat Sink	28480	02100-20051	1
02100-20052	Standoff, ceramic	28480	02100-20052	1
02100-60064	Diode Board and Bracket Assembly	28480	02100-60064	1
05210-4001	Guide, Printed-Circuit	28480	05210-4001	2

Table 6-13. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

A	= assembly	K	= relay	TB	= terminal board
B	= motor, synchro	L	= inductor	TP	= test point
BT	= battery	M	= meter	U	= integrated circuit, non-repairable assembly
C	= capacitor	MC	= microcircuit	V	= vacuum tube, photocell, etc.
CB	= circuit breaker	P	= plug connector	VR	= voltage regulator
CR	= diode	Q	= semiconductor device other than diode or microcircuit	W	= cable, jumper
DL	= delay line	R	= resistor	X	= socket
DS	= indicator	RT	= thermistor	Y	= crystal
E	= Misc electrical parts	S	= switch	Z	= tuned cavity, network
F	= fuse	T	= transformer		
FL	= filter				
J	= receptacle connector				

ABBREVIATIONS

A	= amperes	gra	= gray	ph	= Phillips head
ac	= alternating current	grn	= green	pk	= peak
ad	= anode			p-p	= peak-to-peak
Al	= aluminum	H	= henries	pt	= point
AR	= as required	Hg	= mercury	PIV	= peak inverse voltage
adj	= adjust	hr	= hour(s)	PNP	= positive-negative-positive
assy	= assembly	Hz	= hertz	PWV	= peak working voltage
		hdw	= hardware	porc	= porcelain
B	= base	hex	= hexagon, hexagonal	posn	= position(s)
bp	= bandpass			pozi	= pozidrive
blk	= black	IC	= integrated circuit		
blu	= blue	ID	= inside diameter		
brn	= brown	in.	= inch, inches	rf	= radio frequency
brs	= brass	I/O	= input/output	rdh	= round head
Btu	= British thermal unit	int	= internal	rmo	= rack mount only
Be Cu	= beryllium copper	incl	= include(s)	rms	= root-mean-square
		insul	= insulation, insulated	RWV	= reverse working voltage
C	= collector	impgrg	= impregnated	rect	= rectifier
cw	= clockwise	incand	= incandescent	r/min	= revolutions per minute
ccw	= counterclockwise			RTL	= resistor-transistor logic
cer	= ceramic	k	= kilo (10^3), kilohm		
cmo	= cabinet mount only			s	= second
com	= common	lp	= low pass	SB	= slow blow
crt	= cathode-ray tube			Se	= selenium
CTL	= complementary-transistor logic	m	= milli (10^{-3})	Si	= silicon
		M	= mega (10^6), megohm	scr	= silicon controlled rectifier
cath	= cathode	My	= Mylar	sil	= silver
cd pl	= cadmium plate	mfr	= manufacturer	sst	= stainless steel
Comp	= composition	mom	= momentary	stl	= steel
conn	= connector	mtg	= mounting	spcl	= special
compl	= complete	misc	= miscellaneous	spdt	= single-pole, double-throw
		Met Ox	= metal oxide	spst	= single-pole, single-throw
dc	= direct current	mintr	= miniature	semicond	= semiconductor
dia	= diameter				
DTL	= diode-transistor logic	n	= nano (10^{-9})	Ta	= tantalum
depc	= deposited carbon	n.c.	= normally closed or no connection	td	= time delay
dpdt	= double-pole, double-throw			Ti	= titanium
dpst	= double-pole, single-throw	Ne	= neon	tgl	= toggle
		no.	= number	thd	= thread
E	= emitter	n.o.	= normally open	tol	= tolerance
ECL	= emitter-coupled logic	np.	= nickel plated	TTL	= transistor transistor logic
ext	= external	NPN	= negative-positive-negative		
encap	= encapsulated	NPO	= negative-positive zero (zero temperature coefficient)		
elctlt	= electrolytic			U(μ)	= micro (10^{-6})
		NSR	= not separately replaceable		
F	= farads	NRFR	= not recommended for field replacement	V	= volt(s)
FF	= flip-flop			var	= variable
flh	= flat head			vio	= violet
Flm	= film	OD	= outside diameter	VDCW	= direct current working volts
Fxd	= fixed	OBD	= order by description		
filh	= fillister head	orn	= orange	W	= watts
		ovh	= oval head	WW	= wirewound
G	= giga (10^9)	oxd	= oxide	wht	= white
Ge	= germanium			WIV	= working inverse voltage
gl	= glass	p	= pico (10^{-12})		
gnd	= ground(ed)	PC	= printed circuit	yel	= yellow

Table 6-14. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 and H4-2, and the latest supplements.

Code No.	Manufacturer	Address
00779	Amp. Inc.	Harrisburg, Pa.
00866	Goe Engineering Co.	City of Industry, Cal.
01121	Allen Bradley Co.	Milwaukee, Wis.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01961	Pulse Engineering Co.	Santa Clara, Cal.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
05245	Components Corp.	Chicago, Ill.
05277	Westinghouse Electric Corp., Semi-Conductor Dept.	Youngwood, Pa.
07263	Fairchild Camera & Instr. Corp., Semi-conductor Div.	Mountain View, Cal.
07910	Continental Device Corp.	Hawthorne, Cal.
09922	Burndy Corp.	Norwalk, Conn.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Cal.
12010	National Semiconductor	Danbury, Conn.
14268	Lidco, Inc.	Freeport, N.Y.
14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
14604	Elmwood Sensors Inc.	Cranston, R.I.
14655	Cornell Dublier Electric Corp.	Newark, N.J.
14659	Sprague Electric Co.	Visalia, Cal.
19701	Electra/Midland Corp.	Mineral Wells, Texas
20940	Micro-Ohm Corp.	El Monte, Cal.
22421	Tomas and Betts Ltd.	Quebec, Canada
24446	General Electric Co.	Schenectady, N.Y.
24931	Specialty Connector Co.	Indianapolis, Ind.
28480	Hewlett-Packard Co.	Palo Alto, Cal.
49367	Pyle-National Co.	Chicago, Ill.
56289	Sprague Electric Co.	North Adams, Mass.
71279	Cambride Thermionics Corp.	Cambridge, Mass.
71785	Chinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
74201	Racon Corp.	New York, N.Y.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76493	J.W. Miller Co.	Los Angeles, Cal.
76530	Chinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Cal.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78947	Ucinite Co.	Newtonville, Mass.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80131	Electronic Industries Association. Any brand part meeting EIA Standards	Washington, D.C.
81640	Controls Co. of America, Control Switch Division	Folcroft, Pa.
81741	Chicago Lock Co.	Chicago, Ill.
82142	Jeffers Electronics, Div. of Speer Carbon Co.	DuBois, Pa.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
86684	Radio Corp. of America, Electronic Corp. & Devices Div.	Harrison, N.Y.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
93332	Sylvania Electric Prod. Inc., Semi-conductor Div.	Woburn, Mass.
95987	Wechesser Co.	Chicago, Ill.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98410	Etc, Inc.	Cleveland, Ohio
99800	Delevan Electronics Corp.	East Aurora, N.Y.

SECTION VII DIAGRAMS

7-1. INTRODUCTION.

7-2. This section contains diagrams and tables of reference data for troubleshooting and repair of the power supply. The information consists of integrated-circuit diagrams and characteristics, wiring information, schematic diagrams, and parts information.

7-3. INTEGRATED CIRCUIT DIAGRAMS

7-4. The integrated circuit diagrams in figure 7-1 show each type of integrated circuit used in the power supply, together with characteristics.

7-5. WIRING INFORMATION.

7-6. Table 7-1 lists the point-to-point wiring between the assemblies in the power supply. The list is in alphanumeric order of reference designations. Each connection is listed twice to enable determining leadwire terminations from either end of the leadwire. For example, the blue leadwire from A5E41 to XA3-16 is also listed as from XA3-16 to A5E41.

7-7. The wiring diagram, figure 7-2, supports table 7-1 by identifying the power supply assemblies and their connecting points.

7-8. REPLACEABLE PARTS LISTS.

7-9. Table 7-2 is the replaceable parts list for power supplies having date codes prior to 1240.

7-10. Tables 7-3 through 7-5 are the replaceable parts lists for the new version of A1, A3, and A4 plug-in cards used in power supplies having date codes 1240 and higher. Use table 7-2 for replaceable parts for A2 plug-in card and for all other assemblies.

7-11. Tables 7-2 and 7-3 are included in this section to supplement the parts location and schematic diagrams. Section VI provides a complete list of replaceable parts for the power supply, descriptions of the table columns, and parts ordering information.

7-12. Parts in tables 7-2 and 7-3 are listed by complete reference designation and include an HP part number, quantity, description, manufacturer's code, and manufacturer's part number. The total quantity of a part used is listed with the first entry for that part number.

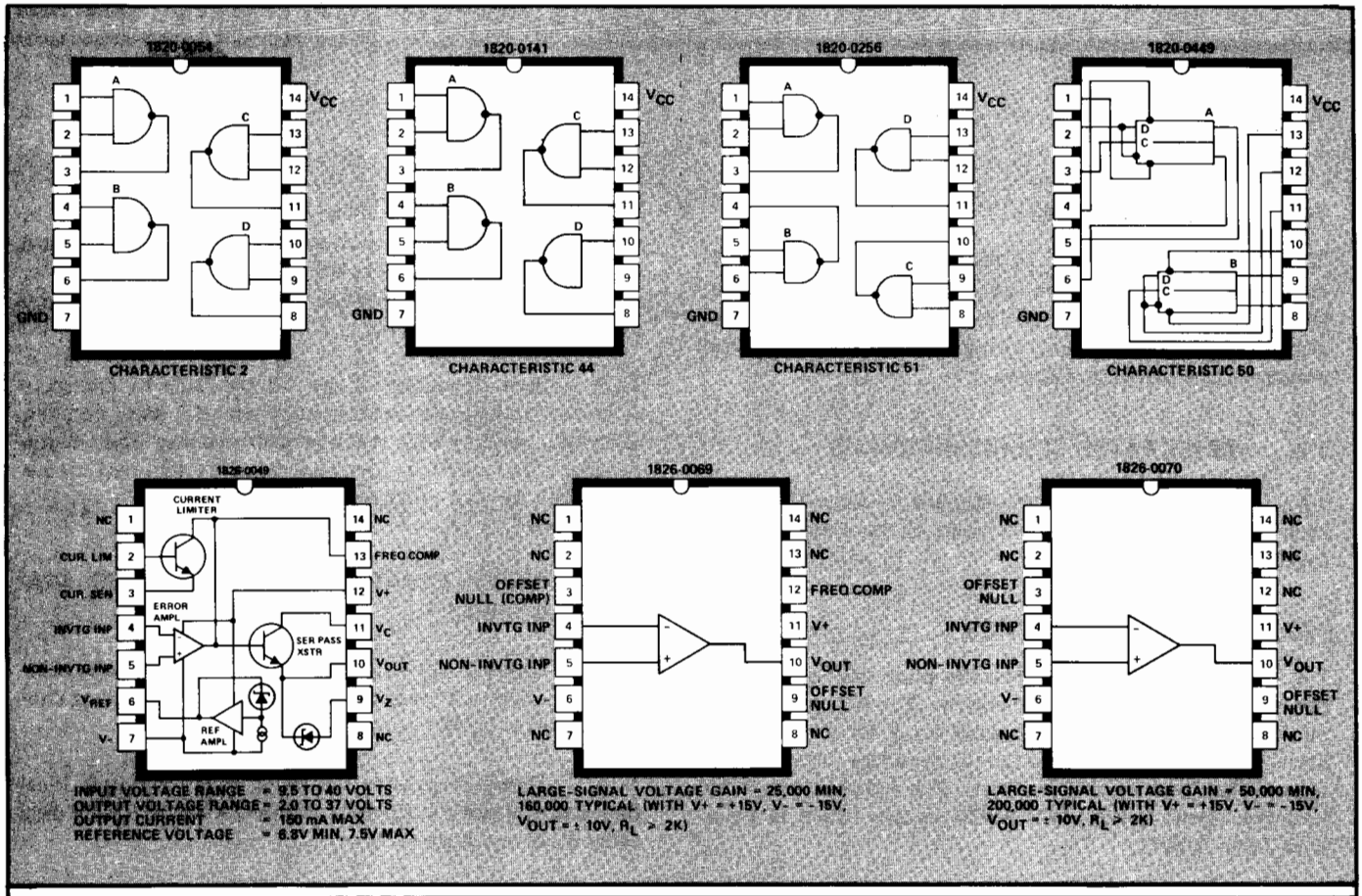
7-13. PARTS LOCATION AND SCHEMATIC DIAGRAMS.

7-14. Figure 7-3, sheets 1 through 4, are the parts location and schematic diagrams for power supplies having date codes prior to 1240.

7-15. Figure 7-4, sheets 1 through 4, are the parts location and schematic diagrams for power supplies having date codes 1240 and higher.

7-16. The parts location diagram for each card is located adjacent to the schematic diagram and shows the location and appearance of the electrical parts on each card. The parts location diagrams for the other assemblies are located on figure 7-2. The parts are identified by the reference designations used on the schematic diagrams. The card part number and identification code is shown on the parts location diagram as it is marked on the card itself. Refer to paragraph 1-36 for a description of the identification code.

7-17. The schematic diagrams use either conventional schematic symbols or logic symbols. The logic symbols are described in the Logic Symbology section of the 2100A Computer Diagrams Manual, part no. 02100-90003.



CHARACTERISTIC	INPUT LEVEL		OUTPUT LEVEL		OPEN INPUT ACTS AS:	MAXIMUM PROPAGATION DELAY	
	LOGIC 1 (VOLTS, MIN)	LOGIC 0 (VOLTS, MAX)	LOGIC 1 (VOLTS, MIN)	LOGIC 0 (VOLTS, MAX)		TO LOGIC 1 (NANOSECONDS)	TO LOGIC 0 (NANOSECONDS)
2	2.0	0.8	2.4	0.4	Logic 1	29	15
44	1.8	1.1	2.5	0.4	Logic 1	15	15
50	1.8	1.1	2.5	0.4	Logic 1	25	25
51	1.8	1.1	*	0.45	Logic 1	50	35

* Note: Level depends on load.

Figure 7-1. Integrated Circuit Diagrams and Characteristics

Table 7-1. Point-to-Point Wiring List

FROM	TO	COLOR	FROM	TO	COLOR
A5E41	XA3-16	blu	A7Q3-C	A5E50	red
A5E42	XA3-13	red	A7Q3-E	A7Q4-C	bare
A5E43	XA3-11	grn	A7Q3-E	A7T1*	yel
A5E44	A10E26	wht-yel	A7Q4-B	A7T1*	grn
A5E45	A10E27	wht-grn	A7Q4-C	A7Q3-E	bare
A5E46	A10E24	wht	A7Q4-C	T3-10	grn
A5E47	A10E25	blk	A7Q4-E	A7T1*	blk-gra
A5E48	C20-	wht-vio	A7Q4-E	C19-	wht-vio
A5E49	A6E3	wht-blu-gra	A7Q4-E	A7T1*	blk-red
A5E50	A7Q3-C	red	A7Q5-B	A7Q6-E	bare
A5E51	L9*	blu	A7Q5-C	T3-11	wht-grn
A5E51	T6*	blu	A7Q5-C	A7T1*	red
A5E52	C19+	wht-orn-gra	A7Q5-E	A7T1-*	wht
A5E53	T6*	blk-red*	A7Q6-B	A7Q5-C	bare
A5E54	A7Q7-C	orn	A7Q6-E	A7T1*	wht-blk
A6CR1-A	A6E4	wht	A7Q7-B	A7T2*	wht
A6CR1-A	A6Q1-A	wht	A7Q7-C	A5E54	orn
A6CR1-C	A6E2	wht-red-gra	A7Q7-E	A7Q8-C	bare
A6CR1-C	A6CR2-A	wht-red-gra	A7Q7-E	A7T2*	wht-blk
A6CR2-A	A6CR1-C	wht-red-gra	A7Q8-B	A7T2*	blk-red
A6CR2-C	A6E6	wht-gra	A7Q8-C	A7Q7-E	bare
A6CR2-C	A6Q2-C	wht-gra	A7Q8-C	T4-10	grn
A6CR2-C	T6*	blk	A7Q8-E	A7T2*	red
A6E1	A6Q2-A	gra	A7Q9-B	A7T2*	grn
A6E2	A6CR1-C	wht-red-gra	A7Q9-C	A7Q10-E	bare
A6E3	A5E49	wht-blu-gra	A7Q9-C	T4-11	wht-grn
A6E4	A6CR1-A	wht	A7Q9-E	A7T2*	blk-grn
A6E6	A6CR2-C	wht-gra	A7Q10-B	A7T2*	blk-yel
A6E7	XA1-20	wht-blk-grn	A7Q10-E	A7T2*	yel
A6E8	XA1-21	red	A7T1*	A7E39	blk
A6E9	XA1-19	blu	A7T1*	A7Q4-E	blk-grn
A6E10	A6Q1-G	wht	A7T1*	A7Q5-B	blk-red
A6E11	A6Q1-C	gra	A7T1*	A7Q3-B	blk-yel
A6E12	A6Q2-C	wht-gra	A7T1*	A7E40	gra
A6E13	A6Q2-G	wht	A7T1*	A7Q4-B	grn
A6Q1-A	A6CR1-A	wht	A7T1*	A7Q5-E	red
A6Q1-A	T6*	wht	A7T1*	A7Q6-B	wht
A6Q1-C	A6E11	gra	A7T1*	A7Q6-E	wht-blk
A6Q1-C	A6Q2-A	gra	A7T1*	A7Q3-E	yel
A6Q1-G	A6E10	wht	A7T2*	A7E38	blk
A6Q2-A	A6E1	gra	A7T2*	A7Q9-E	blk-grn
A6Q2-A	A6Q1-C	gra	A7T2*	A7Q8-B	blk-red
A6Q2-C	A6E12	wht-gra	A7T2*	A7Q10-B	blk-yel
A6Q2-C	A6CR2-C	wht-gra	A7T2*	A7E37	gra
A6Q2-G	A6E13	wht	A7T2*	A7Q9-B	grn
A6S1-1	A9S2-2	wht	A7T2*	A7Q8-E	red
A6S1-2	TB2-8	brn	A7T2*	A7Q7-B	wht
A7E37	A7T2*	gra	A7T2*	A7Q7-E	wht-blk
A7E37	XA2-14,R	wht	A7T2*	A7Q10-E	grn
A7E38	A7T2*	blk	A8CR19-A	T3-6	wht-yel-grn
A7E38	XA2-17,U	wht-blk-blu	A8CR20-A	T3-9	wht-yel-blu
A7E39	A7T1*	blk	A8CR21-A	T4-6	wht-red-yel
A7E39	XA2-20,X	wht-blk-yel	A8CR22-A	T4-9	wht-brn-yel
A7E40	A7T1*	gra	A8CR23-A	A8CR31-C	**
A7E40	XA2-21,Y	wht	A8CR23-A	T3-7	wht
A7Q3-B	A7T1*	blk-yel	A8CR24-A	A8CR32-C	**
			A8CR24-A	T3-8	yel
			A8CR25-A	A8CR33-C	**
			A8CR25-A	T4-7	wht-yel

*Indicates leadwire is part of component.
**Denotes insulating tubing over bare leadwire.

Table 7-1. Point-to-Point Wiring List (Continued)

FROM	TO	COLOR	FROM	TO	COLOR
A8CR26-A	A8CR34-C	**	A11E28	A8E20	brn
A8CR26-A	T4-8	brn	A11E29	C16+	red
A8CR27-A	E66	blu	A11E30	E60	blk
A8CR27-C	T3-2	vio	A11E31	A11Q14-E	wht-brn-yel
A8CR28-A	E66	blu	A11E32	A11E35	wht-red-yel
A8CR28-C	T3-4	orn	A11E32	A11L4*	brn
A8CR29-A	E66	blu	A11E33	A11E36	wht-grn
A8CR29-C	T4-2	orn	A11E34	A11L4*	red
A8CR30-A	E66	blu	A11E34	XA2-3	wht-red-orn
A8CR30-C	T4-4	vio	A11E35	A11E32	wht-red-yel
A8CR31-C	A8CR23-A	**	A11E35	XA4-W	wht-red-yel
A8CR32-C	A8CR24-A	**	A11E36	A11CR41-A	bare
A8CR33-C	A8CR25-A	**	A11E36	A11E33	wht-grn
A8CR34-C	A8CR26-A	**	A11L4*	A11E32	brn
A8E14	A8E16	**	A11L4*	A11Q14-C	orn
A8E15	A8E17	**	A11L4*	A11E34	red
A8E15	A8E18	wht-brn-vio	A11Q13-B	XA2-13,P	wht-blk-grn
A8E16	A8E14	**	A11Q13-C	A8E19	wht-red-vio
A8E16	A8E19	wht-red-vio	A11Q13-C	XA4-8,J	wht-red-vio
A8E17	A8E15	**	A11Q13-E	XA2-19,W	wht-orn-blu
A8E18	A8E15	wht-brn-vio	A11Q14-B	XA2-C	wht-brn-grn
A8E18	XA1-16,T	wht-brn-vio	A11Q14-C	XA2-E	wht-red-blu
A8E19	A8E16	wht-red-vio	A11Q14-C	A11L4*	orn
A8E19	A11Q13-C	wht-red-vio	A11Q14-C	A11CR41-C	bare
A8E20	A11E28	brn	A11Q14-E	XA2-5	wht-brn-yel
A8E20	XA4-5,E	brn	A11Q14-E	A11E31	wht-brn-yel
A8E21	L5*	yel	B1-J1	TB3-5	blk
A8E21	XA4-2,B	wht-red-grn	B1-J1	TB3-6	blk
A8E22	L6*	yel	B2-J1	TB3-5	blk
A8E22	XA4-H	wht-orn-grn	B2-J1	TB3-6	blk
A9CR35-A	T3-5	blu	C16+	A11E29	red
A9CR36-A	T3-1	blu	C16+	TB1-1	blu
A9CR37-A	T4-1	blu	C16-	E55	bus
A9CR38-A	T4-5	blu	C19+	C20+	bus
A9E23	XA4-21,Y	wht-red-blu	C19+	L9*	red
A9E23	L7*	blk	C19+	A5E52	wht-orn-gra
A9S2-1	XA4-L	wht-brn	C19-	C20,-	bus
A9S2-2	A6S1-1	wht-brn	C19-	T6*	yel
A10CR39-A	A10CR40-C	blk	C19-	A7Q4-E	wht-vio
A10CR39-C	A10Q12-A	bare	C20+	C19+	bus
A10CR39-C	TB1-1	red	C20-	C19-	bus
A10CR40-A	A10Q12-C	bare	C20-	A5E48	wht-vio
A10CR40-C	A10CR39-A	blk	C21+	XA1-6,F	wht-brn-red
A10CR40-C	E60	blk	C21+	TB3-10	wht-brn-red
A10E24	A10Q12-C	bare	C21-	E65	blk
A10E24	TB2-1	wht-grn	C21-	T5*	blk
A10E24	A5E46	wht	C22+	XA1-5,E	wht-brn-orn
A10E25	A5E47	blk	C22+	TB3-8	wht-brn-orn
A10E26	A10Q11-C	bare	C22-	E65	bus
A10E26	TB1-3	vio	C23+	L5*	yel
A10E26	A5E44	wht-yel	C23+	TB2-3	wht-red
A10E27	A5E45	wht-grn	C23-	E63	bus
A10Q11-A	TB1-5	brn	C24+	L7*	blk
A10Q11-C	A10E26	bare	C24+	TB1-4	blu
A10Q12-A	A10CR39-C	bare	C24+	TB1-5	blu
A10Q12-C	A10E24	bare	C24-	E56	bus
A10Q12-C	A10CR40-A	bare	C25+	E57	bus
A11CR41-A	A11E36	bare	C25-	L8*	grn
A11CR41-C	A11Q14-C	bare	C25-	TB1-2	blu

*Indicates leadwire is part of component.
**Denotes insulating tubing over bare leadwire.

Table 7-1. Point-to-Point Wiring List (Continued)

FROM	TO	COLOR	FROM	TO	COLOR
C25-	TB1-3	blu	TB2-3	C23+	wht-red
C26+	E64	bus	TB2-4	XF5-2	wht-orn
C26-	TB2-2	wht-vio	TB2-5	XA3-E,5	wht-blk-brn
C26-	L6*	yel	TB2-6	XA1-N,12	wht-blu
E55	C16-	bus	TB2-7	XA2-H	wht-yel
E56	C24-	bus	TB2-8	A6S1-2	wht-brn
E57	C25+	bus	TB2-9	XA2-7	wht-blk
E58	TB1-7	blu	TB3-1	T5*	red
E58	TB1-6	blu	TB3-1	XA1-3,C	wht-grn-blu
E59	T3-3	wht-blu	TB3-2	T5*	blk-red
E60	A10CR40-C	blk	TB3-2	XA1-2,B	wht-grn-vio
E60	A11E30	blk	TB3-3	T5*	grn-blk
E60	XA3-22,Z	blk	TB3-4	T5*	grn
E60	XA4-A,1	blk	TB3-5	T5*	yel
E60	XA4-22,Z	blk	TB3-5	B1-J1	blk
E61	XA1-8,J	blk	TB3-5	B2-J1	blk
E61	XA1-22,Z	blk	TB3-6	T5*	yel-blk
E61	XA2-11,M	blk	TB3-6	B1-J1	blk
E61	XA2-22,Z	blk	TB3-6	B2-J1	blk
E62	T4-3	wht-blu	TB3-8	C22+	wht-brn-orn
E63	C23-	bus	TB3-10	C21+	wht-brn-red
E64	C26+	bus	TB3-11	T5*	blu-wht
E65	C21-	bus	TB3-12	T5*	blu
E65	C22-	bus	T3-1	A9CR36-A	blu
E66	A8CR27-A	blu	T3-2	A8CR27-C	vio
E66	A8CR28-A	blu	T3-3	E59	wht
E66	A8CR29-A	blu	T3-4	A8CR28-C	orn
E66	A8CR30-A	blu	T3-5	A9CR35-A	blu
E66	L8*	grn	T3-6	A8CR19-A	wht-yel-grn
E66	XA4-13,P	wht-orn-yel	T3-7	A8CR23-A	wht
L5*	A8E21	yel	T3-8	A8CR24-A	yel
L5*	C23+	yel	T3-9	A8CR20-A	wht-yel-blu
L6*	A8E22	yel	T3-10	A7Q4-C	grn
L6*	C26-	yel	T3-11	A7Q5-C	wht-grn
L7*	A9E23	blk	T4-1	A9CR37-A	blu
L7*	C24+	blk	T4-2	A8CR29-C	vio
L8*	C25-	grn	T4-3	E62	wht
L8*	E66	grn	T4-4	A8CR30-C	orn
L9*	A5E51	blu	T4-5	A9CR38-A	blu
L9*	C19+	red	T4-6	A8CR21-A	wht-red-yel
TB1-1	C16+	blu	T4-7	A8CR25-A	wht-yel
TB1-1	XA2-F,6	red	T4-8	A8CR26-A	brn
TB1-1	A10CR39-C	red	T4-9	A8CR22-A	wht-brn-yel
TB1-2	C25-	blu	T4-10	A7Q8-C	grn
TB1-3	C25-	blu	T4-11	A7Q9-C	wht-grn
TB1-3	XA4-M,11	vio	T5*	C21-	blk
TB1-3	A10E26	vio	T5*	TB3-2	blk-red
TB1-4	C24+	blu	T5*	TB3-12	blu
TB1-4	XA3-Y,21	orn	T5*	TB3-11	wht-blu
TB1-5	C24+	blu	T5*	TB3-4	grn
TB1-5	A10Q11-A	orn	T5*	TB3-3	blk-grn
TB1-5	XA4-X,20	orn	T5*	TB3-1	red
TB1-6	E58	blu	T5*	TB3-5	yel
TB1-7	E58	blu	T5*	TB3-6	blk-yel
TB2-1	XA2-10,L	wht-grn	T6*	A6CR1-C	blk
TB2-1	A10E24	wht-grn			
TB2-2	XA3-H,7	wht-vio			
TB2-2	C26-	wht-vio			
TB2-3	XA4-C,3	wht-red			

*Indicates leadwire is part of component.

**Denotes insulating tubing over bare leadwire.

Table 7-1. Point-to-Point Wiring List (Continued)

FROM	TO	COLOR	FROM	TO	COLOR
T6*	A5E53	blk-red	XA2-X,20	A7E38	wht-blk-yel
T6*	A5E51	blu	XA2-Y,21	A7E37	wht
T6*	A6Q1-A	wht	XA2-Z,22	E61	blk
T6*	C19-	yel	XA2-3	A11E34	wht-red-orn
XA1-A,1	XA2-A,1	bare	XA2-5	A11Q14-E	wht-brn-yel
XA1-B,2	TB3-2	wht-grn-vio	XA2-7	TB2-9	wht-blk
XA1-B,2	XA3-2	wht-grn-vio	XA3-A,1	XA2-A,1	bare
XA1-C,3	TB3-1	wht-grn-blu	XA3-A,1	XA4-A,1	bare
XA1-C,3	XA3-6	wht-grn-blu	XA3-B	XA1-11,M	blu
XA1-D,4	XA2-D,4	bare	XA3-C,3	XA4-C,3	bare
XA1-E,5	C22+	wht-brn-orn	XA3-C,3	XA1-H,7	wht-red
XA1-E,5	XA2-16,T	wht-brn-orn	XA3-D,4	XA2-D,4	bare
XA1-F,6	C21+	wht-brn-red	XA3-D,4	XA4-D,4	bare
XA1-H,7	XA3-C,3	wht-red	XA3-E,5	TB2-5	wht-blk-brn
XA1-J,8	E61	blk	XA3-F	XA1-13,P	wht
XA1-K,9	XA2-K,9	bare	XA3-H,7	XA4-7	bare
XA1-L,10	XA2-L,10	bare	XA3-H,7	TB2-2	wht-vio
XA1-M,11	XA3-B	blu	XA3-J,8	XA2-J,8	bare
XA1-N,12	XA2-N,12	bare	XA3-J,8	XA4-J,8	bare
XA1-N,12	TB2-6	wht-blu	XA3-K,9	XA2-K,9	bare
XA1-P,13	XA3-F	wht	XA3-K,9	XA4-K,9	bare
XA1-R	XA4-6,F	yel	XA3-L,10	XA4-10	bare
XA1-S,15	XA2-S,15	bare	XA3-M	XA4-M,11	bare
XA1-T,16	A8E18	wht-brn-vio	XA3-N,12	XA2-N,12	bare
XA1-V,18	XA2-V,18	bare	XA3-N,12	XA4-N,12	bare
XA1-X	XA3-20	brn	XA3-R,14	XA4-R,14	bare
XA1-Z,22	E61	blk	XA3-S,15	XA2-S,15	bare
XA1-19	A6E9	blu	XA3-U,17	XA4-U,17	bare
XA1-20	A6E7	wht-blk-grn	XA3-V,18	XA2-V,18	bare
XA1-21	A6E8	red	XA3-V,18	XA4-V,18	bare
XA2-A,1	XA1-A,1	bare	XA3-W,19	XA4-19	bare
XA2-A,1	XA3-A,1	bare	XA3-W,19	XA2-6,F	red
XA2-B,2	XA4-16	wht	XA3-X	XA4-X,20	bare
XA2-C	A11Q14-B	wht-brn-grn	XA3-Y,21	TB1-5	orn
XA2-D,4	XA1-D,4	bare	XA3-Z,22	E60	blk
XA2-D,4	XA3-D,4	bare	XA3-2	XA1-2,B	wht-grn-vio
XA2-E	A11Q14-C	wht-brn-blu	XA3-6	XA1-3,C	wht-grn-blu
XA2-F,6	XA3-W	red	XA3-11	A5E43	grn
XA2-F,6	TB1-1	red	XA3-13	A5E42	red
XA2-H	TB2-7	wht-yel	XA3-16	A5E41	blu
XA2-J,8	XA3-J,8	bare	XA3-20	XA1-X	brn
XA2-K,9	XA1-K,9	bare	XA4-A,1	XA3-A,1	bare
XA2-K,9	XA3-K,9	bare	XA4-A,1	E60	blk
XA2-L,10	XA1-L,10	bare	XA4-B,2	A8E21	wht-red-grn
XA2-L,10	TB2-1	wht-grn	XA4-C,3	XA3-C,3	bare
XA2-L,10	XA4-R,14	wht-grn	XA4-C,3	TB2-3	wht-red
XA2-M,11	E61	blk	XA4-D,4	XA3-D,4	bare
XA2-N,12	XA1-N,12	bare	XA4-E,5	A8E20	brn
XA2-N,12	XA3-N,12	bare	XA4-E,5	XF5-1	brn
XA2-P,13	A11Q13-B	wht-blk-grn	XA4-F,6	XA1-R	yel
XA2-R,14	A7E40	wht	XA4-H	A8E22	wht-orn-grn
XA2-S,15	XA1-S,15	bare	XA4-J,8	XA3-J,8	bare
XA2-S,15	XA3-S,15	bare	XA4-J,8	A11Q13-C	wht-red-vio
XA2-T,16	XA1-5,E	wht-brn-orn	XA4-K,9	XA3-K,9	bare
XA2-U,17	A7E39	wht-blk-blu	XA4-L	A9S2-1	wht-brn
XA2-V,18	XA1-V,18	bare	XA4-M,11	XA3-M	bare
XA2-V,18	XA3-V,18	bare	XA4-M,11	TB1-3	vio
XA2-W,19	A11Q13-E	wht-orn-blu	XA4-N,12	XA3-N,12	bare
XA2-W,19	XA4-S	wht-orn-blu	XA4-P,13	E66	wht-orn-yel

*Indicates leadwire is part of component.

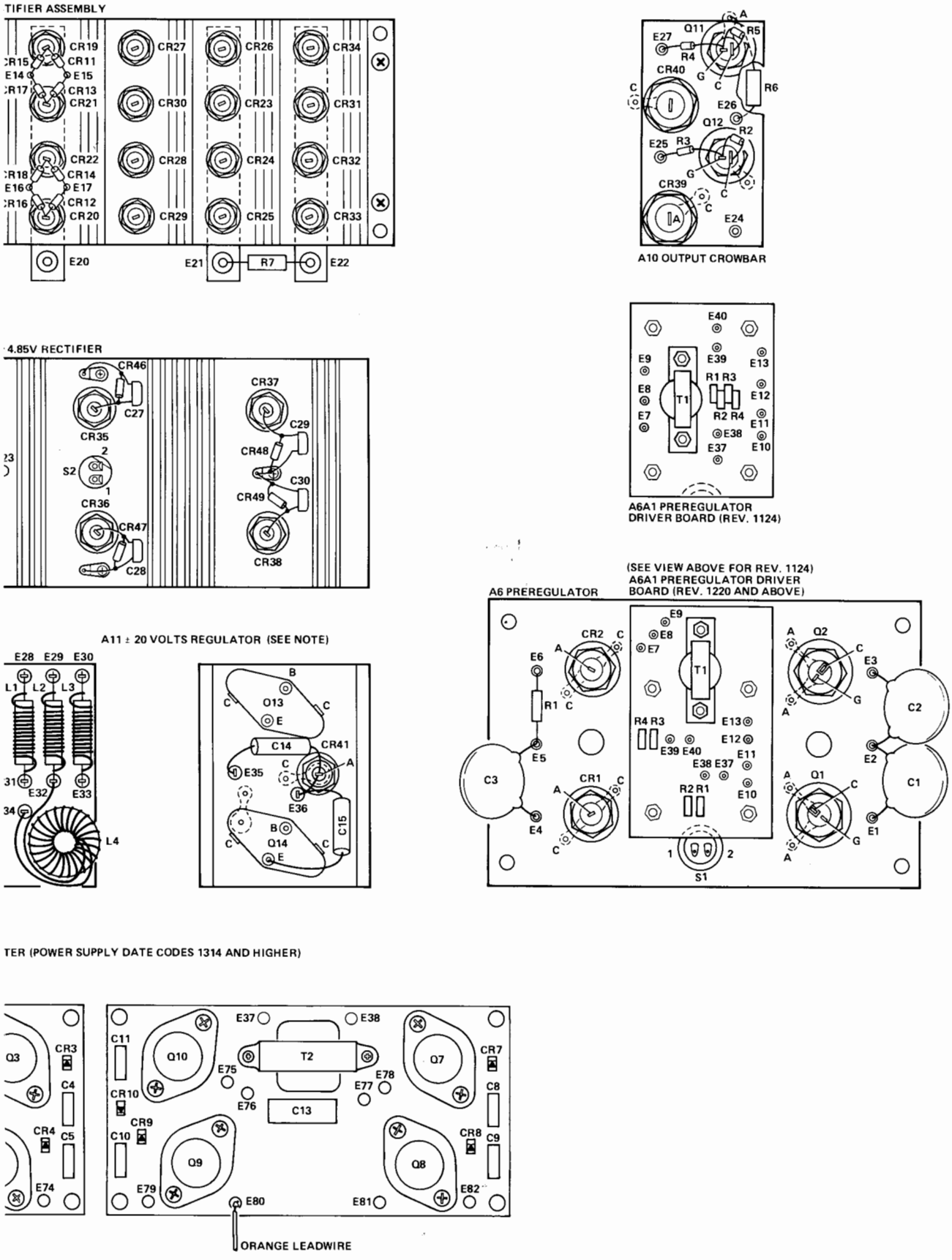
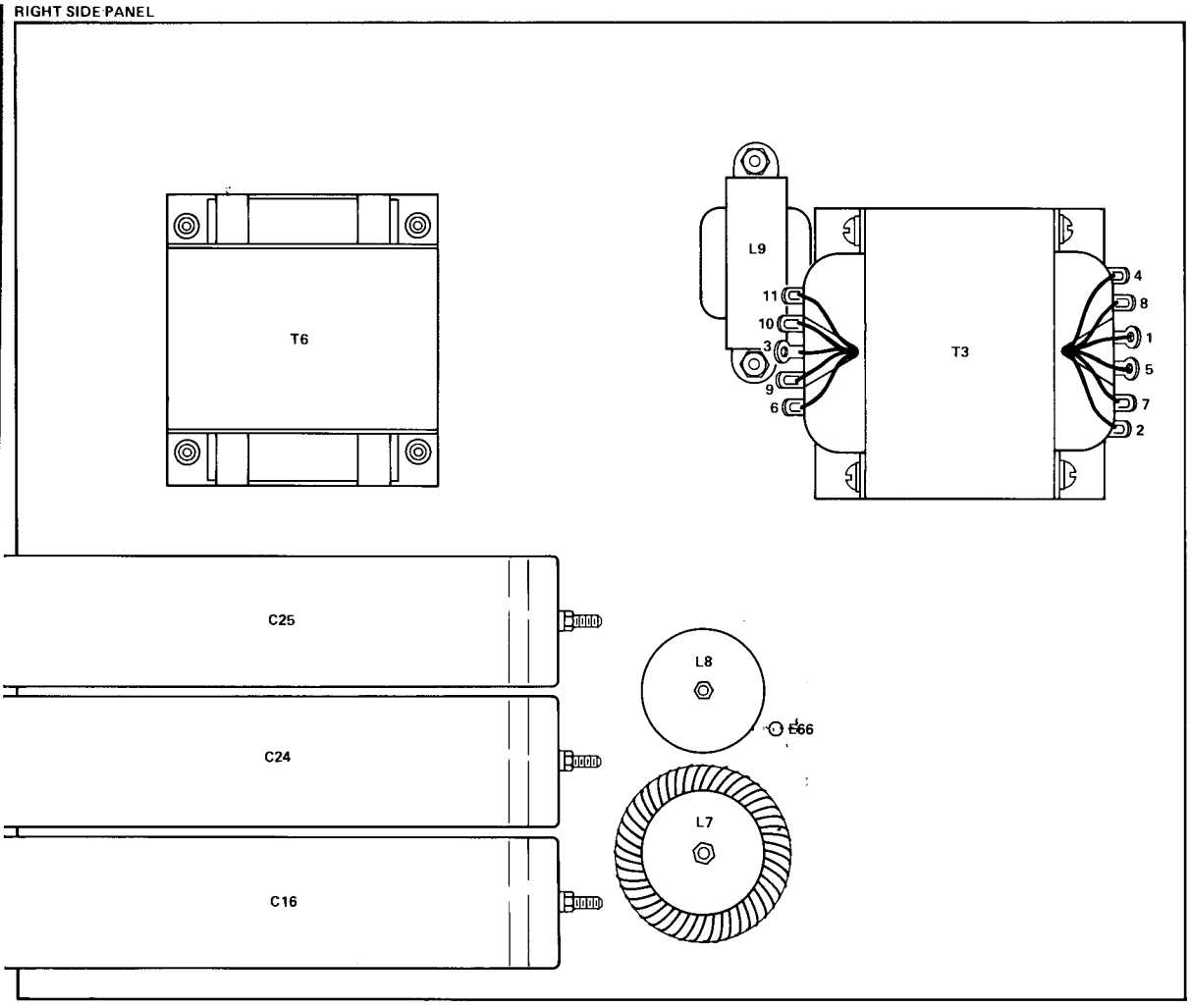
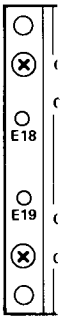


Figure 7-2. Power Supply, Wiring Diagram

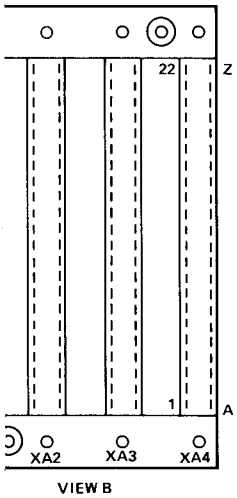
RIGHT SIDE PANEL



A8 REC

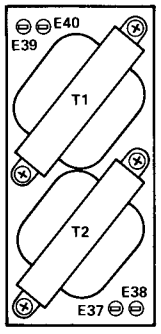


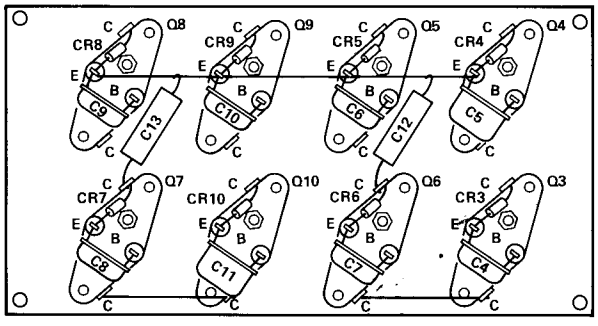
A9



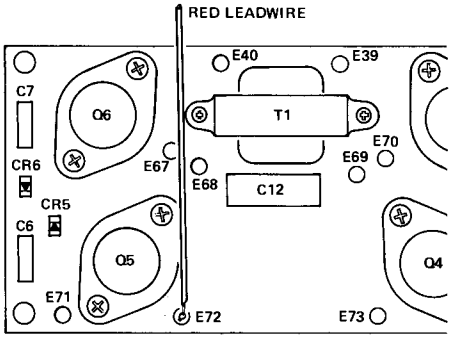
VIEW B

A7 INVERTER
(POWER SUPPLY DATE
CODES 1250 AND PRIOR)

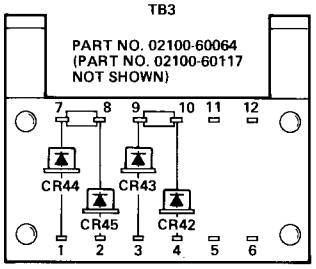




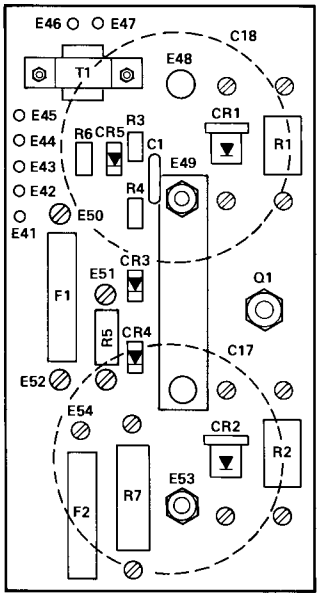
A7 INVER



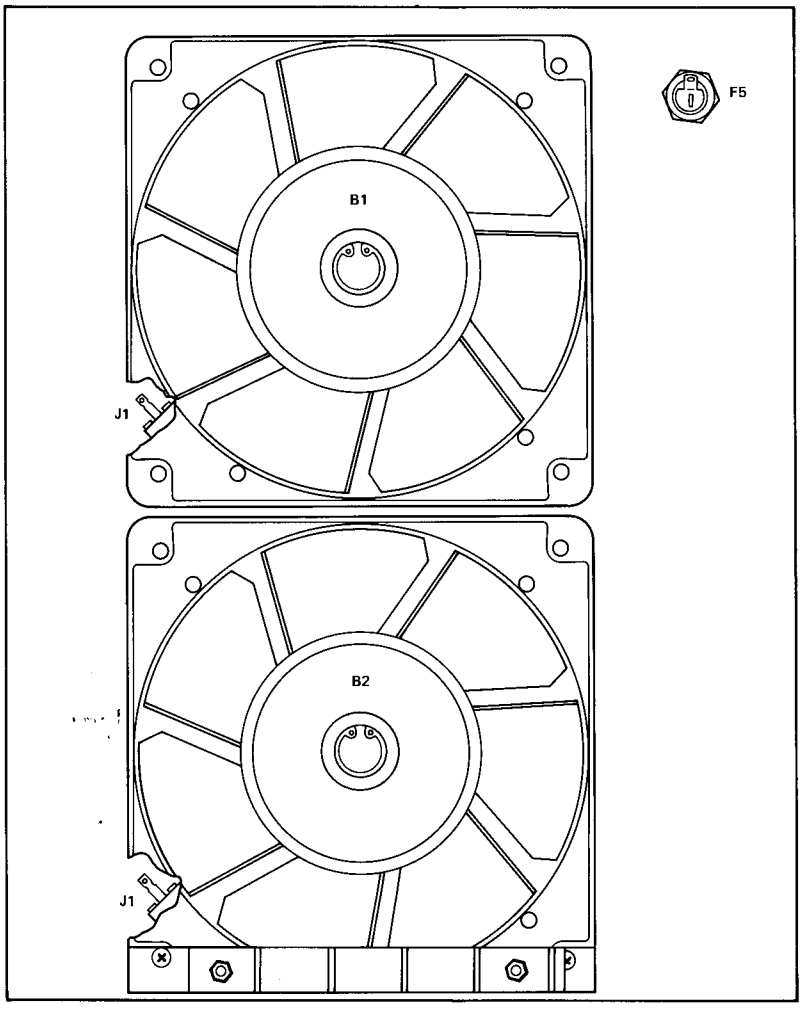
VIEW A
TB3



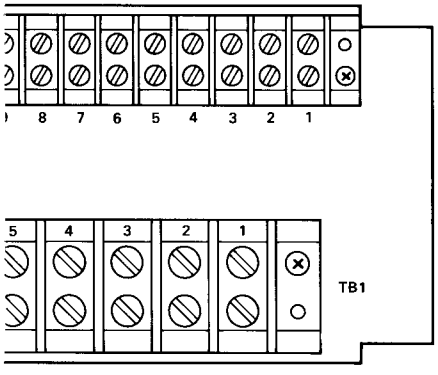
A5 160V OUTPUT BOARD

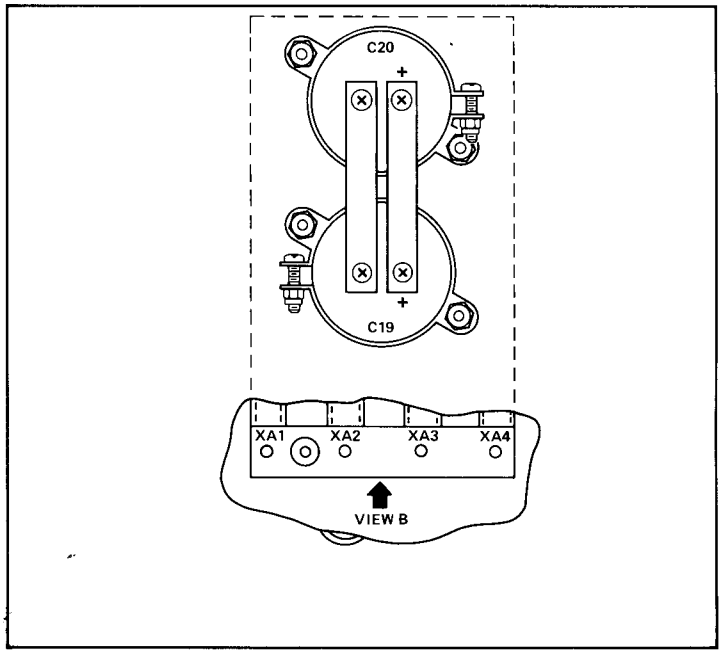


REAR PANEL

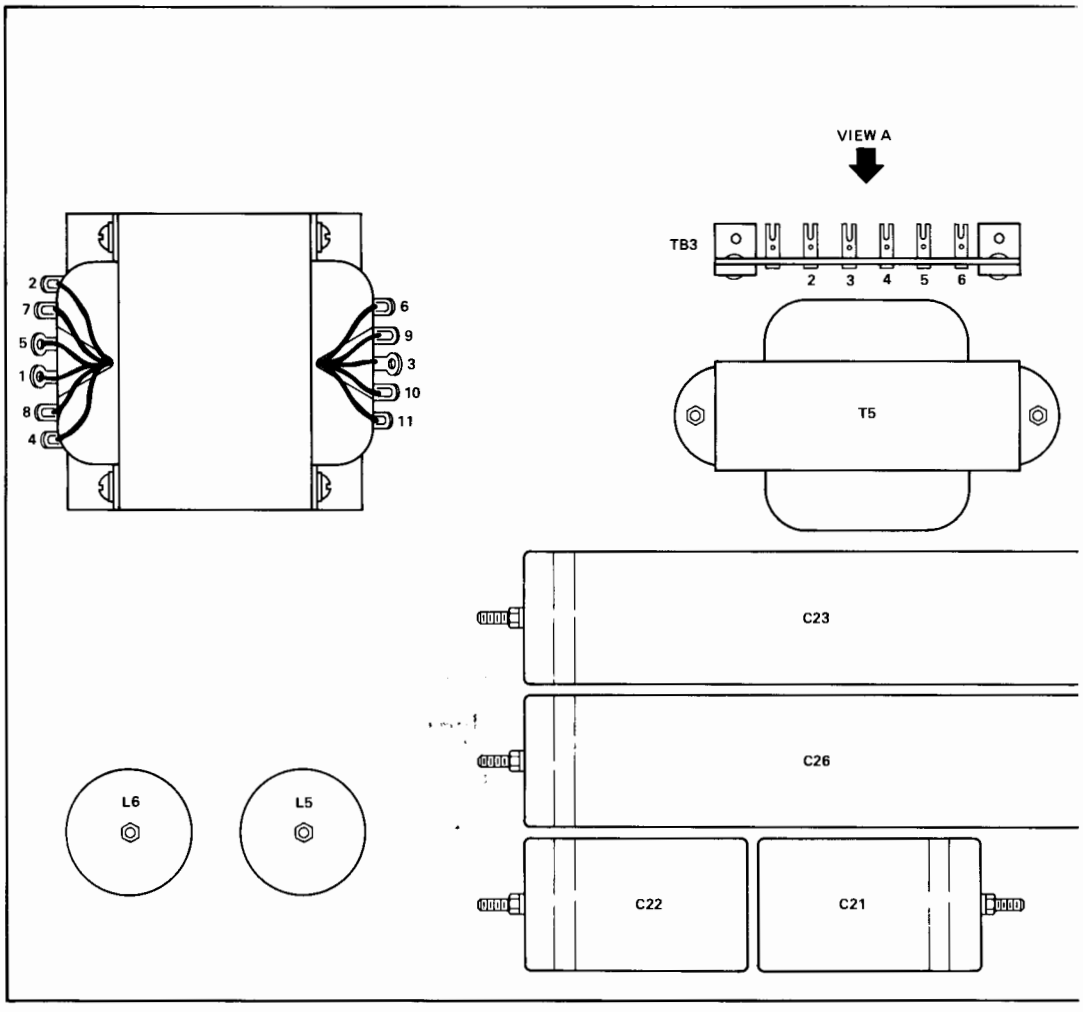


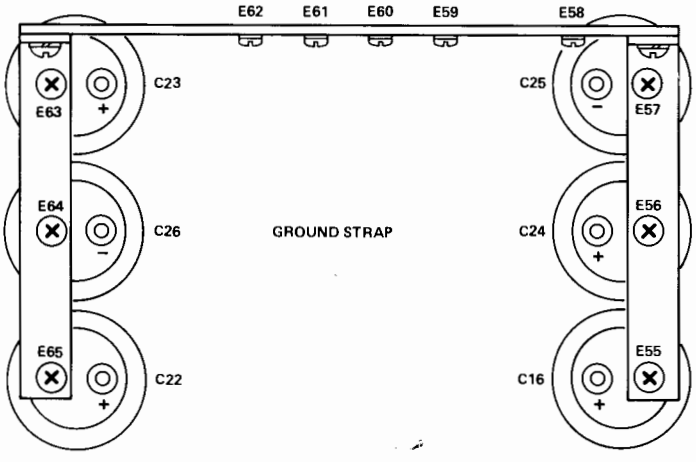
SUPPLY OUTPUT TERMINAL BOARD ASSEMBLY

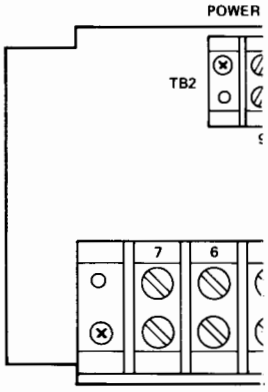




LEFT SIDE PANEL







NOTE: A11L1 AND A11L3 ARE REPLACED WITH JUMPER WIRES STARTING WITH POWER SUPPLY DATE CODE 1229.

2134-3E

Table 7-1. Point-to-Point Wiring List (Continued)

FROM	TO	COLOR		FROM	TO	COLOR
XA4-R,14	XA3-R,14	bare		XA4-Y,21	A9E23	wht-red-blu
XA4-R,14	XA2-10,L	wht-brn		XA4-Z,22	E60	blk
XA4-S	XA2-19,W	wht-orn-blu		XA4-7	XA3-H,7	bare
XA4-U,17	XA3-U,17	bare		XA4-10	XA3-L,10	bare
XA4-V,18	XA3-V,18	bare		XA4-16	XA2-B,2	wht
XA4-W	A11E35	wht-red-yel		XA4-19	XA3-W,19	bare
XA4-X,20	XA3-X,20	bare		XF5-1	XA4-E,5	brn
XA4-X,20	TB1-5	orn		XF5-2	TB2-4	wht-orn

Table 7-2. Power Supply, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	02100-60046	1	PREREGULATOR CONTROL CARD	28480	02100-60046
A1C1(NOTE 1)	0180-1794	1	C:FXD ELECT 22 UF 10% 35VDCW	56289	1500226X9035R2-DYS
A1C1(NOTE 2)	0180-0228	2	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A1C2	0180-0097	3	C:FXD TANT. 47 UF 10% 35VDCW	56289	1500476X9035S2-DYS
A1C3	0170-0040	2	C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A1C4	0160-0162	1	C:FXD MY 0.022 UF 10% 200VDCW	56289	192P22392-PTS
A1C5	0160-2055	6	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-COH
A1C6	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-COH
A1C7	0180-0197	4	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C8	0180-0291	9	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1C9	0160-0158	1	C:FXD MY 0.0056 UF 10% 200VDCW	56289	192P56292-PTS
A1C10	0150-0096	5	C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A1C11	0150-0121	5	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A1C12	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1C13	0160-0161	3	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A1C14	0150-0096		C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A1C15	0150-0096		C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A1C16	0150-0096		C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A1C17	0150-0096		C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A1C18	0180-0100	1	C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A1C19	0180-0161	1	C:FXD ELECT 3.3 UF 20% 35VDCW	56289	150D335X0035B2-DYS
A1C20	0160-2940	1	C:FXD MICA 470 PF 5% 300VDCW	72136	RDM15F471J3C
A1C21	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C22	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C23	0160-0153	3	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A1C24	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A1C25	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A1C26	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C27	0180-2415	1	C:FXD AL ELECT 200 UF +75-10% 40VDCW	56289	39D207G040EL4
A1CR1	1901-0040	9	DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR4	1901-0159	15	DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR7	1902-3171	3	DIODE BREAKDOWN:11.0V 5%	28480	1902-3171
A1CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR12	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR13	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR14	1902-3171		DIODE BREAKDOWN:11.0V 5%	28480	1902-3171
A1CR15	1902-3171		DIODE BREAKDOWN:11.0V 5%	28480	1902-3171
A1CR16	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR17	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR18(NOTE 3)	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1L1	9140-0131	2	COIL:FXD RF 10 MH	28480	9140-0131
A1Q1	1854-0039	13	TSTR:SI NPN	80131	2N3053
A1Q2	1854-0477	12	TSTR:SI NPN	80131	2N2222A
A1Q3	1853-0281	12	TSTR:SI PNP	80131	2N2907A
A1Q4	1855-0050	1	TSTR:SI FET DUAL	28480	1855-0050
A1Q5	1855-0062	1	TSTR:SI FET 30V	01295	2N1595
A1Q6	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q7	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q8	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q9	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q10	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q11	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q12	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q13	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q14	1854-0072	2	TSTR:SI NPN	80131	2N3054
A1Q15	1853-0052	2	TSTR:SI PNP	80131	2N3740
A1Q16	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q17	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q18	1854-0072		TSTR:SI NPN	80131	2N3054
A1Q19	1854-0477		TSTR:SI NPN	80131	2N2222A
A1R1	0698-3160	6	R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A1R2	0757-0460	2	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A1R3	0757-0199	7	R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R4	0757-0442	19	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R5	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R6	0757-0458	1	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1R7	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R8	0757-0394	2	R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394

NOTES: 1. First used on card rev. 1140.
2. Used on card rev. 1133 and 1139.
3. Used on card rev. 1133 only.

Table 7-2. Power Supply, Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R9	0757-0401	8	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R10	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R11	2100-2413	1	R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2413
A1R12	0757-0280	9	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R13	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A1R14	0757-0440	4	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1R15	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R16	0698-3162	13	R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A1R17	0757-0461	4	R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A1R18	0757-0279	2	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1R19	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1R20	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A1R21	0757-0439	1	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A1R22	0698-3410	1	R:FXD MET FLM 3.16K OHM 1% 1/2W	28480	0698-3410
A1R23	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R24	0757-0438	3	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R25	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1R26	0757-0465	8	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A1R27	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R28	0698-3441	1	R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
A1R29	0757-1094	1	R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A1R30	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A1R31	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A1R32	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R33	0698-3159	2	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A1R34	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R35	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R36	2100-2521	2	R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521
A1R37	0757-0290	1	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A1R38	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R39	0698-3454	1	R:FXD MET FLM 215K OHM 1% 1/8W	28480	0698-3454
A1R40	0698-3156	1	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A1R41	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R42	0698-3159		R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A1R43	0698-3155	18	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1R44	0683-0275	3	R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1R45	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1R46	0757-0288	1	R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A1R47	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R48	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1R49	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R50	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R51	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R52	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1R53	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1R54	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1R55	0757-0459	10	R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A1R56	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1R57	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1R58	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1R59	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1U1	1826-0070	13	IC:LINEAR OPER. AMPL.	07263	U6A7741393
A1U2	1826-0049	1	IC:VOLTAGE REGULATOR PROGRAMMABLE	07263	U6A7723393
A1U3	1826-0069	4	IC:LINEAR OPER. AMPL.	12040	LM301AD
A1U4	1826-0069		IC:LINEAR OPER. AMPL.	12040	LM301AD
A2	02100-60058	1	INVERTER DRIVER CARD	28480	02100-60058
A2C1	0180-1746	7	C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A2C2	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A2C3	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A2C4	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A2C5	0180-0141	4	C:FXD ELECT 50 UF +75-10% 50VDCW	56289	30D506G050DD2-DSM
A2C6	0180-0141		C:FXD ELECT 50 UF +75-10% 50VDCW	56289	30D506G050DD2-DSM
A2C7	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A2C8	0160-0298	1	C:FXD MY 0.0015 UF 10% 200VDCW	56289	192P15292-PTS
A2C9	0160-0194	5	C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A2C10	0160-0194		C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A2C11	0160-0194		C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A2C12	0160-0194		C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A2C13	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A2C14	0160-3456	1	C:FXD CER 1000 PF 10% 2500VDCW	14655	C067F251F102KS??-CD
A2C15	0160-0194		C:FXD MY 0.015 UF 10%	56289	192P15392-PTS
A2C16(NOTE 19)	0150-0093	1	C:FXD CER 0.01 UF +80 -20% 100VDCW	72982	801-K800011
A2CR1	1901-1065	12	DIODE:1N4936	28480	1901-1065
A2CR2	1901-1065		DIODE:1N4936	28480	1901-1065
A2CR3	1901-1065		DIODE:1N4936	28480	1901-1065
A2CR4	1901-1065		DIODE:1N4936	28480	1901-1065

NOTES: 19. First used on card rev. 1249.

Table 7-2. Power Supply, Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2CR5	1901-0050	16	DIODE:SI 200 MA AT 1V	07263	FDA 6308
A2CR6	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A2CR7	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A2CR8	1902-3149	1	DIODE BREAKDOWN:9.09V 5%	28480	1902-3149
A2CR9	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A2CR10	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A2CR11(NOTE 4)	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A2E1	0360-0294	11	TERMINAL:SOLDER POINT	28480	0360-0294
A2L1	9140-0098	1	COIL/CHOKE 2.20 UH 10%	99800	1537-20
A2L2	9140-0210	1	COIL/CHOKE 100 UH 5%	82142	15-1315-12J
A2L3	9140-0131		COIL:FXD RF 10 MH	28480	9140-0131
A2Q1	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q2	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q3	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q4	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q5	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q6	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q7	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q8	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q9	1854-0477		TSTR:SI NPN	80131	2N2222A
A2Q10(NOTE 5)	1853-0281		TSTR:SI PNP	80131	2N2907A
A2Q10(NOTE 6)	1854-0477		TSTR:SI NPN	80131	2N2222A
A2Q11	1854-0477		TSTR:SI NPN	80131	2N2222A
A2Q12	1854-0039		TSTR:SI NPN	80131	2N3053
A2Q13	1853-0281		TSTR:SI PNP	80131	2N2907A
A2Q14	1853-0281		TSTR:SI PNP	80131	2N2907A
A2Q15	1854-0477		TSTR:SI NPN	80131	2N2222A
A2Q16	1853-0052		TSTR:SI PNP	80131	2N3740
A2R1	0698-3402	9	R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A2R2	0698-3402		R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A2R3	0698-3438	5	R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A2R4	0698-3402		R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A2R5	0698-3402		R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A2R6	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A2R7	0698-3402		R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A2R8	0698-3402		R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A2R9	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A2R10	0698-3402		R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A2R11	0698-3402		R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A2R12	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A2R13	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A2R14	0698-0084	5	R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A2R15	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R16	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A2R17	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2R18	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R19	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R20	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A2R21	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R22	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R23	0698-3449	1	R:FXD MET FLM 28.7K OHM 1% 1/8W	28480	0698-3449
A2R24	0698-0082	11	R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A2R25	0698-3180	3	R:FXD MET OX 68 OHM 2% 2W	28480	0698-3180
A2R26	0698-3180		R:FXD MET OX 68 OHM 2% 2W	28480	0698-3180
A2R27	0811-1668	1	R:FXD WW 1.5 OHM 5% 2W	28480	0811-1668
A2R28	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R29	0698-7398	2	R:FXD FLM 6.124K OHM 0.1% 1/8W	28480	0698-7398
A2R30	0698-4037	5	R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A2R31	0698-7398		R:FXD FLM 6.124K OHM 0.1% 1/8W	28480	0698-7398
A2R32	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R33	0698-3445	2	R:FXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A2R34	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R35	2100-2521		R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521
A2R36	0757-0200	1	R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A2R37	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A2R38	0757-0458		R:FXD MET FLM 5.1K OHM 1% 1/8W	28480	0757-0458
A2R39	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R40	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R41	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A2R42	0757-0274	5	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A2R43	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A2R44	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R45	0757-1078	1	R:FXD MET FLM 1.47K OHM 1% 1/2W	28480	0757-1078
A2R46	0698-3452	3	R:FXD MET FLM 147K OHM 1% 1/8W	28480	0698-3452
A2R47	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A2U1	1820-0256	1	IC:DTL QUAD 2-INPUT POWER GATE	04713	MC858P

NOTES: 4. Used on card rev. 1126 only.
5. First used on card rev. 1140.
6. Used on card rev. 1126 only. Use 1853-0281 for replacement.

Table 7-2. Power Supply, Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2U2	1820-0054	1	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2U3	1820-0141	1	IC:TTL QUAD 2-INPT AND GATE	04713	MC3001P
A2U4	1820-0512	1	IC:TTL DUAL D F/F	01295	SN74H74N
A2U5	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A2U6	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A2U7	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A2U8	1826-0069		IC:LINEAR OPER. AMPL.	12040	LM301AD
A2U9	1826-0069		IC:LINEAR OPER. AMPL.	12040	LM301AD
A3	02100-60047	1	PROTECTION AND CONTROL CARD	28480	02100-60047
A3C1	0160-3456	12	C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C2	0160-2143	3	C:FXD CER 2000 PF +80-20% 1000VDCW	91418	TYPE B
A3C3	0170-0040		C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A3C4	0160-2143		C:FXD CER 2000 PF +80-20% 1000VDCW	91418	TYPE B
A3C5	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A3C6	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C7	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C8	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A3C9	0180-0376	1	C:FXD ELECT 0.47 UF 10% 35VDCW	56289	150D474X9035A2-DYS
A3C10	0160-2143		C:FXD CER 2000 PF +80-20% 1000VDCW	91418	TYPE B
A3C11	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C12	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A3C13	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A3C14	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C15	0180-0098	1	C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A3C16	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C17	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A3C18	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C19	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C20	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A3C21	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C22	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C23	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C24	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C25	0160-0174	9	C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C1187S-CML
A3C26	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C27	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3C28	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CD
A3CR1	1901-0033	26	DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR2	1902-3245	1	DIODE BREAKDOWN:SILICON 21.5V 5%	28480	1902-3245
A3CR3	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR4	1902-0041	1	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A3CR5	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR6	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR7	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR8	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR9	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR10	1902-0033	2	DIODE:BREAKDOWN 6.2V	04713	1N823
A3CR11	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR12	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR13	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR14	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR15	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR16	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR17	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR18	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR19	1902-0033		DIODE:BREAKDOWN 6.2V	04713	1N823
A3CR20 (NOTE 20)	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR21	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR22	1902-3139	1	DIODE:BREAKDOWN 8.25V 5%	04713	SZ10939-158
A3CR23	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR24	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR25	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR26	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR27	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR28	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR29	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR30	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3CR31	1901-0033		DIODE:SILICON 100MA 180WV	07263	FD3369
A3E1	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A3E2	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A3E3	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A3Q1	1854-0039		TSTR:SI NPN	80131	2N3053
A3Q2	1853-0281		TSTR:SI PNP	80131	2N2907A
A3Q3	1854-0039		TSTR:SI NPN	80131	2N3053
A3Q4	1853-0281		TSTR:SI PNP	80131	2N2907A

NOTES: 20. Used only on card rev. 1132 and 1147.

Table 7-2. Power Supply, Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3Q5	1854-0039		TSTR:SI NPN	80131	2N3053
A3Q6	1853-0281		TSTR:SI PNP	80131	2N2907A
A3R1	0698-0083	1	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R2	0698-3445		R:FXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A3R3	0757-0428	3	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A3R4	2100-2574	1	R:VAR CERMET 500 OHM 10% LIN 1/2W	28480	2100-2574
A3R5	0757-0441	2	R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A3R6	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A3R7	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3R8	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R9	0698-3136	1	R:FXD MET FLM 17.8K OHM 1% 2/8W	19701	MF4C T-0
A3R10	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A3R11	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R12	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A3R13	0757-0198	2	R:FXD MET FLM 100 OHM 1% 1/2W	28480	0757-0198
A3R14	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R15	0698-3150	3	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R16	0757-0346	3	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A3R17	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A3R18	0698-3152	1	R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A3R19	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A3R20	0757-0422	1	R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A3R21	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R22	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R23	0757-0446	7	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R24	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R25	0757-0418	1	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A3R26	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R27	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R28	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R29	0698-3455	3	R:FXD MET FLM 261K OHM 1% 1/8W	28480	0698-3455
A3R30	0698-4442	1	R:FXD MET FLM 4.42K OHM 1% 1/8W	28480	0698-4442
A3R31	0698-3455		R:FXD MET FLM 261K OHM 1% 1/8W	28480	0698-3455
A3R32	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R33	0757-0462	2	R:FXD MET FLM 75.0K OHM 1% 1/8W	28480	0757-0462
A3R34	0757-0123	2	R:FXD MET FLM 34.8K OHM 1% 1/8W	28480	0757-0123
A3R35	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A3R36	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R37	0698-3158	4	R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R38	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R39	0698-3398	1	R:FXD MET FLM 46.4 OHM 1% 1/2W	28480	0698-3398
A3R40(NOTE 7)	0757-0416	1	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A3R40(NOTE 8)	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A3R41	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R42	0698-3151	1	R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A3R43	0698-3157	2	R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A3R44	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R45(NOTE 21)	0698-3388	1	R:FXD MET FLM 14.7 OHM 1% 1/2W	28480	0698-3388
A3R45(NOTE 22)	0757-0984	1	R:FXD MET FLM 10.0 OHM 1% 1/2W	28480	0757-0984
A3R46	0757-0198		R:FXD MET FLM 100 OHM 1% 1/2W	28480	0757-0198
A3R47(NOTE 23)	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R47(NOTE 23)	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A3R48	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R49(NOTE 21)	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R49(NOTE 22)	0757-0290	2	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A3R50	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A3R51	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R52	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R53(NOTE 7)	0757-0123		R:FXD MET FLM 34.8K OHM 1% 1/8W	28480	0757-0123
A3R53(NOTE 8)	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R54	0698-3447	2	R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A3R55(NOTE 21)	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R55(NOTE 22)	0698-3455		R:FXD MET FLM 261K OHM 1% 1/8W	28480	0698-3455
A3R56	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A3R57(NOTE 21)	0757-0421	1	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A3R57(NOTE 22)	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A3R58	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R59(NOTE 7)	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R59(NOTE 8)	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R60(NOTE 21)	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R60(NOTE 22)	0757-0442	1	R:FXD MET FLM 10K OHMS 15 1/8W	28480	0757-0442
A3R61(NOTE 7)	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R61(NOTE 8)	0757-0441		R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A3R61(NOTE 22)	0757-0290		R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A3R62	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R63	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R64	2100-2522	1	R:VAR CERMET 10K OHM 10% LIN 1/2W	28480	2100-2522
A3R65	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A3R66	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R67	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A3R68	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465

NOTES: 7. First used on card rev. 1147.
8. Used on card rev. 1132 only.
21. Used on card rev. 1132 and 1147 only.
22. First used on card rev. 1215.
23. Replaced with jumper on card rev. 1215.

Table 7-2. Power Supply, Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R69	0757-0444	1	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A3R70	0698-3155		R:FXD MET FLM 4.64K OHM 1%1/8W	28480	0698-3155
A3R71	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R72	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R73	0757-0460		R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A3U1	1821-0001	3	TRANSISTOR ARRAY:SI NPN	02735	CA3046
A3U2	1821-0001		TRANSISTOR ARRAY:SI NPN	02735	CA3046
A3U3	1821-0001		TRANSISTOR ARRAY:SI NPN	02735	CA3046
A3W1(NOTE 22)	8159-0005	2	JUMPER WIRE	28480	8159-0005
A3W2(NOTE 22)	8159-0005		JUMPER WIRE	28480	8159-0005
A4	02100-60061	1	CURRENT LIMIT CARD	28480	02100-60061
A4C1	0160-0168	3	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C2	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C3	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C4	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C5	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C6	0170-0024	2	C:FXD MY 0.022UF 20% 200VDCW	56289	192P22302
A4C7	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C8	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A4C9	0180-0049	4	C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A4C10	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A4C11	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C12	0170-0024		C:FXD MY 0.022UF 20% 200VDCW	56289	192P22302
A4C13	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C14	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A4C15	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A4C16	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C17	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4CR2	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR3	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR4	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR5	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR6	1902-3290	2	DIODE BREAKDOWN:SILICON 31.6V 5%	28480	1902-3290
A4CR7	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR8	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR9	1902-3290		DIODE BREAKDOWN:SILICON 31.6V 5%	28480	1902-3290
A4CR10	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR11	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR12	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR13	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4E1	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A4E2	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A4E3	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A4E4	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A4E5	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A4E6	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A4E7	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A4Q1	1853-0281		TSTR:SI PNP	80131	2N2907A
A4R1	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R2	0757-0461		R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A4R3	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R4	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A4R5	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R7	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R8	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R9	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R10	0698-3452		R:FXD MET FLM 147K OHM 1% 1/8W	28480	0698-3452
A4R11	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R12	0757-0464	1	R:FXD MET FLM 90.9K OHM 1% 1/8W	28480	0757-0464
A4R13	0698-3260	3	R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A4R14	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R15	0757-0461		R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A4R16	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R17(NOTE 9)	0698-3450	1	R:FXD MET FLM 42.2K OHM 1% 1/8W	28480	0698-3450
A4R17(NOTE 10)	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A4R18	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R19	0698-3266	1	R:FXD MET FLM 237K OHM 1% 1/8W	28480	0698-3266
A4R20	0698-3459	2	R:FXD MET FLM 383K OHM 1% 1/8W	28480	0698-3459
A4R21	0698-3452		R:FXD MET FLM 147K OHM 1% 1/8W	28480	0698-3452
A4R22	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R23	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R24	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R25	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R26	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R27	0698-3161	1	R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A4R28	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R29	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199

NOTES: 9. First used on card rev. 1144.
10. Used on card rev. 1126 only.

Table 7-2. Power Supply, Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R30	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R31	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R32	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R33	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R34	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R35	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A4R36	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A4R37	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R38	0757-0461		R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A4R39	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R40	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A4R41	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R42	0698-4037		R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R43	0698-4037		R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R44	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A4R45	0698-4037		R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R46	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A4R47	0698-4037		R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R48	0683-8245	1	R:FXD COMP 820K OHM 5% 1/4W	01121	CB 8245
A4R49	0698-3459		R:FXD MET FLM 383K OHM 1% 1/8W	28480	0698-3459
A4R50	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R51	0698-3456	1	R:FXD MET FLM 287K OHM 1% 1/8W	28480	0698-3456
A4R52	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R53	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R54	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R55	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R56	0757-0462		R:FXD MET FLM 75.0K OHM 1% 1/8W	28480	0757-0462
A4R57	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R58	0757-0463	1	R:FXD MET FLM 82.5K OHM 1% 1/8W	28480	0757-0463
A4R59	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A4U1	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U2	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U3	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U4	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U5	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U6	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U7	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U8	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U9	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A5	02100-60048	1	OUTPUT BOARD ASSY:+160V	28480	02100-60048
A5C1	0160-0127	1	C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A5C17	0180-2418	2	C:FXD AL ELECT 9800 UF +75-10% 100VDCW	56289	36D982G100CC2A
A5C18	0180-2418		C:FXD AL ELECT 9800 UF +75-10% 100VDCW	56289	36D982G100CC2A
A5CR1	1901-0164	6	DIODE:SILICON 200PIV 3A	04713	1N4721
A5CR2	1901-0164		DIODE:SILICON 200PIV 3A	04713	1N4721
A5CR3(NOTE 11)	1902-0175	2	DIODE BREAKDOWN:SILICON 100V 5%	28480	1902-0175
A5CR3(NOTE 12)	1902-3416	2	DIODE BREAKDOWN:90.9V 5% 400 MW	07910	CD35982
A5CR4(NOTE 11)	1902-0175		DIODE BREAKDOWN:SILICON 100V 5%	28480	1902-0175
A5CR4(NOTE 12)	1902-3416		DIODE BREAKDOWN:90.9V 5% 400 MW	07910	CD35982
A5CR5	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A5F1	2110-0083	2	FUSE:2/2.5A(FOR 230V OPERATION)	28480	2110-0083
A5F2	2110-0083		FUSE:2/2.5A(FOR 230V OPERATION)	28480	2110-0083
A5Q1(NOTE 13)	1884-0219	3	THYRISTOR	28480	1884-0219
A5Q1(NOTE 14)	1884-0211	3	THYRISTOR:SCR SI NPN	04713	2N5171
A5R1	0764-0018	2	R:FXD MET FLM 4700 OHM 5% 2W	28480	0764-0018
A5R2	0764-0018		R:FXD MET FLM 4700 OHM 5% 2W	28480	0764-0018
A5R3	0757-0284	5	R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A5R4	0757-0316	6	R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A5R5	0689-0275	1	R:FXD COMP 2.7 OHM 5% 1W	01121	GB 27G5
A5R6	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A5R7	0811-3108	1	R:FXD WW 2 OHM 10%	28480	0811-3108
A5T1	9100-2927	1	TRANSFORMER:PULSE	28480	9100-2927
A6C1	0160-0904	3	C:FXD CER 0.05 UF 20% 1000VDCW	56289	41C 169A4-CDH
A6C2	0160-0904		C:FXD CER 0.05 UF 20% 1000VDCW	56289	41C 169A4-CDH
A6C3	0160-0904		C:FXD CER 0.05 UF 20% 1000VDCW	56289	41C 169A4-CDH
A6CR1	1901-0314	2	DIODE:RECTIFIER 12A 600V	04713	MR886
A6CR2	1901-0314		DIODE:RECTIFIER 12A 600V	04713	MR886
A6Q1(NOTE 15)	1884-0219		THYRISTOR	28480	1884-0219
A6Q1(NOTE 16)	1884-0211		THYRISTOR:SCR SI NPN	04713	2N5171
A6Q2(NOTE 15)	1884-0219		THYRISTOR	28480	1884-0219
A6Q2(NOTE 16)	1884-0211		THYRISTOR:SCR SI NPN	04713	2N5171
A6R1	0698-3402		R:FXD MET FLM 316 OHM 1% 1/2W	28480	0698-3402
A6S1	3103-0015	2	SWITCH:THERMAL FXD SPST	28480	3103-0015
A6A1	02100-60059	1	PREREGULATOR DRIVER BOARD ASSY	28480	02100-60059
A6A1R1	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316

NOTES:
11. First used on card rev. 1330.
12. Used on card rev. 1125 only.
13. First used on card rev. 1150.
14. Used on card rev. 1125 and 1139. Use 1884-0219 for replacement.
15. First used on power supply with date code 1146.
16. Used on power supply with date code 1126, 1140, and 1141. Use 1884-0219 for replacement.

Table 7-2. Power Supply, Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A1R2	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A6A1R3	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A6A1R4	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0234
A6A1T1	9100-2925	1	TRANSFORMER:PULSE	28480	9100-2925
A7C4 THRU A7C11	0160-0174		C:FXD CER 0.47 UF +80-20% 25VDCW	56289	5C1187S-CML
A7C12	0160-0303	2	C:FXD MYLAR .15 UF 10% 200VDCW	28480	0160-0303
A7C13	0160-0303		C:FXD MYLAR .15 UF 10% 200VDCW	28480	0160-0303
A7CR3 THRU A7CR10	1901-1065		DIODE:1N4936	28480	1901-1065
A7Q3 THRU A7Q10	1854-0080	8	TSTR:SI NPN	28480	1854-0080
A7T1	9100-2924	2	TRANSFORMER:PULSE	28480	9100-2924
A7T2	9100-2924		TRANSFORMER:PULSE	28480	9100-2924
A8CR11 THRU A8CR18	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A8CR19 THRU A8CR26	1901-1036	9	DIODE:RECTIFIER 12A 100V	04713	MR881
A8CR27 THRU A8CR30	1901-1062	8	DIODE:POWER RECTIFIER	04713	MBD-5400
A8CR31 THRU A8CR34	1901-1035	4	DIODE:FXD 100V 12 AMP	28480	1901-1035
A8R7	0761-0021	1	R:FXD MET OX 1000 OHM 5% 1W	28480	0761-0021
A9C27 THRU A9C30	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A9CR35 THRU A9CR38	1901-1062		DIODE:POWER RECTIFIER	04713	MBD-5400
A9CR46 THRU A9CR49	1902-0202	4	DIODE BREAKDOWN:15.0V 5% 1W	28480	1902-0202
A9S2	3103-0015		SWITCH:THERMAL FXD SPST	28480	3103-0015
A10CR39	1901-0315	2	DIODE:SI 50 PIV 40A	80131	1N1183A
A10CR40	1901-0315		DIODE:SI 50 PIV 40A	80131	1N1183A
A10Q11	1884-0208	2	THYRISTOR:35 AMP RMS 100V	12040	NL570A
A10Q12	1884-0208		THYRISTOR:35 AMP RMS 100V	12040	NL570A
A10R2	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A10R3	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A10R4	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A10R5	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A10R6	0698-3180		R:FXD MET OX 68 OHM 2% 2W	28480	0698-3180
A11C14	0180-0141		C:FXD ELECT 50 UF +75-10% 50VDCW	56289	30D506G050DD2-DSM
A11C15(NOTE 24)	0180-0141		C:FXD ELECT 50 UF +75-10% 50VDCW	56289	30D506G050DD2-DSM
A11C15(NOTE 25)	0180-2546	1	C:FXD ELECT 770 UF #75-10% 40VDCW	56289	601D777G040CP4-DAC
A11CR41	1901-1036		DIODE:RECTIFIER 12A 100V	04713	MR881
A11L1(NOTE 24)	9100-2928	3	INDUCTOR:4 UH	28480	9100-2928
A11L2	9100-2928		INDUCTOR:4 UH	28480	9100-2928
A11L3(NOTE 24)	9100-2928		INDUCTOR:4 UH	28480	9100-2928
A11L4(NOTE 17)	9100-2934	1	INDUCTOR	28480	9100-2934
A11L4(NOTE 17)	9100-2926	1	INDUCTOR:200 UH	28480	9100-2926
A11Q13	1853-0310	2	TSTR:SI PNP	04713	2N4398
A11Q14	1853-0310		TSTR:SI PNP	04713	2N4398
B1	3160-0224	2	FAN:TUBE AXIAL	28480	3160-0224
B2	3160-0224		FAN:TUBE AXIAL	28480	3160-0224
C16	0180-2416	1	C:FXD AL ELECT 9900 UF +75-10% 30VDCW	56289	602D992G030AF2A
C19	0180-2417	2	C:FXD AL ELECT 430 UF +50-10% 200VDCW	56289	36D431F200AB2A
C20	0180-2417		C:FXD AL ELECT 430 UF +50-10% 200VDCW	56289	36D431F200AB2A
C21	0180-2413	1	C:FXD AL ELECT 7500 UF +75-10% 15VDCW	56289	36D752G015AA2A
C22	0180-2414	1	C:FXD AL ELECT 2900 UF +75-10% 40VDCW	56289	36D292G040AA2A
C23	0180-2410	2	C:FXD ELECT 18000 UF +75-10% 15VDCW	56289	602D183G015AF2A
C24	0180-2411	1	C:FXD AL ELECT 22000 UF +75-10% 10VDCW	56289	602D223G010AF2A
C25	0180-2412	1	C:FXD AL ELECT 37000 UF +75-10% 5VDCW	56289	602D373G5R0AF2A
C26	0180-2410		C:FXD ELECT 18000 UF +75-10% 15VDCW	56289	602D183G015AF2A
CR42 THRU CR45	1901-0164		DIODE:SILICON 200PIV 3A	04713	1N4721
F5	2110-0004	1	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
L5 (NOTE 18)	9100-2931	2	INDUCTOR	28480	9100-2931
L5 (NOTE 18)	9100-2917	2	INDUCTOR:50 UH	28480	9100-2917
L6 (NOTE 18)	9100-2931		INDUCTOR	28480	9100-2931
L6 (NOTE 18)	9100-2917		INDUCTOR:50 UH	28480	9100-2917
L7 (NOTE 18)	9100-2932	1	INDUCTOR	28480	9100-2932
L7 (NOTE 18)	9100-2918	1	INDUCTOR:8 UH	28480	9100-2918
L8 (NOTE 18)	9100-2933	1	INDUCTOR	28480	9100-2933
L8 (NOTE 18)	9100-2919	1	INDUCTOR:9 UH	28480	9100-2919
L9	9100-2920	1	INDUCTOR:1.6 UH	28480	9100-2920
T3	9100-2923	2	TRANSFORMER:POWER	28480	9100-2923
T4	9100-2923		TRANSFORMER:POWER	28480	9100-2923
T5	9100-2922	1	TRANSFORMER:POWER	28480	9100-2922
T6	9100-2921	1	INDUCTOR:DUAL 8 MH	28480	9100-2921

NOTES: 17. Encapsulated (9100-2934) and open (9100-2927) inductors are electrically but not mechanically interchangeable. See Section VI for replacement information.
18. Note 17 applies (9100-2931, 9100-2932, and 9100-2933 are encapsulated inductors).
24. Used only on power supplies prior to date code 1229.
25. First used on power supply date code 1229.

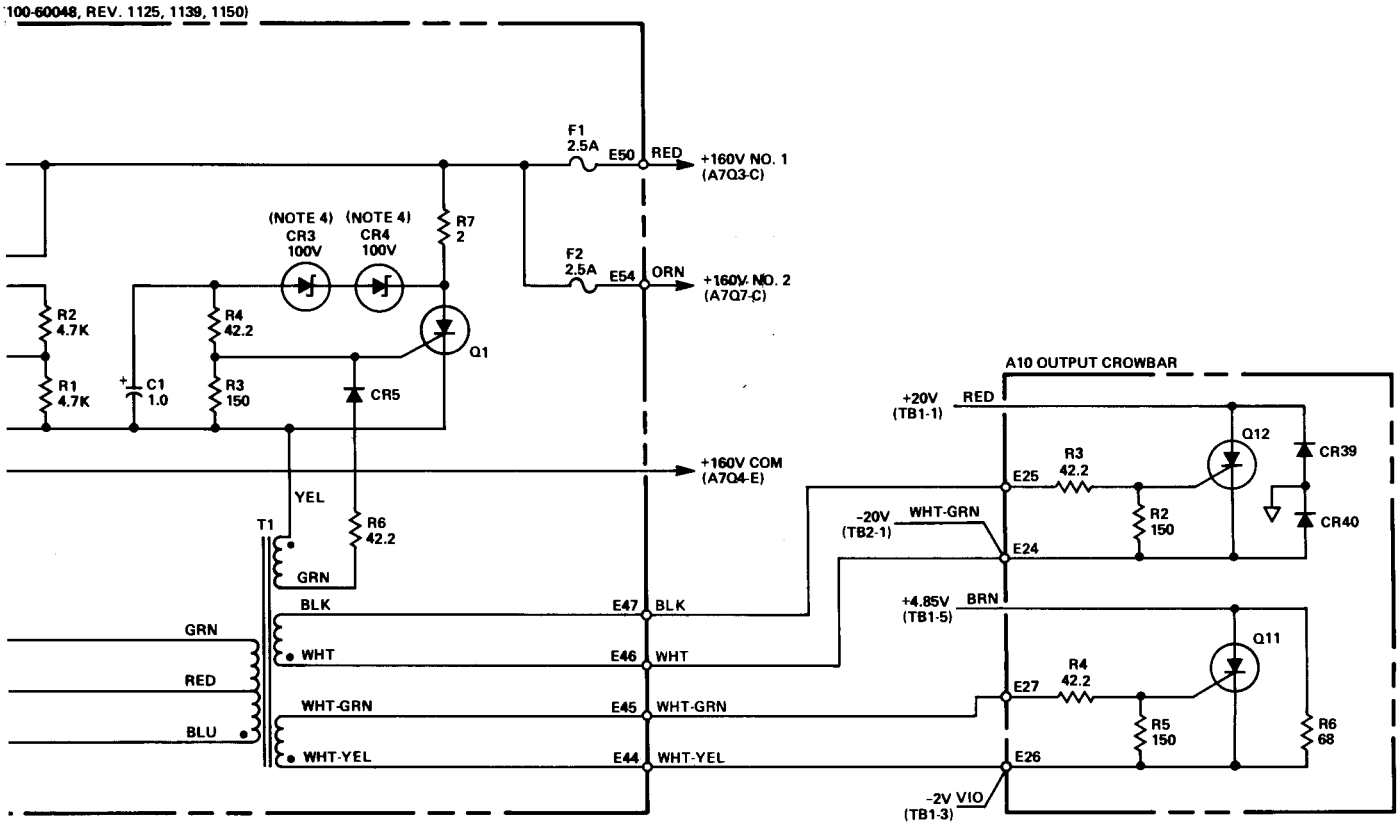
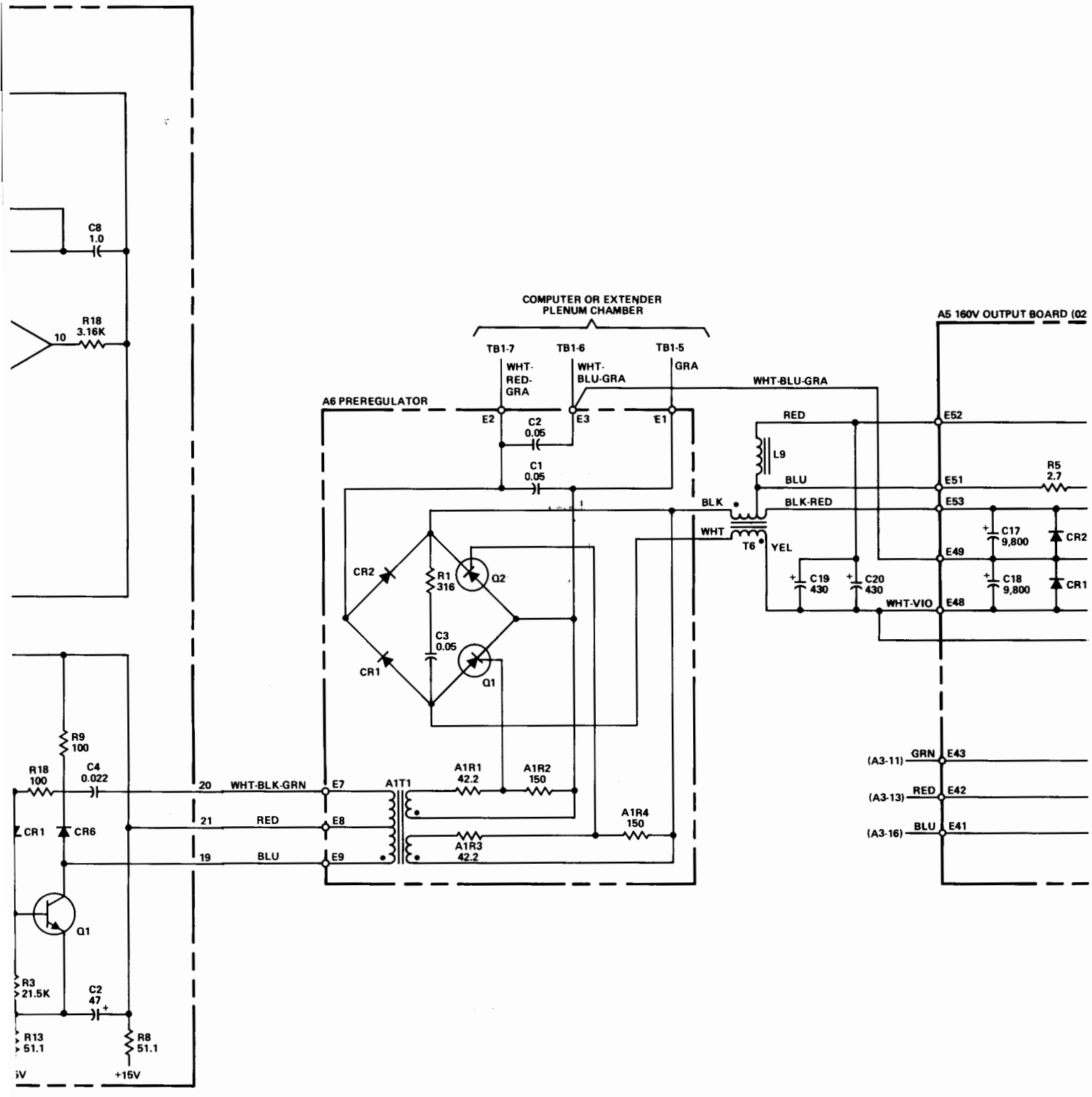
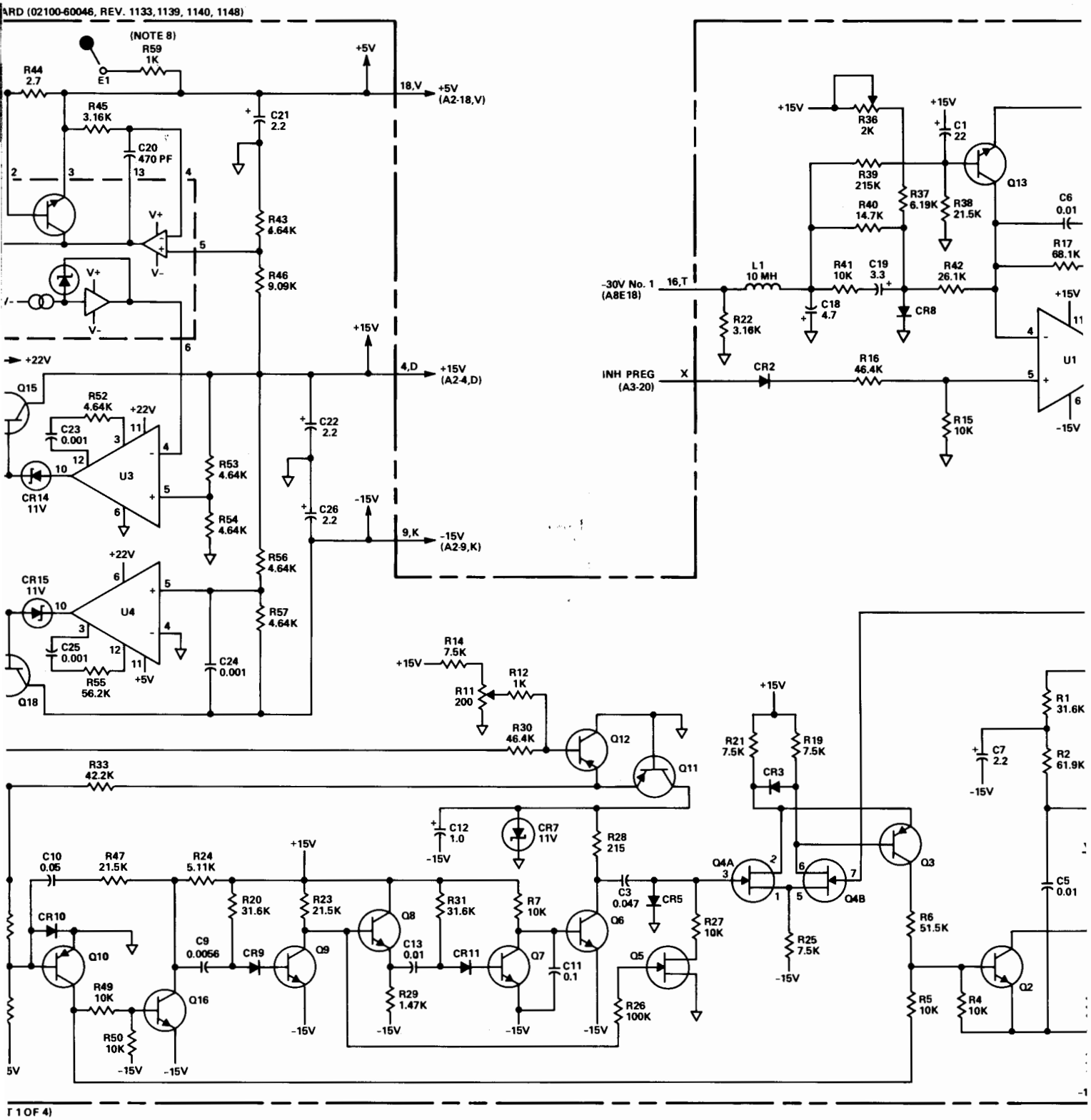


Figure 7-3. Power Supply (Preregulator Control) Parts Location and Schematic Diagrams, Date Codes Prior to 1240 (Sheet 1 of 4)

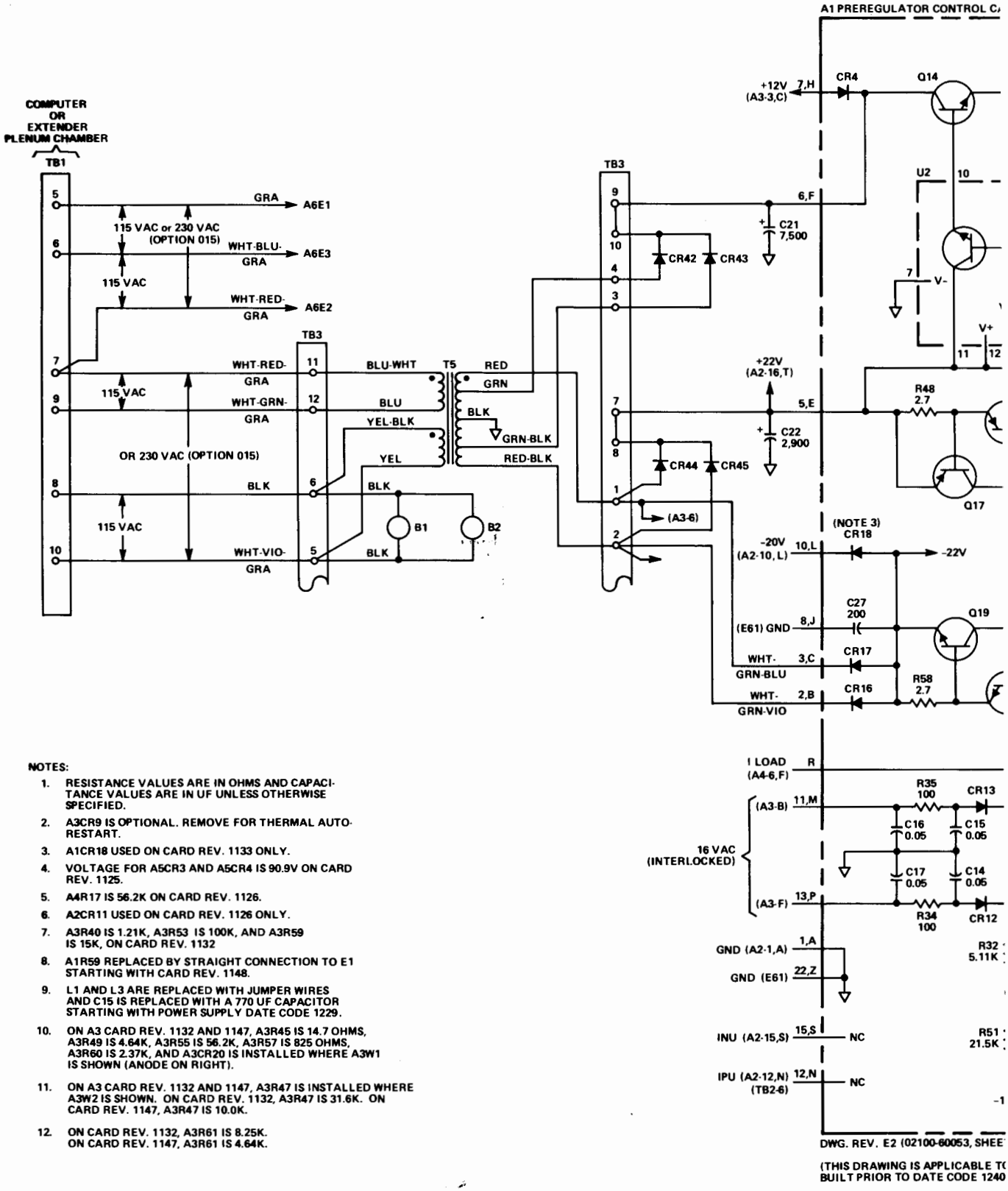

C8
1.0
R18
3.16K
10
COMPUTER OR EXTENDER
PLENUM CHAMBER
TB1-7
TB1-6
TB1-5
WHT-
RED-
GRA
WHT-
BLU-GRA
GRA
WHT-BLU-GRA
A6 PREREGULATOR
E2
E3
E1
C2
0.05
C1
0.05
A5 160V OUTPUT BOARD (02
RED
E52
L9
BLU
E51
R5
2.7
BLK
BLK-RED
E53
WHT
T6
YEL
C17
9,800
CR2
E49
C19
430
C20
430
C18
9,800
CR1
WHT-VIO
E48
CR2
R1
316
Q2
C3
0.05
CR1
Q1
R9
100
R18
100
C4
0.022
20
WHT-BLK-GRN
E7
A1T1
A1R1
42.2
A1R2
150
CR1
CR6
21
RED
E8
A1R4
150
19
BLU
E9
A1R3
42.2
(A3-11)
GRN
E43
(A3-13)
RED
E42
(A3-16)
BLU
E41
Q1
R3
21.5K
C2
47
R13
51.1
R8
51.1
+15V

ARD (02100-60046, REV. 1133, 1139, 1140, 1148)



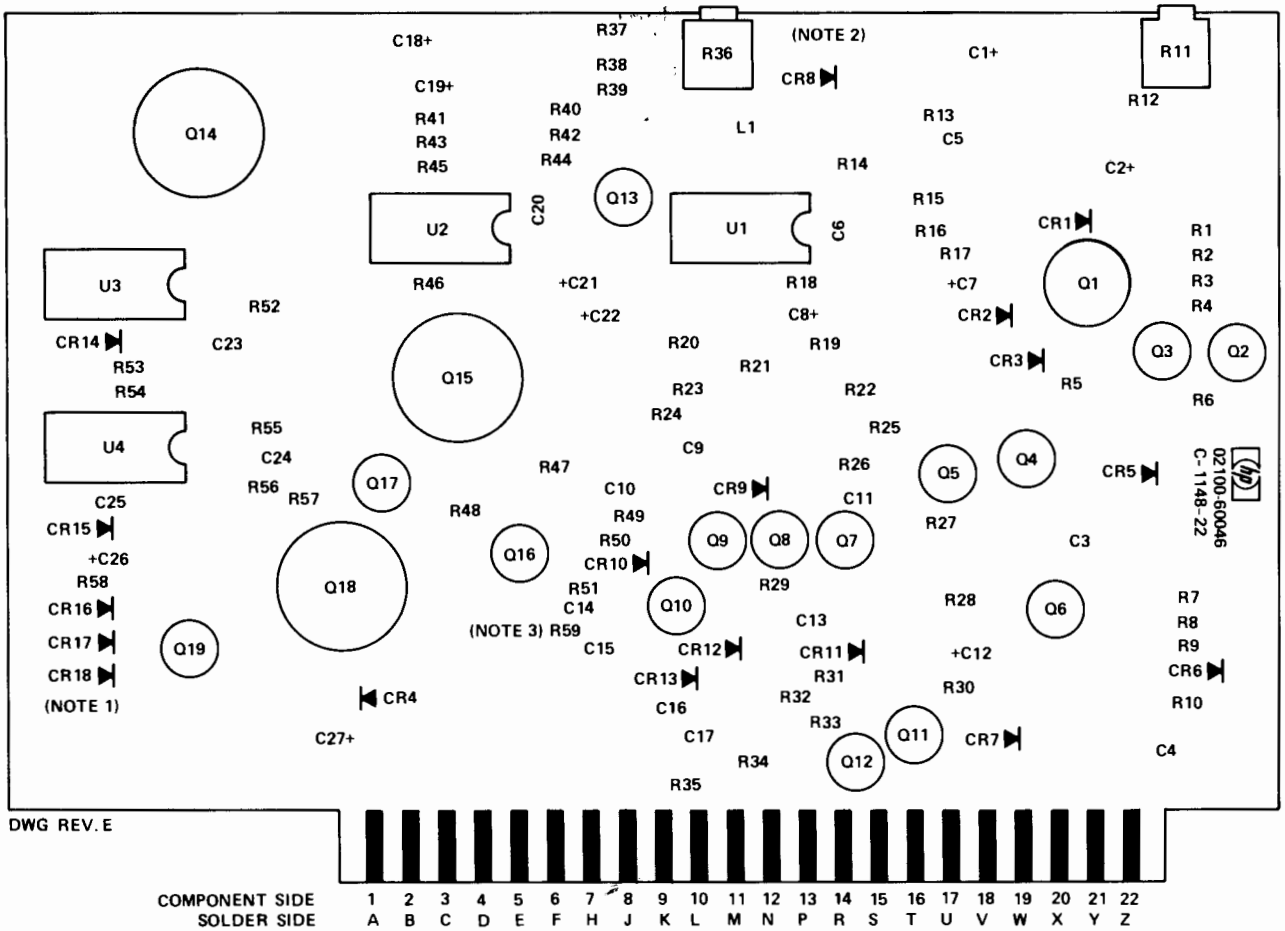
(T 1 OF 4)

) POWER SUPPLIES



NOTES:

1. RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. A3CR9 IS OPTIONAL. REMOVE FOR THERMAL AUTO-RESTART.
3. A1CR18 USED ON CARD REV. 1133 ONLY.
4. VOLTAGE FOR A5CR3 AND A5CR4 IS 90.9V ON CARD REV. 1125.
5. A4R17 IS 56.2K ON CARD REV. 1126.
6. A2CR11 USED ON CARD REV. 1126 ONLY.
7. A3R40 IS 1.21K, A3R53 IS 100K, AND A3R59 IS 15K, ON CARD REV. 1132
8. A1R59 REPLACED BY STRAIGHT CONNECTION TO E1 STARTING WITH CARD REV. 1148.
9. L1 AND L3 ARE REPLACED WITH JUMPER WIRES AND C15 IS REPLACED WITH A 770 UF CAPACITOR STARTING WITH POWER SUPPLY DATE CODE 1229.
10. ON A3 CARD REV. 1132 AND 1147, A3R45 IS 14.7 OHMS, A3R49 IS 4.64K, A3R55 IS 56.2K, A3R57 IS 825 OHMS, A3R60 IS 2.37K, AND A3CR20 IS INSTALLED WHERE A3W1 IS SHOWN (ANODE ON RIGHT).
11. ON A3 CARD REV. 1132 AND 1147, A3R47 IS INSTALLED WHERE A3W2 IS SHOWN. ON CARD REV. 1132, A3R47 IS 31.6K. ON CARD REV. 1147, A3R47 IS 10.0K.
12. ON CARD REV. 1132, A3R61 IS 8.25K. ON CARD REV. 1147, A3R61 IS 4.64K.



NOTES:

1. CR18 USED ON CARD REV. 1133 ONLY.
2. C1 LOCATED HERE ON CARD REV. 1133 AND 1139.
3. R59 USED ON CARD REV. 1133, 1139, AND 1140 ONLY.

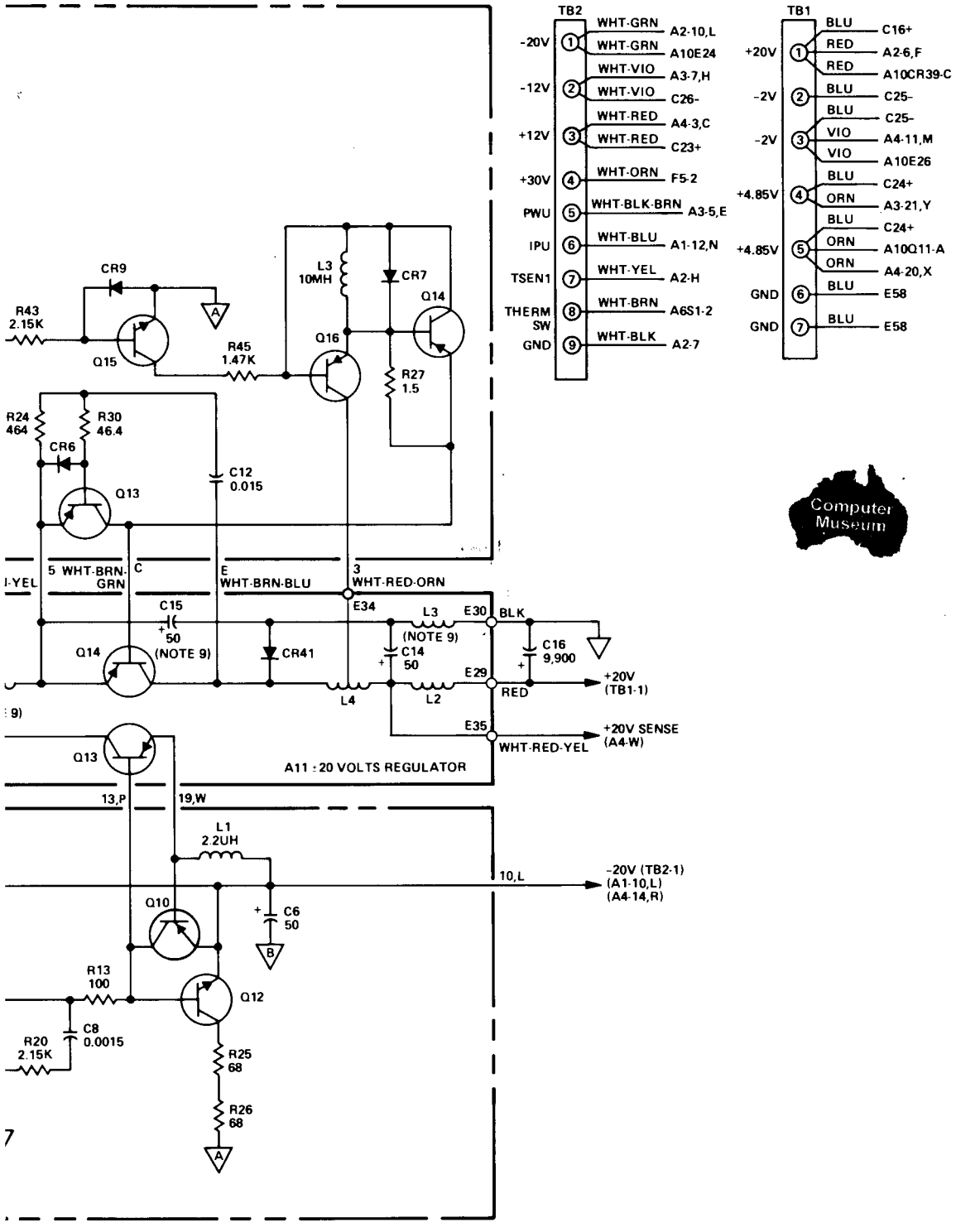
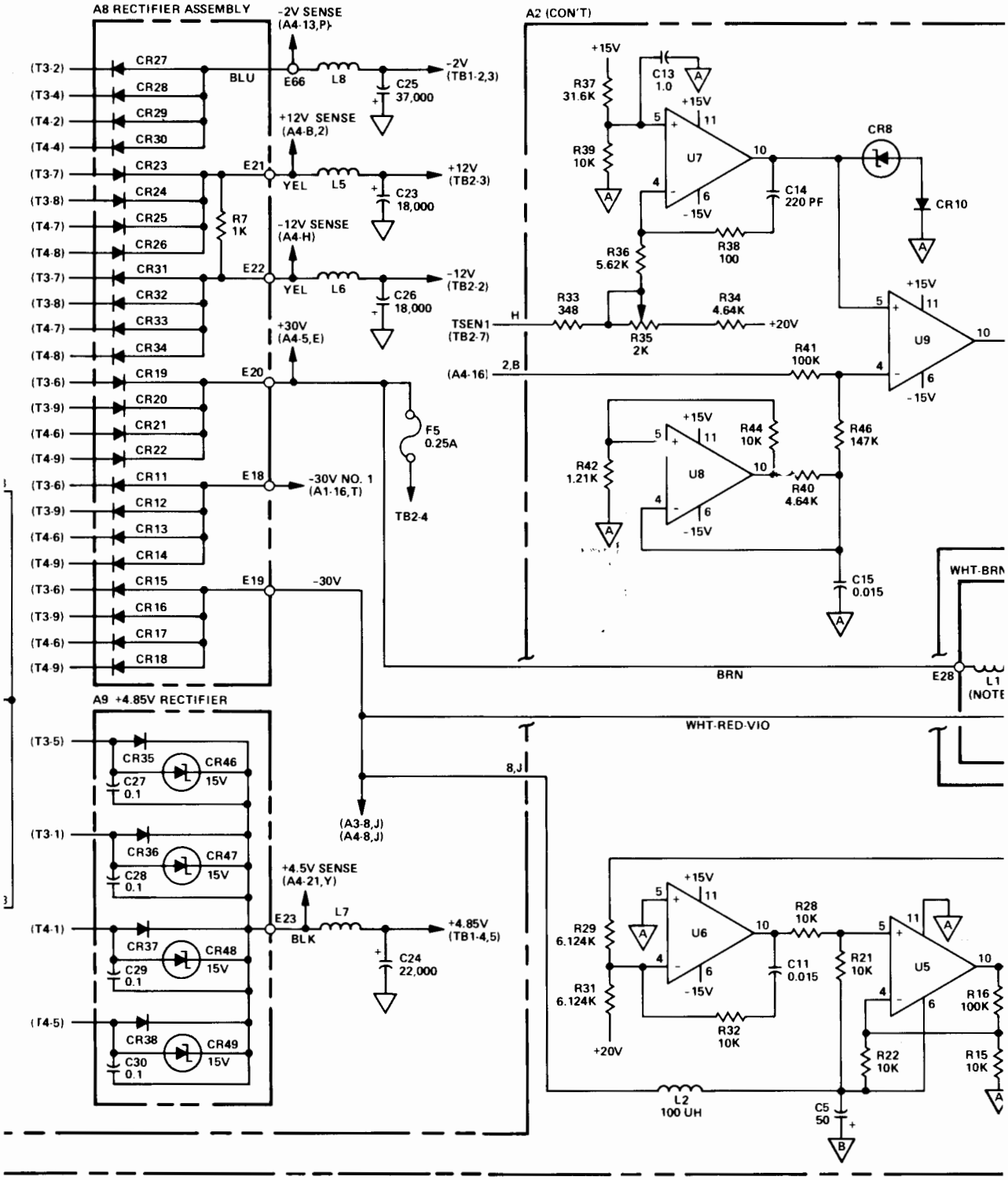
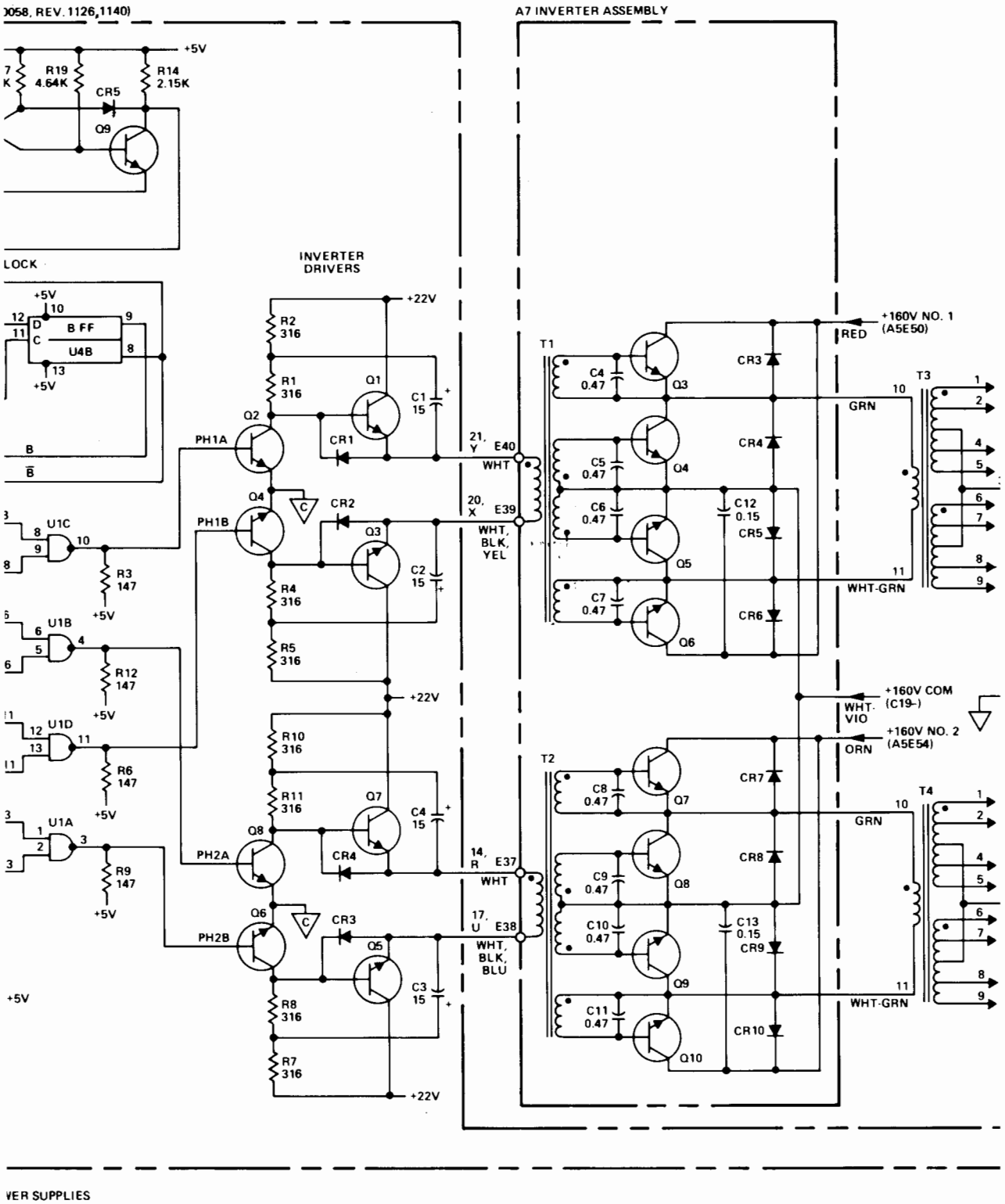
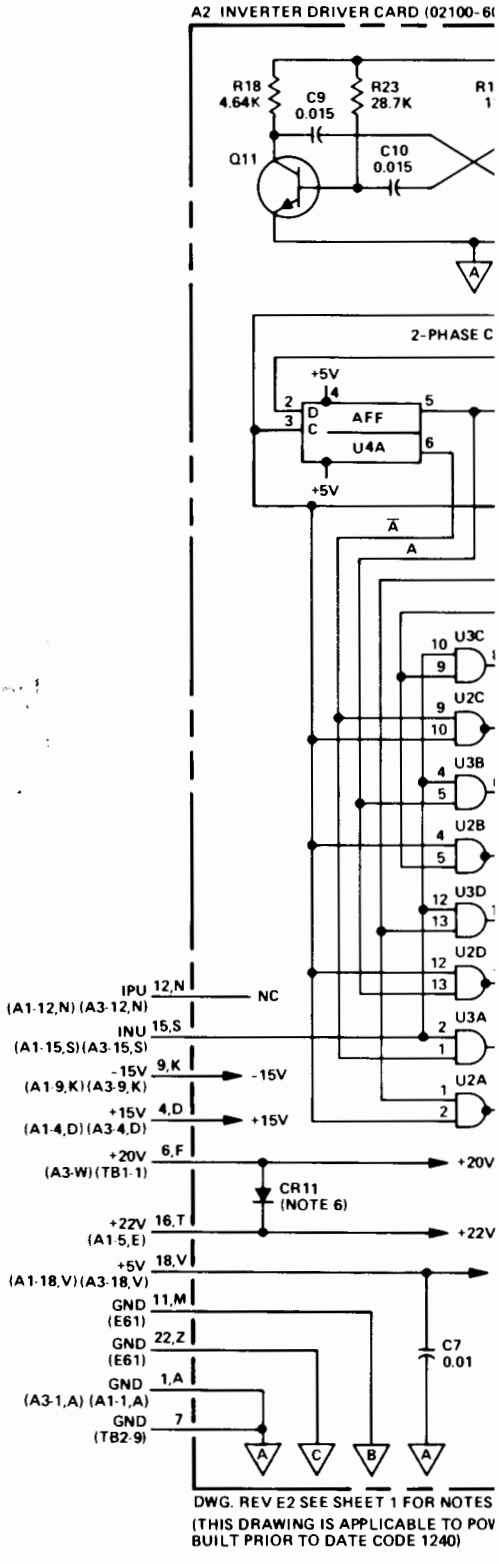


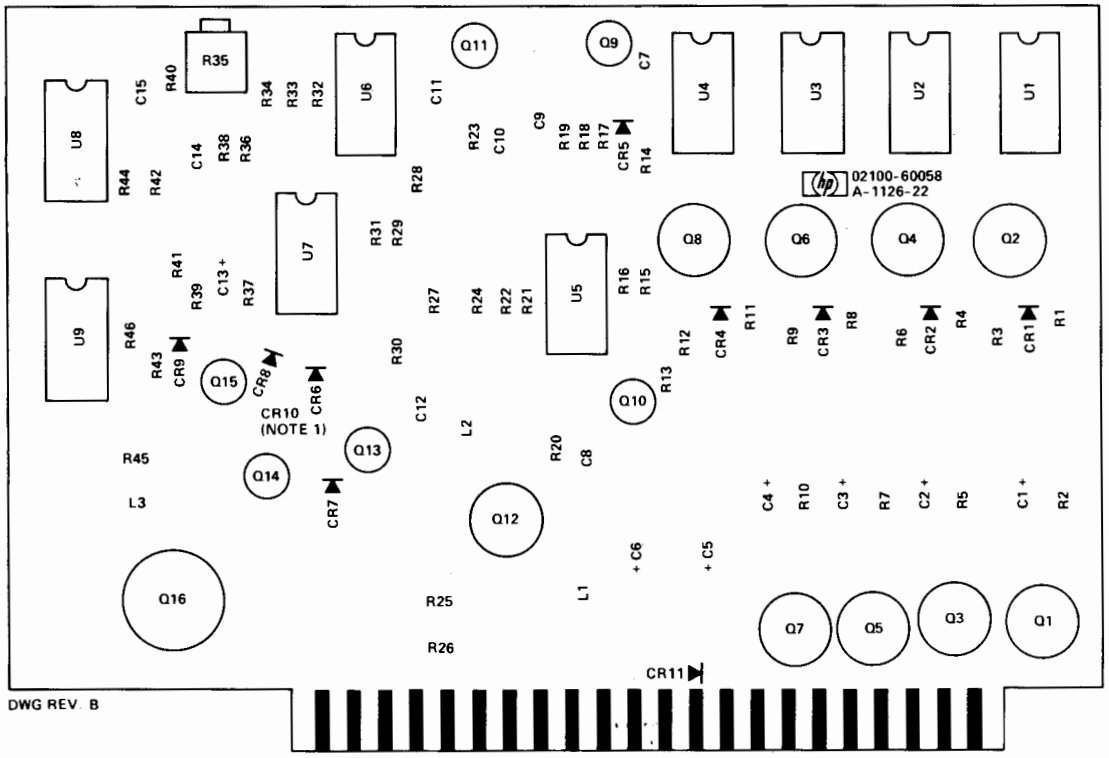
Figure 7-3. Power Supply (Inverter Driver) Parts Location and Schematic Diagrams, Date Codes Prior to 1240 (Sheet 2 of 4)


A8 RECTIFIER ASSEMBLY
-2V SENSE (A4-13,P)
+12V SENSE (A4-B,2)
-12V SENSE (A4-H)
+30V (A4-5,E)
-30V NO. 1 (A1-16,T)
-30V
+4.5V SENSE (A4-21,Y)
(T3-2)
(T3-4)
(T4-2)
(T4-4)
(T3-7)
(T3-8)
(T4-7)
(T4-8)
(T3-7)
(T3-8)
(T4-7)
(T4-8)
(T3-6)
(T3-9)
(T4-6)
(T4-9)
(T3-6)
(T3-9)
(T4-6)
(T4-9)
(T3-6)
(T3-9)
(T4-6)
(T4-9)
CR27
CR28
CR29
CR30
CR23
CR24
CR25
CR26
CR31
CR32
CR33
CR34
CR19
CR20
CR21
CR22
CR11
CR12
CR13
CR14
CR15
CR16
CR17
CR18
BLU
E66
L8
C25 37,000
-2V (TB1-2,3)
E21
YEL
L5
C23 18,000
+12V (TB2-3)
R7 1K
E22
YEL
L6
C26 18,000
-12V (TB2-2)
E20
F5 0.25A
TB2-4
E18
E19
A9 +4.85V RECTIFIER
(T3-5)
(T3-1)
(T4-1)
(T4-5)
CR35
CR46
15V
C27 0.1
CR36
CR47
15V
C28 0.1
CR37
CR48
15V
C29 0.1
CR38
CR49
15V
C30 0.1
E23
BLK
L7
C24 22,000
+4.85V (TB1-4,5)
(A3-8,J)
(A4-8,J)
8,J
A2 (CON'T)
+15V
R37 31.6K
C13 1.0
R39 10K
U7
C14 220 PF
-15V
R38 100
CR8
CR10
R36 5.62K
R33 348
R35 2K
R34 4.64K
+20V
TSEN1 (TB2-7)
H
2,B
(A4-16)
R41 100K
U9
R42 1.21K
U8
R44 10K
R40 4.64K
R46 147K
C15 0.015
WHT-BRN
BRN
E28
L1 (NOTE
WHT-RED-VIO
R29 6.124K
R31 6.124K
U6
R28 10K
C11 0.015
R32 10K
U5
R21 10K
R22 10K
R16 100K
R15 10K
L2 100 UH
C5 50

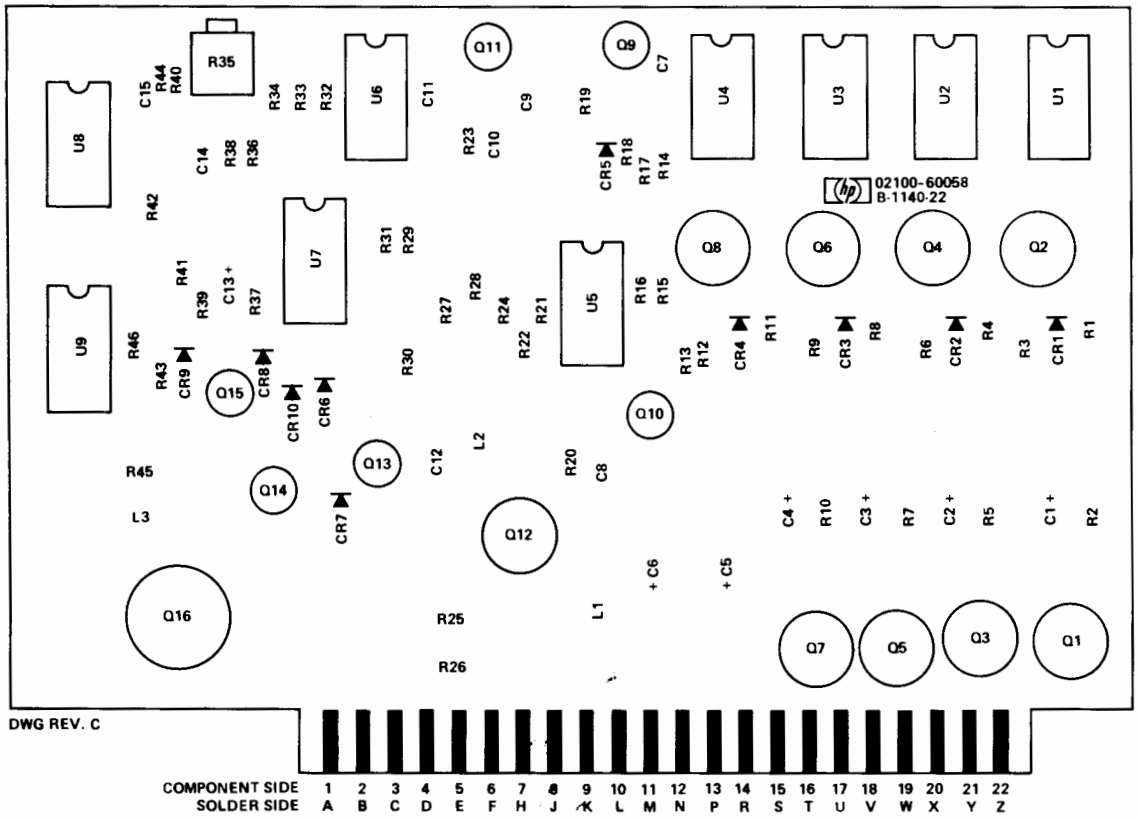

)058, REV. 1126,1140)
A7 INVERTER ASSEMBLY
+5V
R19 4.64K
R14 2.15K
CR5
Q9
LOCK
INVERTER DRIVERS
+22V
R2 316
R1 316
Q1
C1 15
Q2
PH1A
CR1
21, Y E40 WHT
Q4
PH1B
CR2
Q3
20, X E39 WHT, BLK, YEL
C2 15
R4 316
R5 316
U1C
U1B
U1D
U1A
R3 147
R12 147
R6 147
R9 147
R10 316
R11 316
Q7
C4 15
Q8
PH2A
CR4
14, R E37 WHT
Q6
PH2B
CR3
Q5
17, U E38 WHT, BLK, BLU
C3 15
R8 316
R7 316
T1
T2
C4 0.47
C5 0.47
C6 0.47
C7 0.47
C8 0.47
C9 0.47
C10 0.47
C11 0.47
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
C12 0.15
C13 0.15
+160V NO. 1 (A5E50) RED
+160V COM (C19-) WHT. VIO
+160V NO. 2 (A5E54) ORN
T3
T4
GRN
WHT-GRN
VER SUPPLIES


A2 INVERTER DRIVER CARD (02100-6(
R18
4.64K
C9
0.015
R23
28.7K
R1
1
Q11
C10
0.015
A
2-PHASE C
+5V
4
2
3
D
C
AFF
U4A
5
6
+5V
A
U3C
10
9
U2C
9
10
U3B
4
5
U2B
4
5
U3D
12
13
U2D
12
13
U3A
2
1
U2A
1
2
IPU
(A1-12,N) (A3-12,N)
12,N
NC
INU
(A1-15,S)(A3-15,S)
15,S
-15V
(A1-9,K)(A3-9,K)
9,K
-15V
+15V
(A1-4,D) (A3-4,D)
4,D
+15V
+20V
(A3-W)(TB1-1)
6,F
+20V
CR11
(NOTE 6)
+22V
(A1-5,E)
16,T
+22V
+5V
(A1-18,V)(A3-18,V)
18,V
GND
(E61)
11,M
GND
(E61)
22,Z
C7
0.01
GND
(A3-1,A) (A1-1,A)
1,A
GND
(TB2-9)
7
A
C
B
A
DWG. REV E2 SEE SHEET 1 FOR NOTES
(THIS DRAWING IS APPLICABLE TO POV
BUILT PRIOR TO DATE CODE 1240)

Power Supply



NOTES:
1. CATHODE END OF CR10 IS TOWARD BOARD.



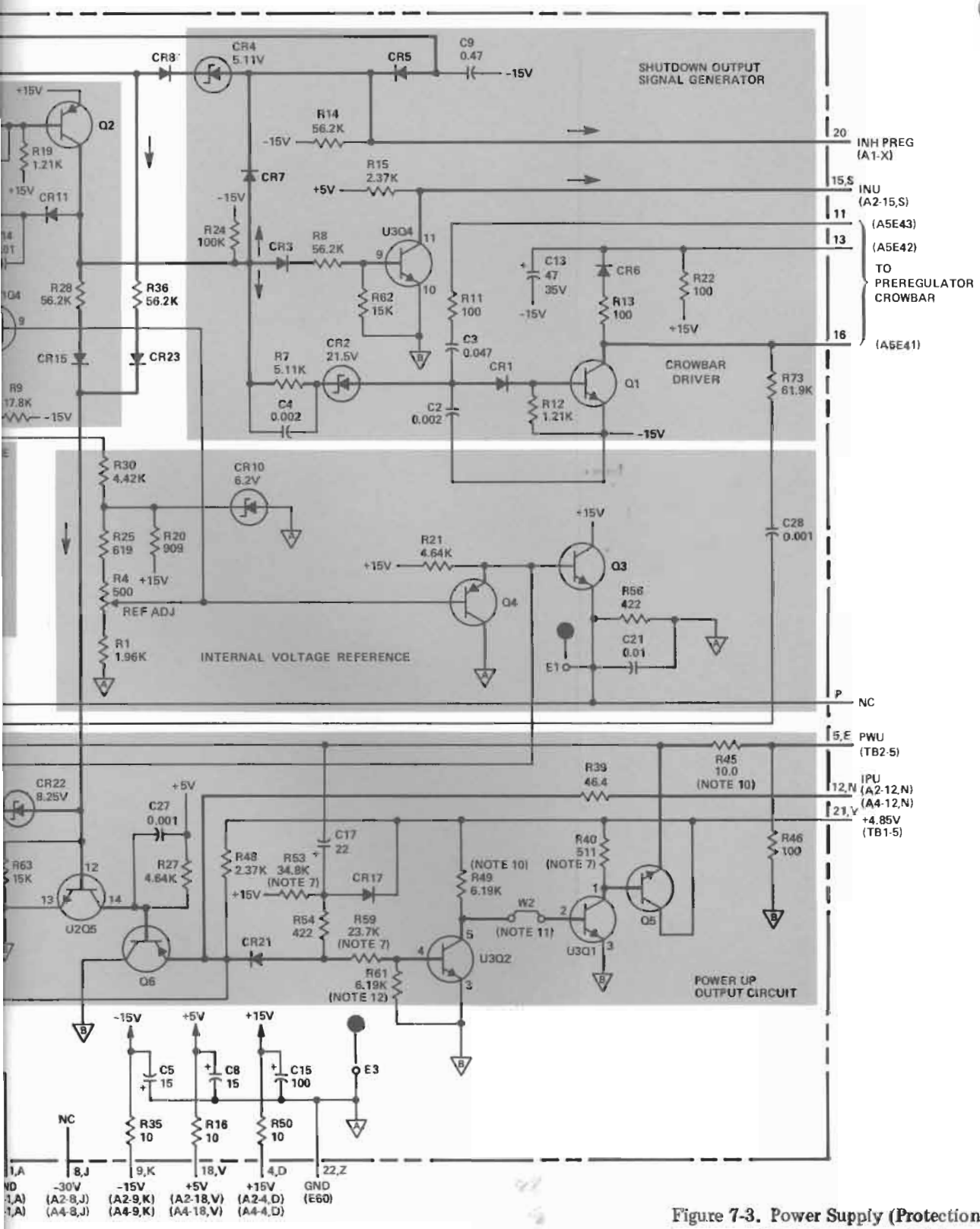
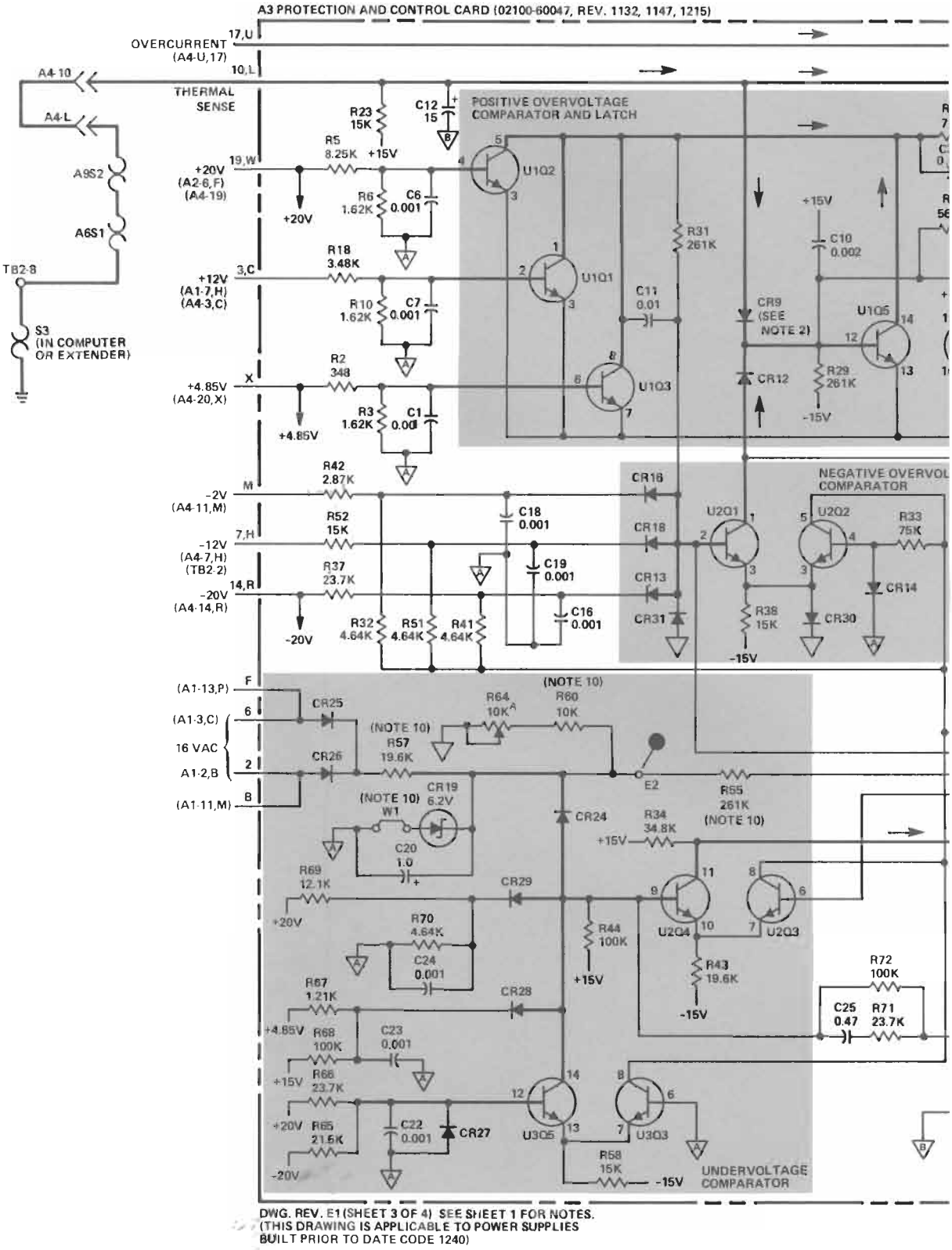
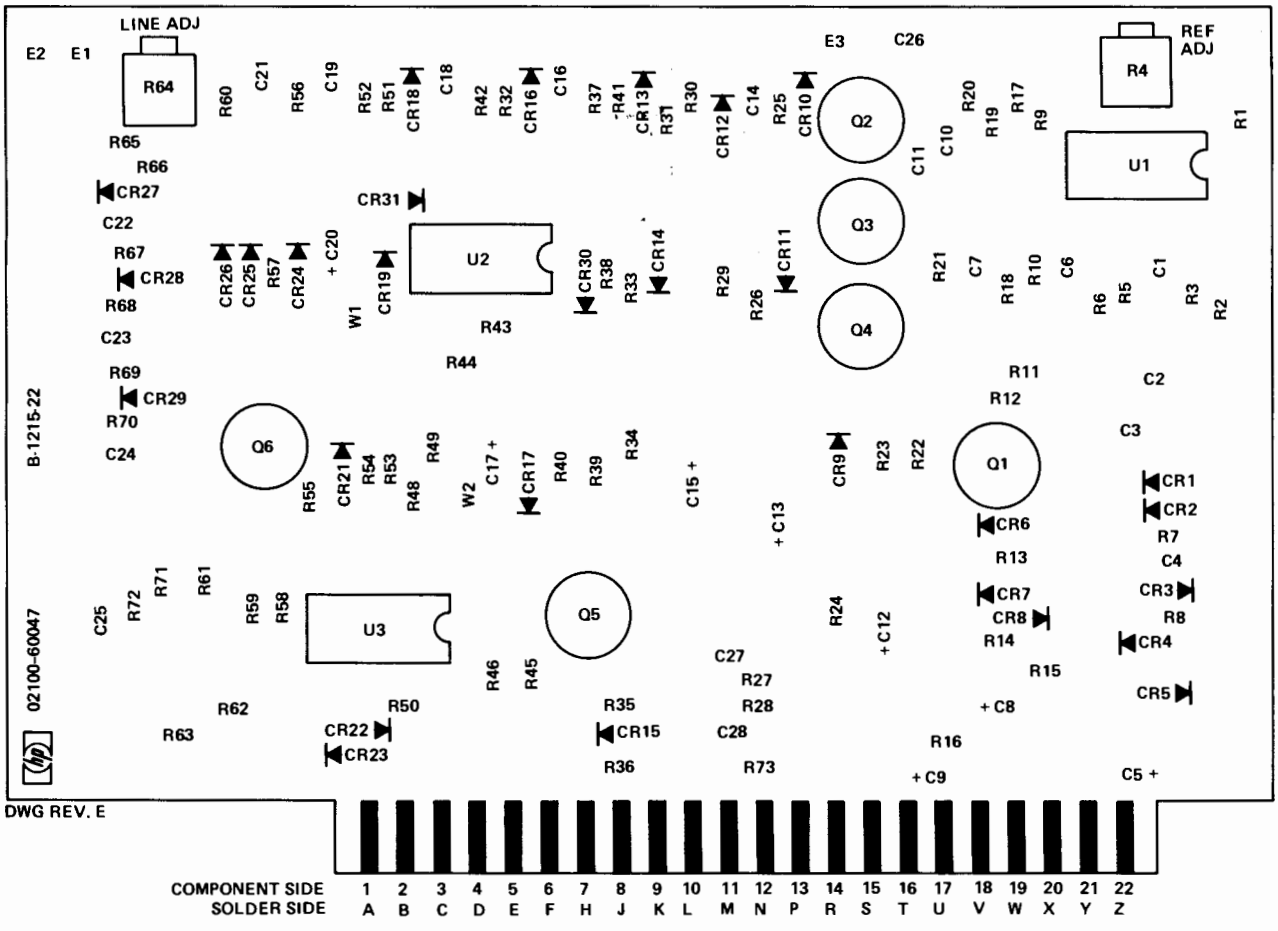


Figure 7-3. Power Supply (Protection and Control) Parts Location and Schematic Diagrams, Date Codes Prior to 1240 (Sheet 3 of 4)


A3 PROTECTION AND CONTROL CARD (02100-60047, REV. 1132, 1147, 1215)
OVERCURRENT (A4-U,17)
17,U
10,L
A4-10
A4-L
THERMAL SENSE
A9S2
A6S1
TB2-8
S3 (IN COMPUTER OR EXTENDER)
+20V (A2-6,F) (A4-19)
19,W
+12V (A1-7,H) (A4-3,C)
3,C
+4.85V (A4-20,X)
X
-2V (A4-11,M)
M
-12V (A4-7,H) (TB2-2)
7,H
-20V (A4-14,R)
14,R
R23 15K
C12 15
R5 8.25K
+15V
R6 1.62K
C6 0.001
R18 3.48K
R10 1.62K
C7 0.001
R2 348
R3 1.62K
C1 0.001
R42 2.87K
R52 15K
R37 23.7K
R32 4.64K
R51 4.64K
R41 4.64K
C18 0.001
C19 0.001
C16 0.001
POSITIVE OVERVOLTAGE COMPARATOR AND LATCH
U1Q2
U1Q1
U1Q3
R31 261K
C11 0.01
CR9 (SEE NOTE 2)
CR12
U1Q5
C10 0.002
R29 261K
NEGATIVE OVERVOL COMPARATOR
CR16
CR18
CR13
CR31
U2Q1
U2Q2
R33 75K
CR14
R38 15K
CR30
(A1-13,P)
F
(A1-3,C)
6
16 VAC
A1-2,B
2
(A1-11,M)
B
CR25
CR26
(NOTE 10)
R64 10K
R60 10K
R57 19.6K
E2
R55 261K (NOTE 10)
CR19 6.2V
W1
C20 1.0
CR24
R34 34.8K
R69 12.1K
CR29
R70 4.64K
C24 0.001
R44 100K
U2Q4
U2Q3
R43 19.6K
R67 1.21K
CR28
R68 100K
C23 0.001
R66 23.7K
R65 21.5K
C22 0.001
CR27
U3Q5
U3Q3
R58 15K
UNDERVOLTAGE COMPARATOR
R72 100K
C25 0.47
R71 23.7K
DWG. REV. E1 (SHEET 3 OF 4) SEE SHEET 1 FOR NOTES.
(THIS DRAWING IS APPLICABLE TO POWER SUPPLIES BUILT PRIOR TO DATE CODE 1240)



NOTE:
EXCEPT FOR W1 AND W2, THIS DIAGRAM ALSO APPLIES TO CARD REV. B-1132-22 AND B-1147-22. ON THESE CARD REV. , CR20 IS INSTALLED WHERE W1 IS SHOWN (ANODE ON BOTTOM) AND R47 IS INSTALLED WHERE W2 IS SHOWN.

GND
(A2-1,A,
(A4-1,A)

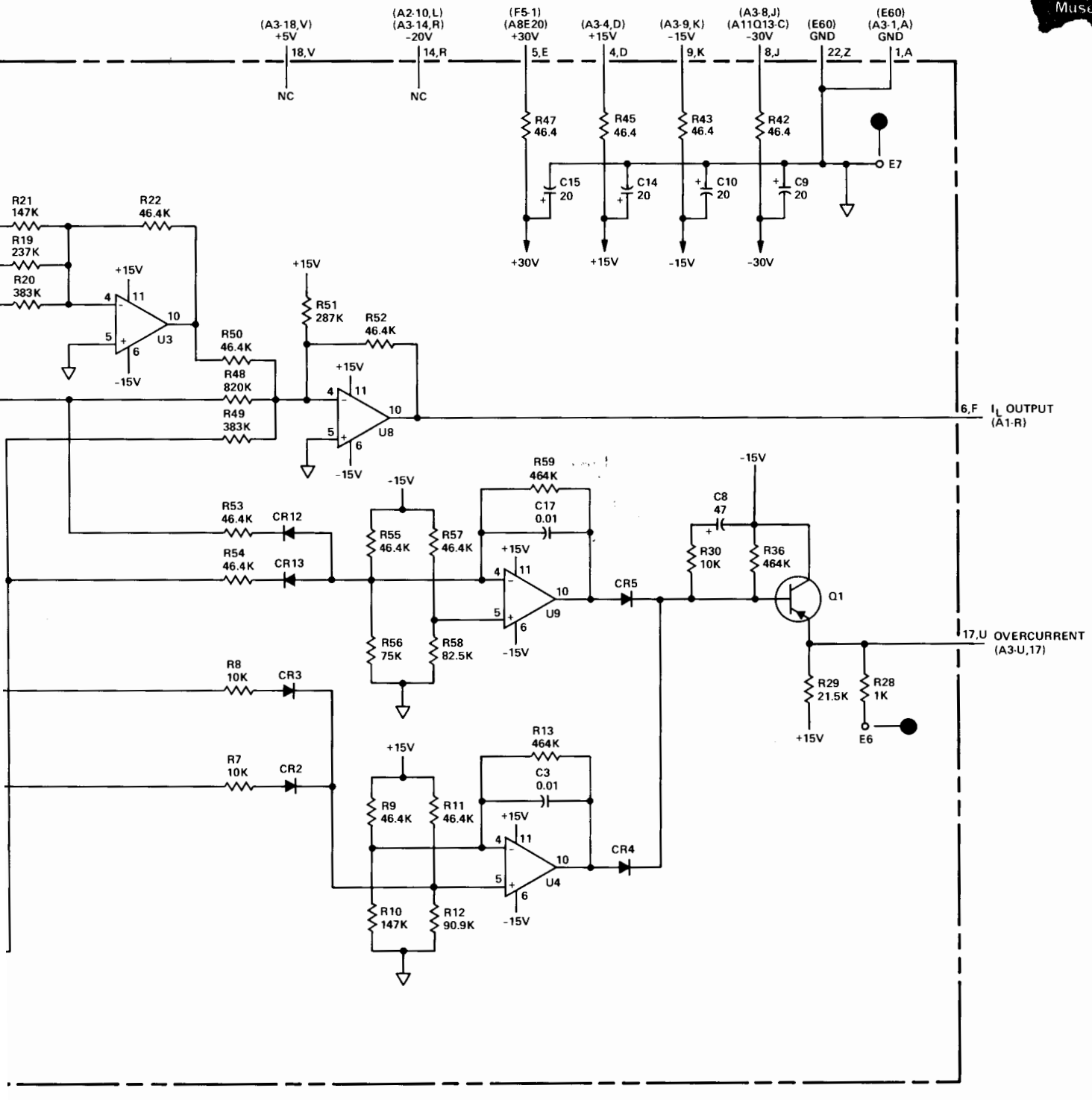
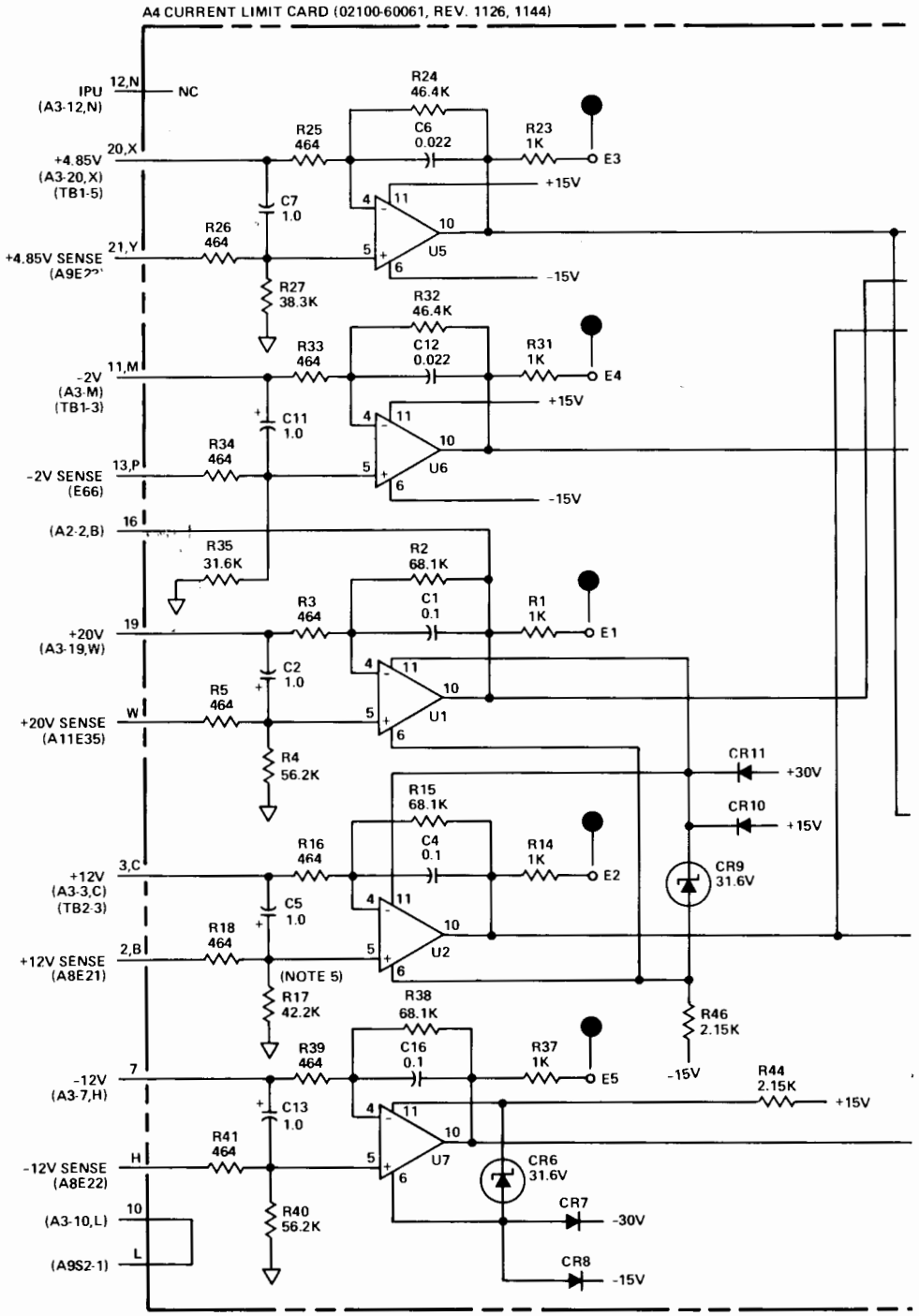
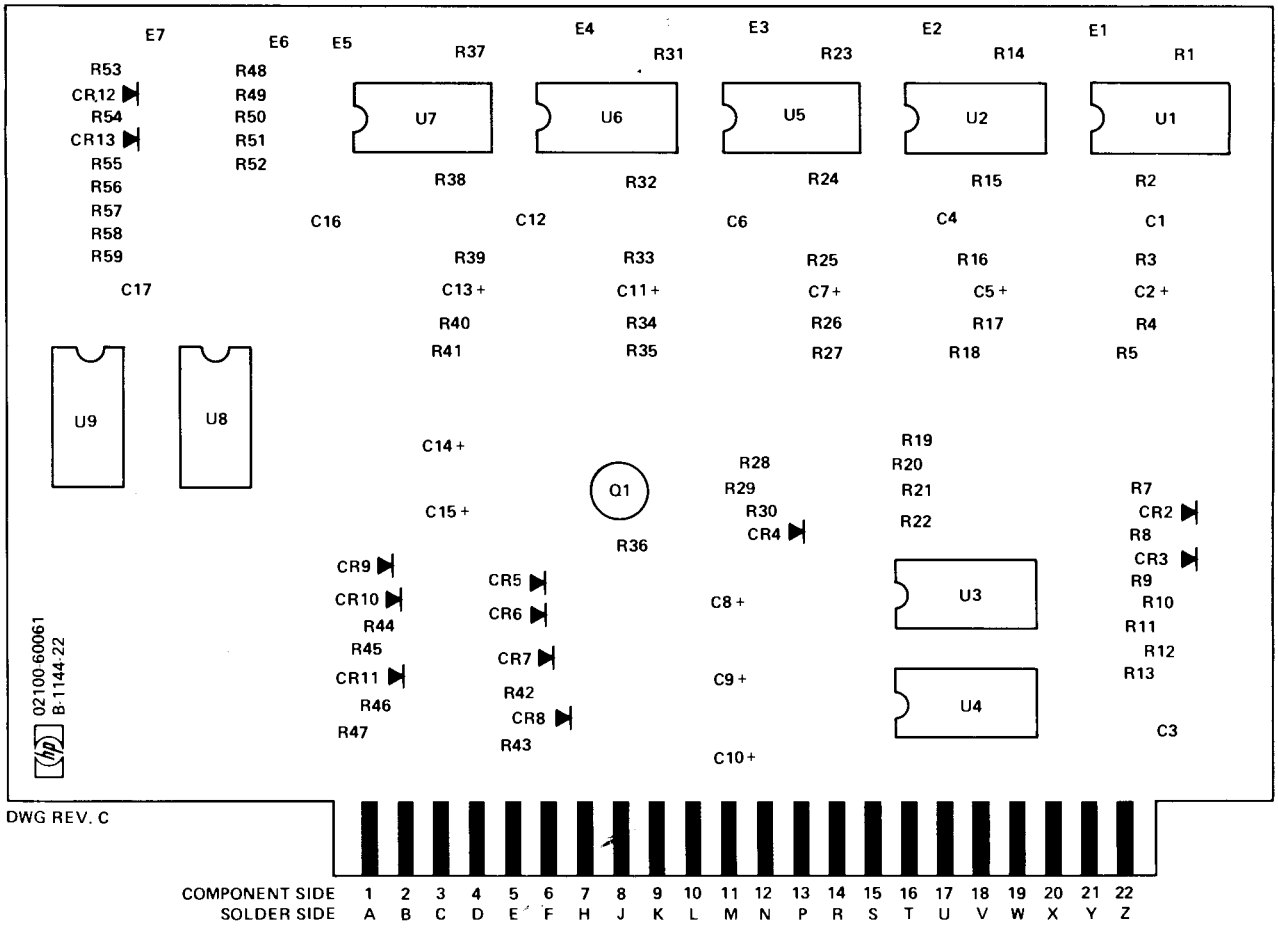


Figure 7-3. Power Supply (Current Limit) Parts Location and Schematic Diagrams, Date Codes Prior to 1240 (Sheet 4 of 4)



DWG. REV. E (SHEET 4 OF 4) SEE SHEET 1 FOR NOTES.
(THIS DRAWING IS APPLICABLE TO POWER SUPPLIES BUILT PRIOR TO DATE CODE 1240)



NOTE: THIS DIAGRAM ALSO APPLIES TO CARD REV. A-1126-22.

Table 7-3. Preregulator Control Card A1 (02100-60108), Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	02100-60108	1	PREREGULATOR CONTROL CARD	28480	02100-60108
A1C1	0160-2147	2	C:FXD CER 0.025 UF +80-20% 100VDCW	91418	TA
A1C2	0180-0291	7	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1C3	0160-2055	3	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A1C4	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1C5	0170-0040	2	C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A1C6	0160-2147		C:FXD CER 0.025 UF +80-20% 100VDCW	91418	TA
A1C7	0180-0197	4	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C8	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C9	0180-0161	1	C:FXD ELECT 3.3 UF 20% 35VDCW	56289	150D335X003582-DYS
A1C10	0180-0160	1	C:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A1C11	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C12	0180-0141	1	C:FXD ELECT 50 UF +75-10% 50VDCW	56289	30D506G050DD2-DSM
A1C13	0180-0097	3	C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A1C14	0180-2415	1	C:FXD AL ELECT 200 UF +75-10% 40VDCW	56289	39D207G040EL
A1C15(NOTE 1)	0150-0093	1	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1CR1	1902-3094	1	DIODE BREAKDOWN:5.11V 2%	28480	1902-3094
A1CR2	1901-0040	30	DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR3	1901-0159	9	DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR4	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR14	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR15	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR16	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR17	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1E1	0683-0275	8	R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1E2	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1E3	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1E4	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1E5	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1L1	9140-0131	1	COIL:FXD RF 10 MH	28480	9140-0131
A1Q1	1854-0477	12	TSTR:SI NPN	80131	2N2222A
A1Q2	1853-0281	14	TSTR:SI PNP	80131	2N2907A
A1Q3	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q4	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q5	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q6	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q7	1854-0072	2	TSTR:SI NPN	80131	2N3054
A1Q8	1854-0477	5	TSTR:SI NPN	80131	2N2222A
A1Q9	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q10	1854-0039	3	TSTR:SI NPN	80131	2N3053
A1Q11	1854-0072		TSTR:SI NPN	80131	2N3054
A1Q12	1854-0477		TSTR:SI NPN	80131	2N222A
A1Q13	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q14	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q15	1854-0477		TSTR:SI NPN	80131	2N2222A
A1Q16	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q17	1853-0281		TSTR:SI PNP	80131	2N2907A
A1Q18	1854-0039		TSTR:SI NPN	80131	2N3053
A1R1	0757-0199	4	R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R2	0757-0279	2	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1R3	0757-0442	14	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R4	0757-0200	1	R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A1R5	0757-0280	10	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R6	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R7	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1R8	0757-0290	1	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A1R9	2100-2521	1	R:VAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521
A1R10	0757-0438	6	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R11	0698-3449	2	R:FXD MET FLM 28.7K OHM 1% 1/8W	28480	0698-3449
A1R12	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R13	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R14	0698-0085	1	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A1R15	0757-0289	1	R:FXD MET FLM 13.3K OHM 1% 1/8W	28480	0757-0289
A1R16	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R17	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R18	0757-0419	1	R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A1R19	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R20	0757-0401	5	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R21	0698-3613	1	R:FXD MET OX 39 OHM 5% 2W	28480	0698-3613
A1R22	0698-3153	1	R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A1R24	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1R25	0757-0424	1	R:FXD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0424
A1R26	0757-0421	1	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A1R26	0757-0461	4	R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A1R28	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A1R29	0757-0401	1	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401

NOTES: 1. First used on card rev. 1249.

Table 7-3. Prereguiator Control Card A1 (02100-60108), Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R30	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R31	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A1R32	0698-3449		R:FXD MET FLM 28.7K OHM 1% 1/8W	28480	0698-3449
A1R33	0757-1094	1	R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A1R34	0698-3154	1	R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A1R35	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R36	0698-3156	5	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A1R37	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R38	0698-3162	9	R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A1R39	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R40	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A1R41	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R42	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A1R43	0757-0416	3	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A1R44	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1R27	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1U1	1826-0070	8	IC:LINEAR OPER. AMPL.	07263	U6A7741393

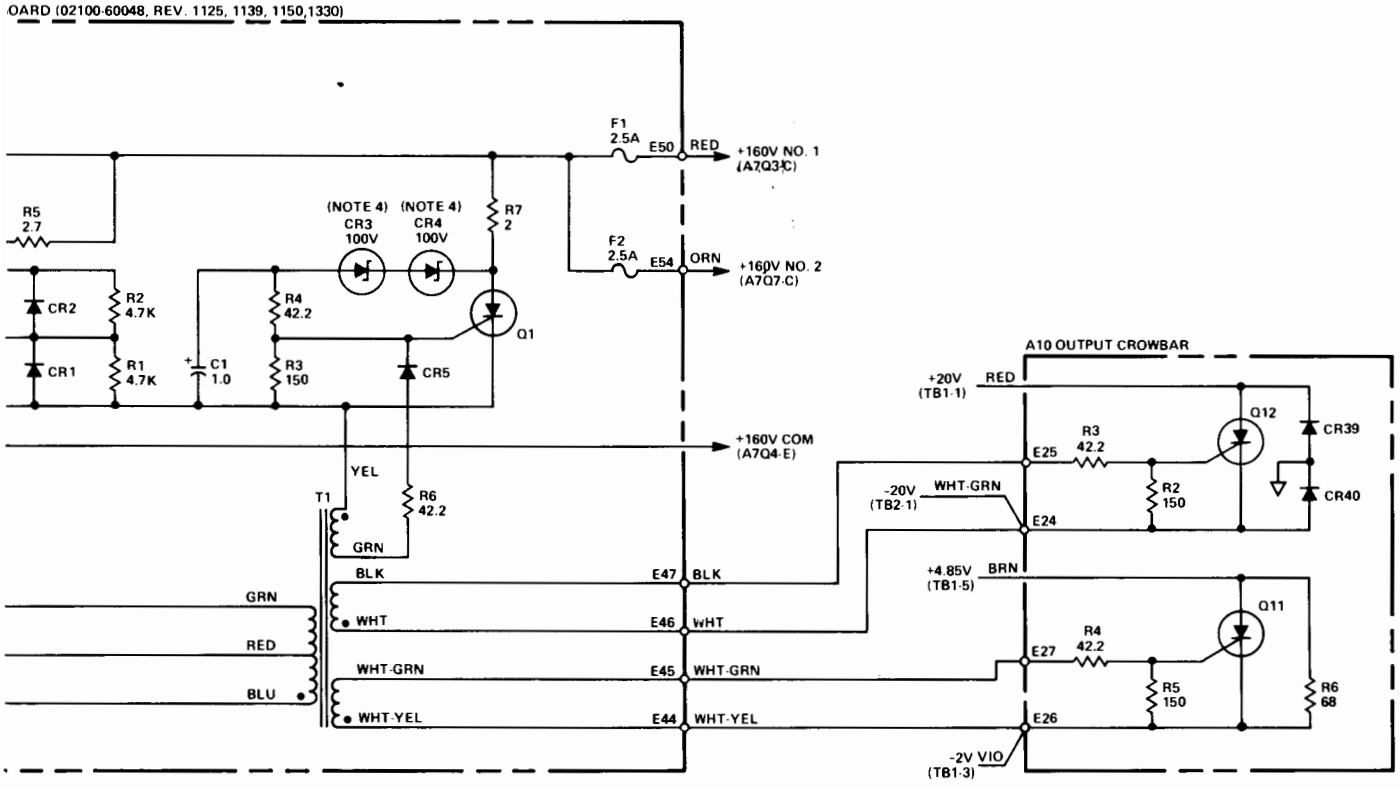
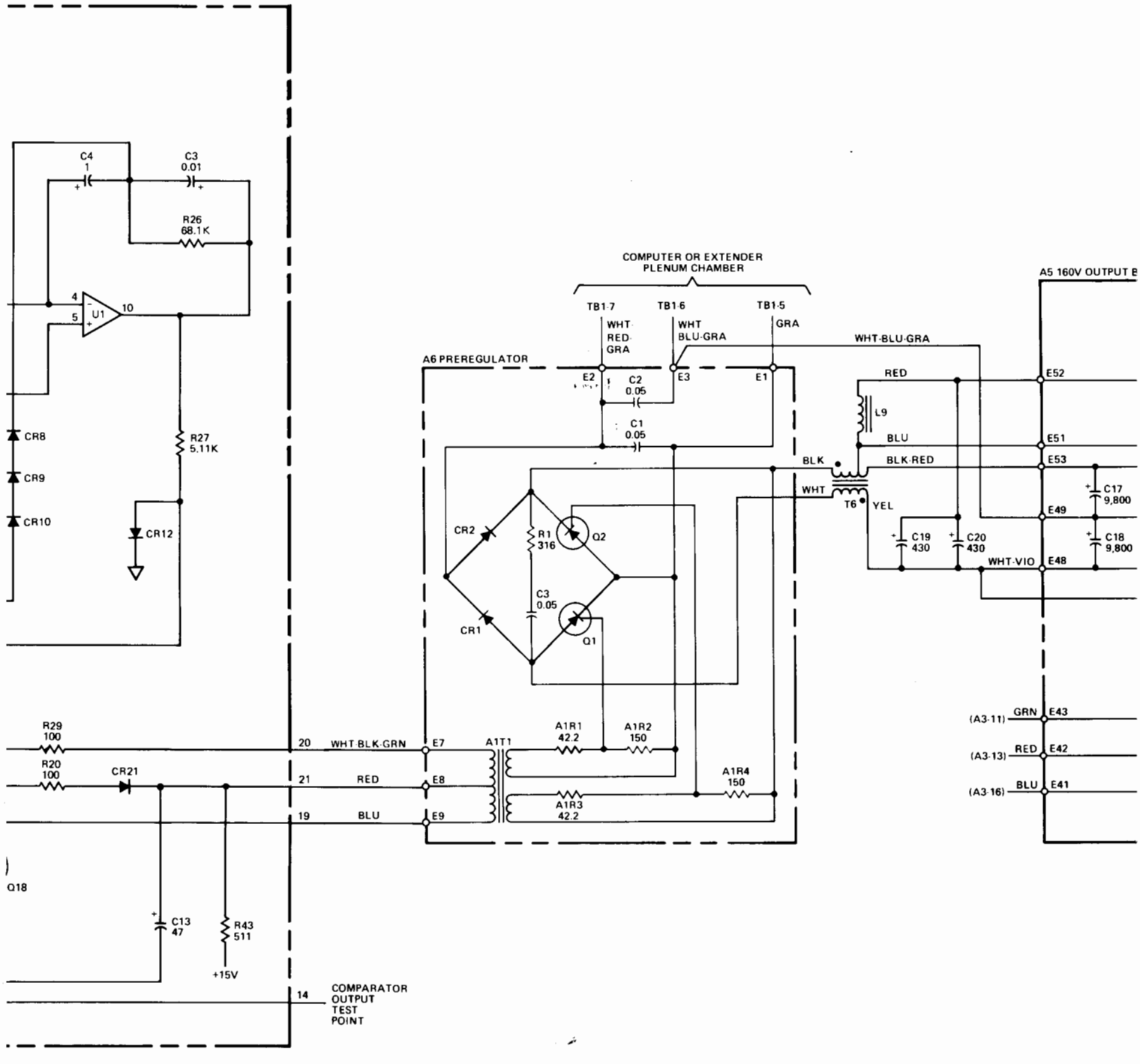
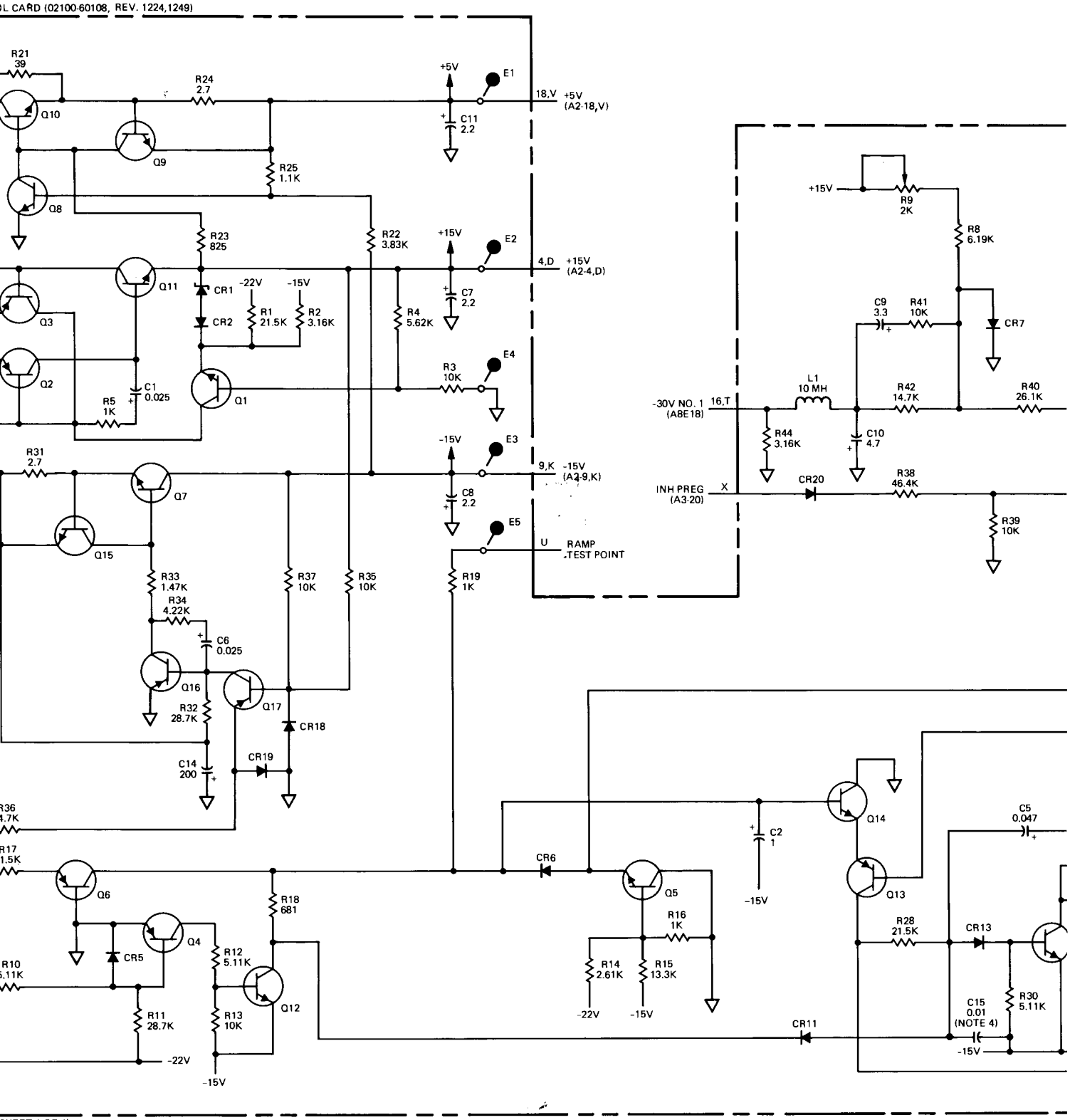


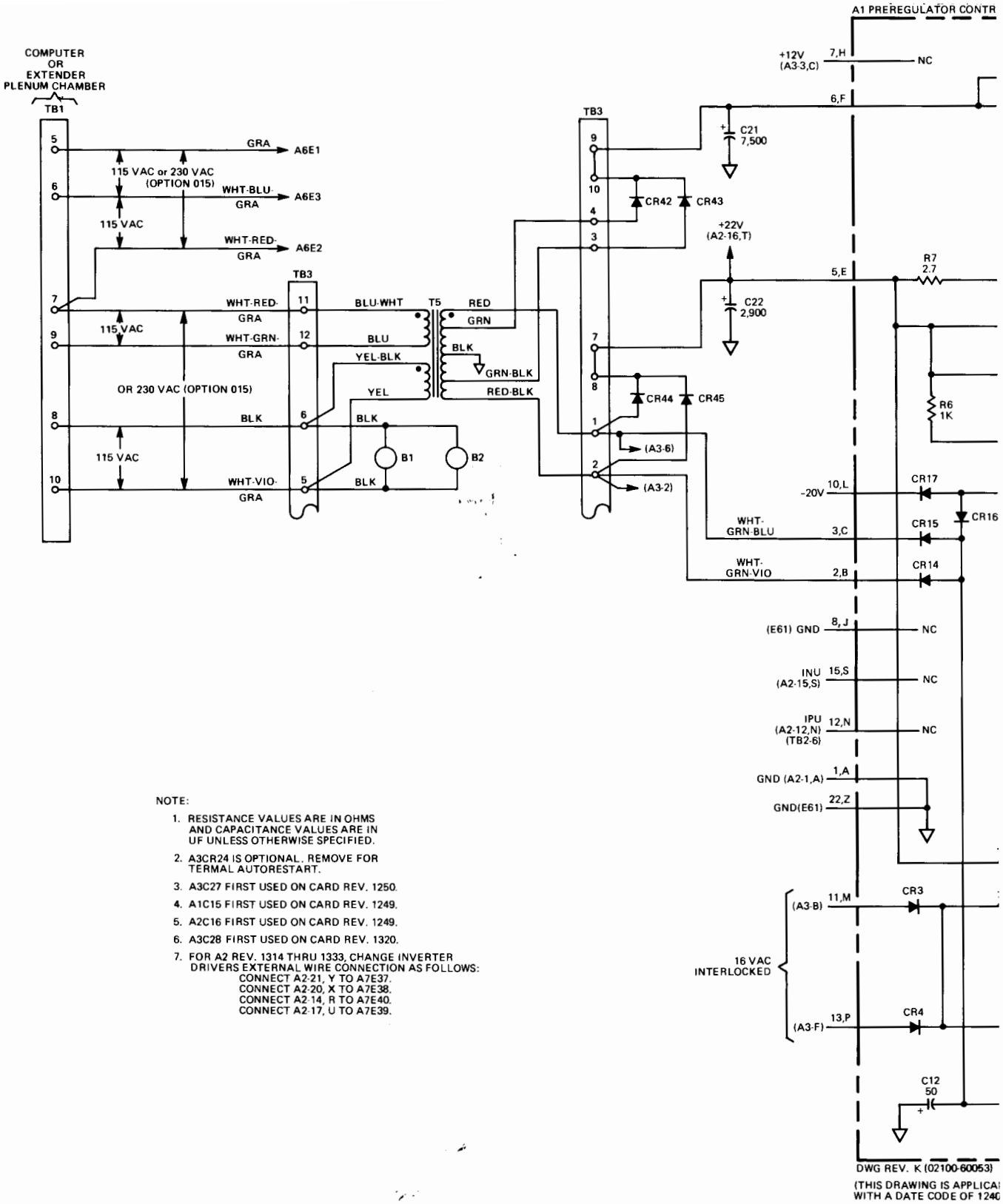
Figure 7-4. Power Supply (Preregulator Control) Parts Location and Schematic Diagrams, Date Codes 1240 and Higher (Sheet 1 of 4)


C4
1
C3
0.01
R26
68.1K
4
5
U1
10
CR8
CR9
CR10
CR12
R27
5.11K
COMPUTER OR EXTENDER
PLENUM CHAMBER
TB1-7
TB1-6
TB1-5
WHT
RED
GRA
WHT
BLU-GRA
GRA
WHT-BLU-GRA
A6 PREREGULATOR
E2
E3
E1
C2
0.05
C1
0.05
A5 160V OUTPUT B
RED
E52
L9
BLU
E51
BLK
BLK-RED
E53
WHT
T6
YEL
E49
C17
9,800
C19
430
C20
430
C18
9,800
WHT-VIO
E48
CR2
R1
316
Q2
C3
0.05
CR1
Q1
R29
100
R20
100
CR21
20
WHT-BLK-GRN
E7
A1T1
A1R1
42.2
A1R2
150
21
RED
E8
A1R4
150
19
BLU
E9
A1R3
42.2
(A3-11)
GRN
E43
(A3-13)
RED
E42
(A3-16)
BLU
E41
Q18
C13
47
R43
511
+15V
14
COMPARATOR
OUTPUT
TEST
POINT



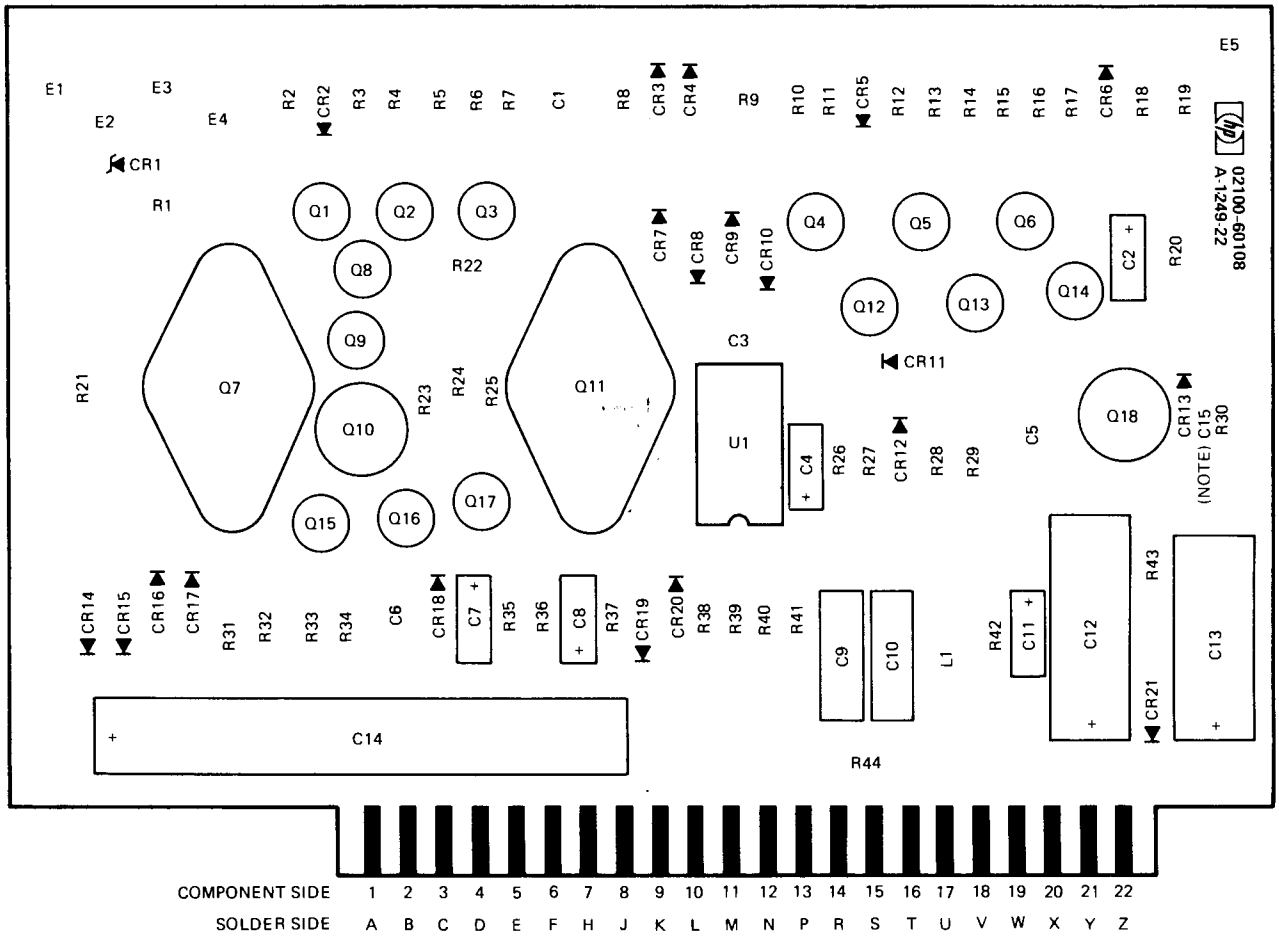
SHEET 1 OF 4)

LE TO POWER SUPPLIES
OR HIGHER)



NOTE:

1. RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. A3CR24 IS OPTIONAL. REMOVE FOR TERMAL AUTORESTART.
3. A3C27 FIRST USED ON CARD REV. 1250.
4. A1C15 FIRST USED ON CARD REV. 1249.
5. A2C16 FIRST USED ON CARD REV. 1249.
6. A3C28 FIRST USED ON CARD REV. 1320.
7. FOR A2 REV. 1314 THRU 1333, CHANGE INVERTER DRIVERS EXTERNAL WIRE CONNECTION AS FOLLOWS:
   CONNECT A2-21, Y TO A7E37.
   CONNECT A2-20, X TO A7E38.
   CONNECT A2-14, R TO A7E40.
   CONNECT A2-17, U TO A7E39.



2233-1A

NOTE: C15 NOT USED ON CARD REV. A-1224-22.

NOTE: Refer to table 7-2 for replaceable parts for assemblies other than A1.

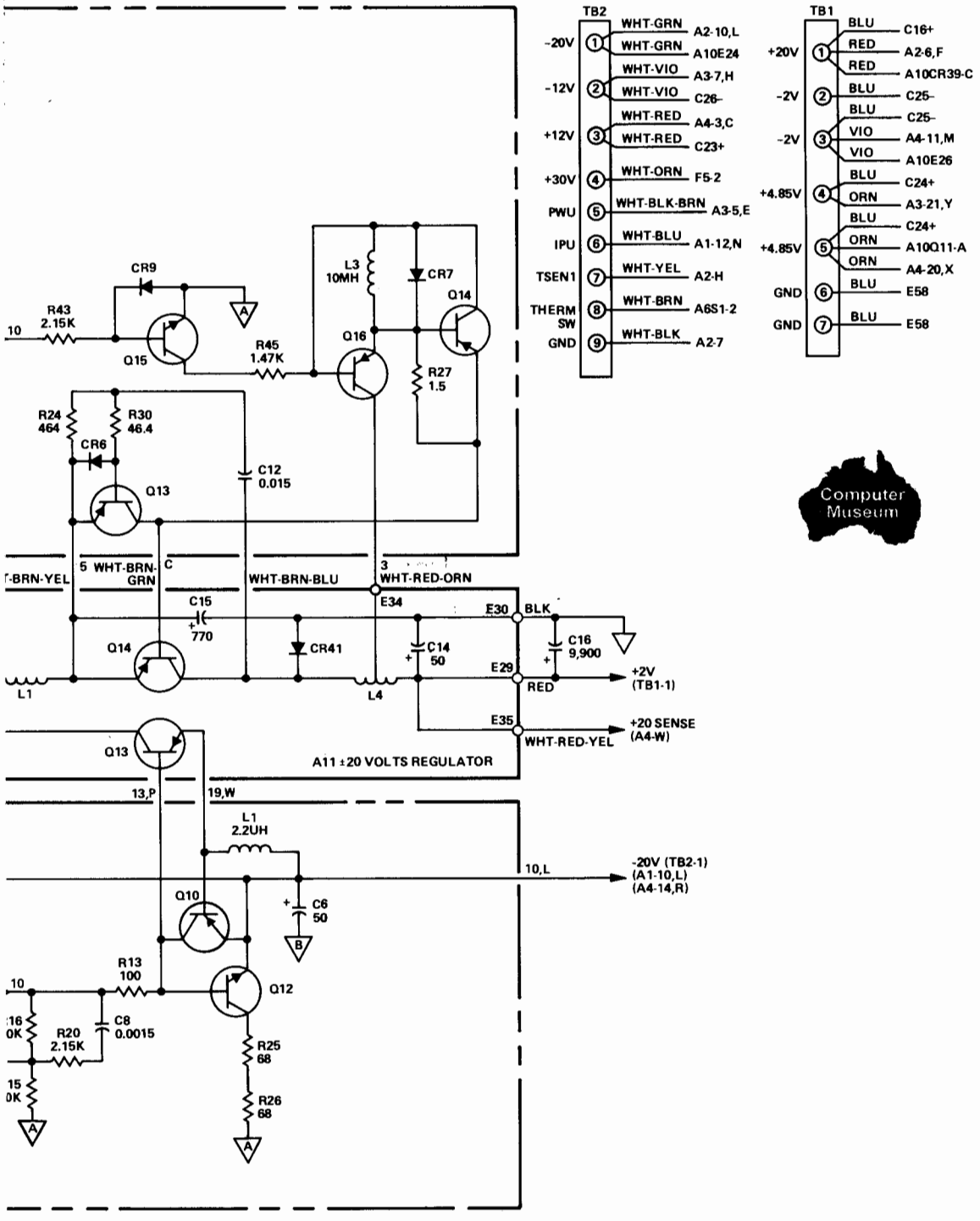
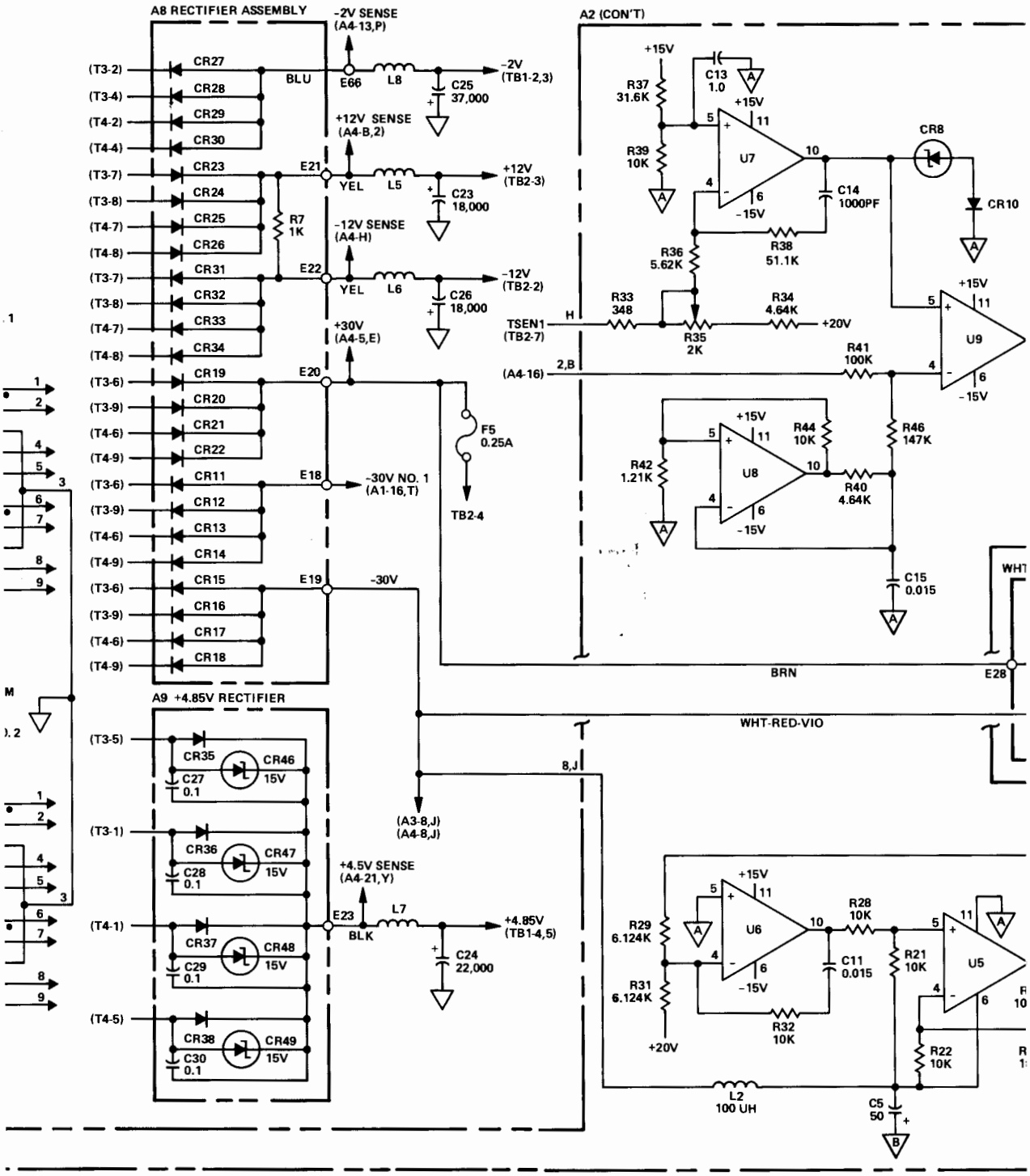
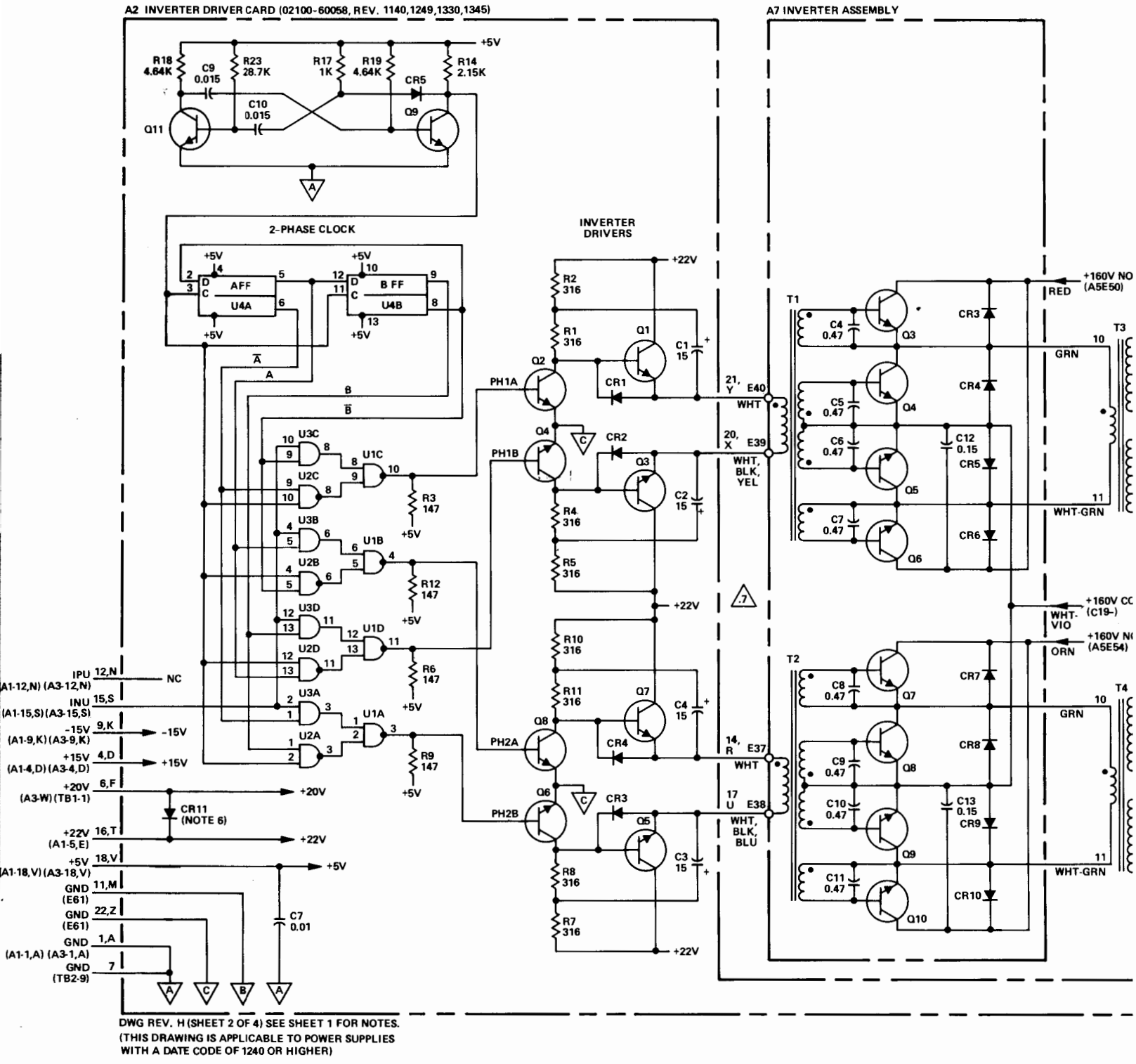
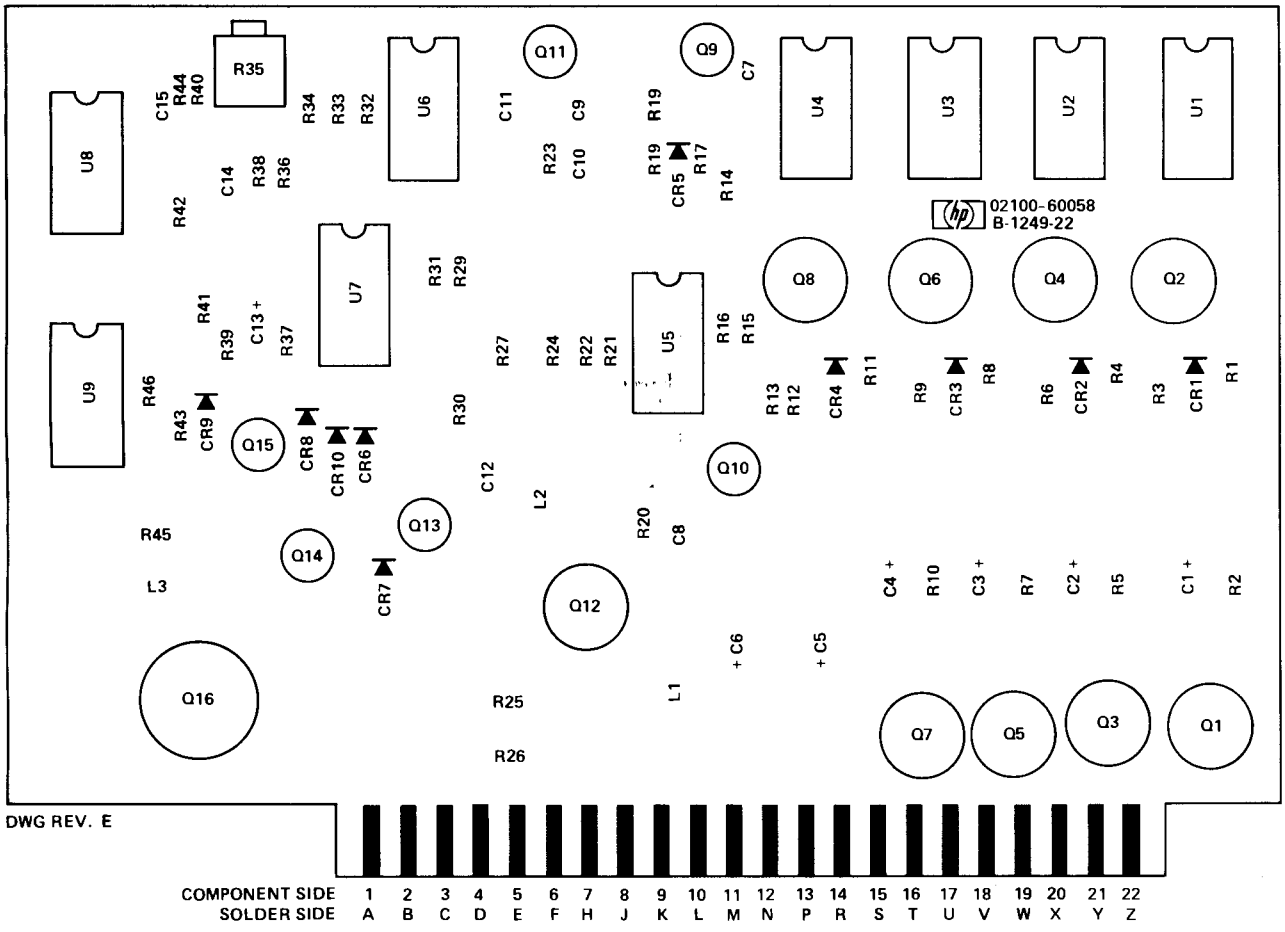


Figure 7-4. Power Supply (Inverter Driver) Parts Location and Schematic Diagrams, Date Codes 1240 and Higher (Sheet 2 of 4)


A8 RECTIFIER ASSEMBLY
-2V SENSE (A4-13,P)
+12V SENSE (A4-B,2)
-12V SENSE (A4-H)
+30V (A4-5,E)
-30V NO. 1 (A1-16,T)
-30V
(A3-8,J) (A4-8,J)
A9 +4.85V RECTIFIER
+4.5V SENSE (A4-21,Y)
CR27
CR28
CR29
CR30
CR23
CR24
CR25
CR26
CR31
CR32
CR33
CR34
CR19
CR20
CR21
CR22
CR11
CR12
CR13
CR14
CR15
CR16
CR17
CR18
CR35
CR36
CR37
CR38
CR46
CR47
CR48
CR49
15V
BLU
YEL
BLK
E66
E21
E22
E20
E18
E19
E23
L8
L5
L6
L7
C25 37,000
C23 18,000
C26 18,000
C24 22,000
C27 0.1
C28 0.1
C29 0.1
C30 0.1
R7 1K
F5 0.25A
TB2-4
-2V (TB1-2,3)
+12V (TB2-3)
-12V (TB2-2)
+4.85V (TB1-4,5)
A2 (CON'T)
+15V
-15V
R37 31.6K
R39 10K
R36 5.62K
R33 348
R35 2K
R34 4.64K
R38 51.1K
R41 100K
R42 1.21K
R44 10K
R46 147K
R40 4.64K
C13 1.0
C14 1000PF
C15 0.015
U7
U8
U9
CR8
CR10
TSEN1 (TB2-7)
(A4-16)
+20V
BRN
WHT
E28
WHT-RED-VIO
R29 6.124K
R31 6.124K
R28 10K
R32 10K
R21 10K
R22 10K
C11 0.015
U6
U5
L2 100 UH
C5 50
+20V



DWG REV. H (SHEET 2 OF 4) SEE SHEET 1 FOR NOTES.
(THIS DRAWING IS APPLICABLE TO POWER SUPPLIES WITH A DATE CODE OF 1240 OR HIGHER)



NOTE: Refer to table 7-2 for replaceable parts.

Table 7-4. Protection and Control Card A3 (02100-60109), Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3	02100-60109	1	PROTECTION AND CONTROL CARD	28480	02100-60109
A3C1	0160-3456	11	C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C2	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C3	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A3C4	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A3C5	0180-0106	2	C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A3C6	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C7	0180-1743	1	C:FXD ELECT 0.1 UF 10% 35VDCW	56289	1500104X9035A2-DYS
A3C8	0160-0127	1	C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A3C9	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C10	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C11	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C12	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C13	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C13	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C14	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C15	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A3C16	0180-0098	1	C:FXD ELECT 100 UF 20% 20VDCW	56289	150D107X9020S2-DYS
A3C17	0180-1746	2	C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A3C18	0150-0121	1	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A3C20	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C21	0180-0376	1	C:FXD ELECT 0.47 UF 10% 35VDCW	56289	150D474X9035A2-DYS
A3C22	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A3C23	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A3C24	0170-0040		C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A3C25	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C26	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A3C27(NOTE 1)	0160-2143	1	C:FXD CER 2000 PF +80-20% 1000 VDCW	91418	TYPE B
A3C28	0150-0093	1	C:FXD CER 0.01 UF +80 -20% 100 VDCW	72982	801-K800011
A3CR1	1901-0040	30	DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR4	1901-0159		DIODE:SILICON 0.75A 600PIV	04713	SR1358-4
A3CR5	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A3CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR8	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR9	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A3CR9	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR10	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR11	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR13	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR15	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR16	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR17	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR19	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR19	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR20	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR21	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR22	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR23	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR24	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR25	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR26	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR27	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR28	1902-0033	1	DIODE:BREAKDOWN 6.2V	04713	1N823
A3CR29	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR30	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR31	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR32	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR33	1902-0126	1	DIODE:BREAKDOWN 2.61V 5%	04713	SZ10939-14
A3CR34	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3E1	0360-0294	3	TERMINAL:SOLDER POINT	28480	0360-0294
A3E2	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A3E3	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A3Q1	1854-0477		TSTR:SI NPN	80131	2N2222A
A3Q2	1853-0281		TSTR:SI PNP	80131	2N2907A
A3Q3	1854-0477		TSTR:SI NPN	80131	2N2222A
A3Q4	1854-0477		TSTR:SI NPN	80131	2N2222A
A3Q5	1853-0281		TSTR:SI PNP	80131	2N2907A
A3Q6	1853-0281		TSTR:SI PNP	80131	2N2907A
A3Q7	1854-0477		TSTR:SI NPN	80131	2N2222A
A3Q8	1854-0477		TSTR:SI NPN	80131	2N2222A
A3Q9	1854-0477		TSTR:SI NPN	80131	2N2222A
A3Q10	1854-0477		TSTR:SI NPN	80131	2N2222A
A3Q11	1854-0477		TSTR:SI NPN	80131	2N2222A
A3Q12	1854-0477		TSTR:SI NPN	80131	2N2222A

NOTES: 1. First used on card rev. 1250.

Table 7-4. Protection and Control Card A3 (02100-60109), Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3Q13	1853-0281		TSTR:SI PNP	80131	2N2907A
A3Q14	1854-0477		TSTR:SI NPN	80131	2N2222A
A3Q15	1853-0281		TSTR:SI PNP	80131	2N2907A
A3Q16	1854-0039		TSTR:SI NPN	80131	2N3053
A3Q17	1853-0281		TSTR:SI PNP	80131	2N2907A
A3R1	0698-3136	1	R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A3R2	2100-2574	2	R:VAR CERMET 500 OHM 10% LIN 1/2W	28480	2100-2574
A3R3	0698-3158	7	R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R4	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R5	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A3R6	0757-0316	1	R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A3R7	0757-0442	4	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R8	0757-0280	4	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R9	0698-3150	2	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R10	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R11	0757-0465	4	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R12	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R13	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A3R14	0698-3155	7	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R15	0757-0444	1	R:FXD MET FLM 12.1K OHM 1% 1/8W	28480	0757-0444
A3R16	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R17	0757-0459	8	R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R18	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R19	0757-0346	4	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A3R20	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R21	0698-0084	3	R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A3R22	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R23	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R24	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R25	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R26	0757-0440	3	R:FXD MET FLM 7.50K OHM 1% 1/3W	28480	0757-0440
A3R27	0757-0420	1	R:FXD MET FLM 7 50 OHM 1% 1/8W	28480	0757-0420
A3R28	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R29	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R30	0757-0274	1	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A3R31	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R33	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R34	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A3R35	0698-3452	2	R:FXD MET FLM 147K OHM 1% 1/8W	28480	0698-3452
A3R36	0698-3151	1	R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A3R37	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R38	0757-0446	1	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R39	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R40	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R41	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R42	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R43	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R44	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R45	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A3R46	0757-0428	3	R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A3R47	0698-3152	1	R:FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A3R48	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A3R49	0757-0440	2	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A3R50	0698-3455	2	R:FXD MET FLM 261K OHM 1% 1/8W	28480	0698-3455
A3R51	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R52	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R53	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A3R54	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A3R55	0698-3445	1	R:FXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A3R56	0698-3455		R:FXD MET FLM 261K OHM 1% 1/8W	28480	0698-3455
A3R57	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3R58	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R59	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A3R60	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R61	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R62	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R63	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R64	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A3R65	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A3R66	2100-2574		R:VAR CERMET 500 OHM 10% LIN 1/2W	28480	2100-2574
A3R67	0698-0083	1	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R68	0757-0418	1	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A3R69	0757-0422	1	R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A3R70	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438

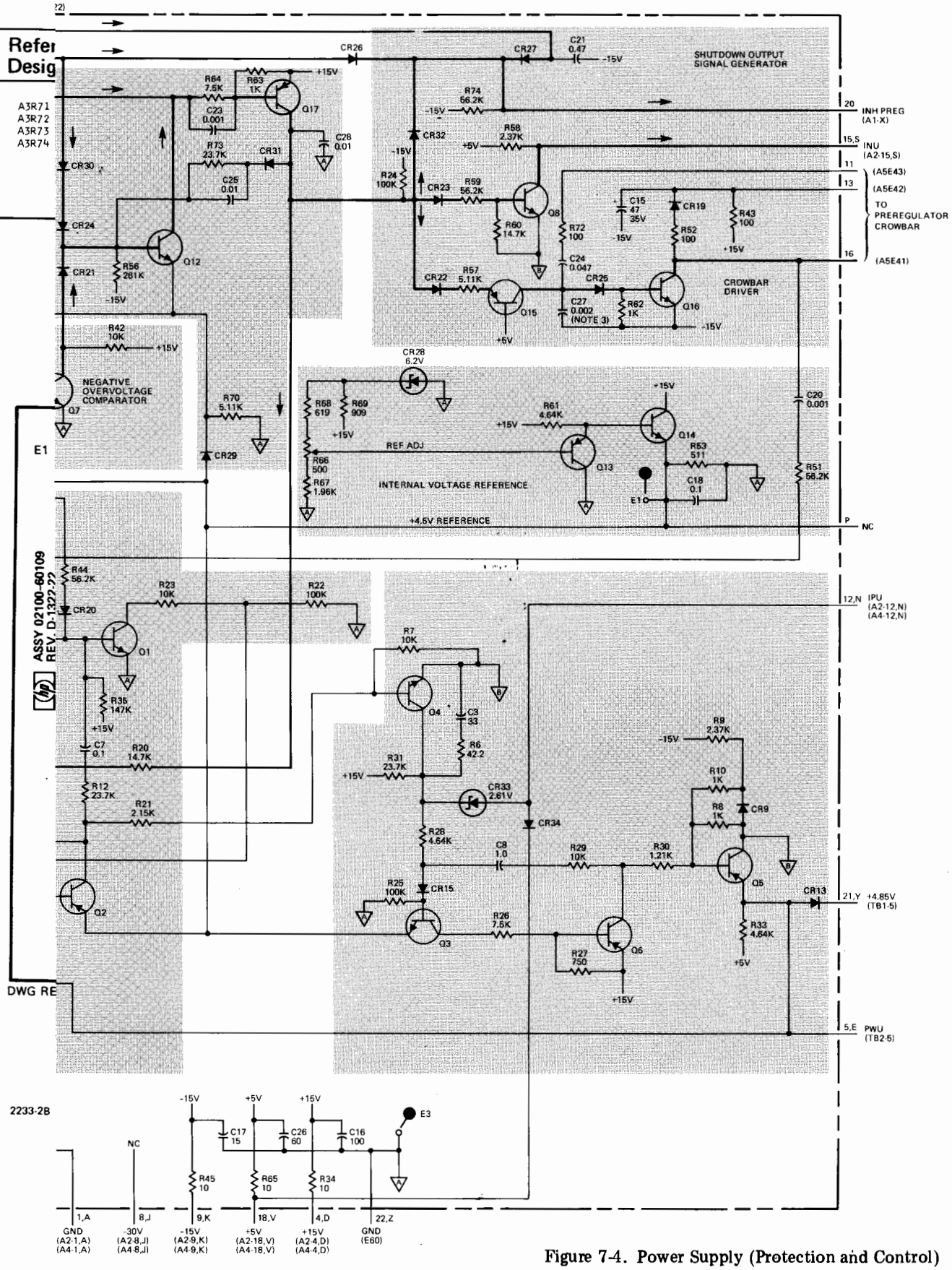


Figure 7-4. Power Supply (Protection and Control) Parts Location and Schematic Diagrams, Date Codes 1240 and Higher (Sheet 3 of 4)

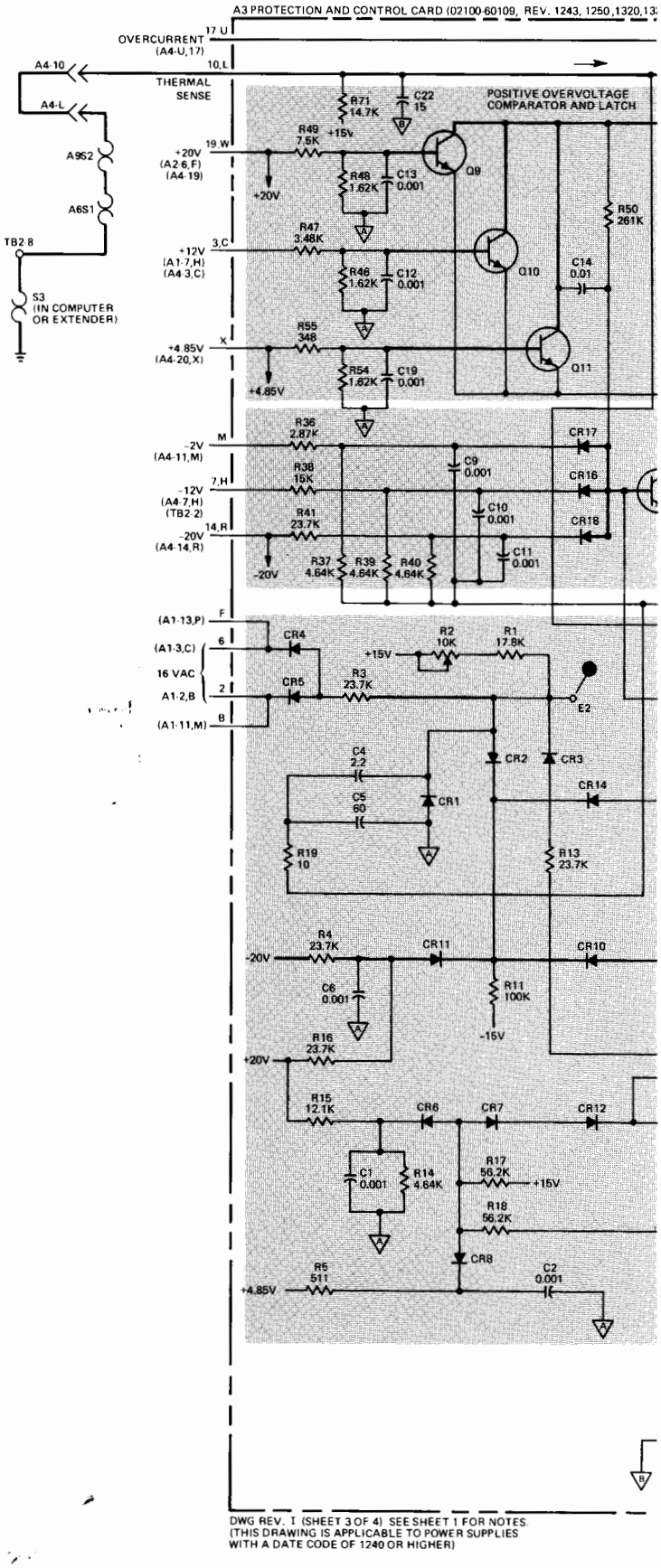
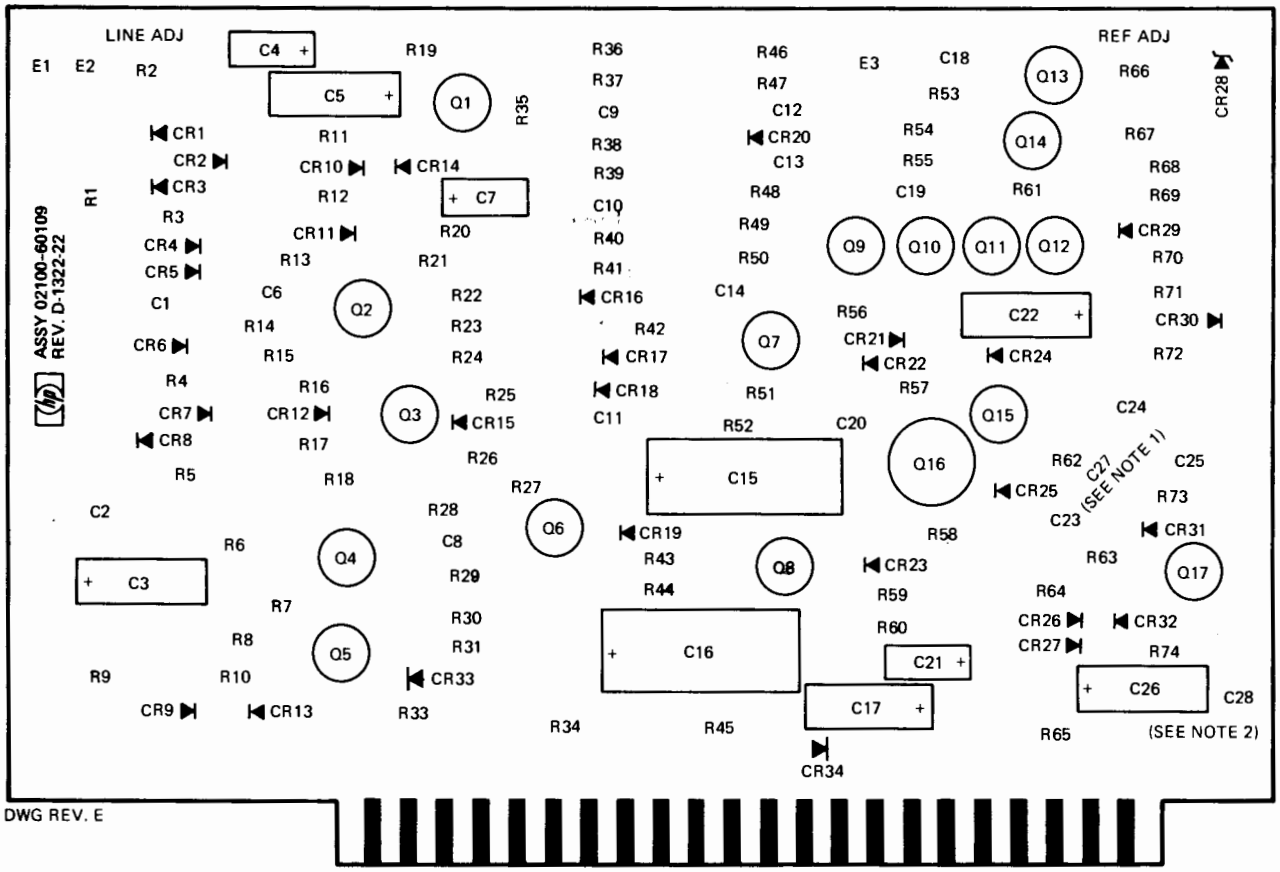

A3 PROTECTION AND CONTROL CARD (02100-60109, REV. 1243, 1250, 1320, 13
OVERCURRENT (A4-U,17)
17,U
A4-10
10,L
THERMAL SENSE
A4-L
A9S2
A6S1
TB2-8
S3 (IN COMPUTER OR EXTENDER)
POSITIVE OVERVOLTAGE COMPARATOR AND LATCH
R71 14.7K
C22 15
R49 7.5K
+15V
19,W
+20V (A2-6,F) (A4-19)
R48 1.62K
C13 0.001
Q9
+20V
R50 261K
R47 3.48K
3,C
+12V (A1-7,H) (A4-3,C)
R46 1.62K
C12 0.001
Q10
C14 0.01
R55 348
X
+4.85V (A4-20,X)
R54 1.62K
C19 0.001
Q11
+4.85V
R36 2.87K
M
-2V (A4-11,M)
CR17
C9 0.001
R38 15K
7,H
-12V (A4-7,H) (TB2-2)
CR16
C10 0.001
R41 23.7K
14,R
-20V (A4-14,R)
CR18
-20V
R37 4.64K
R39 4.64K
R40 4.64K
C11 0.001
F
(A1-13,P)
6
(A1-3,C)
16 VAC
2
A1-2,B
8
(A1-11,M)
CR4
CR5
R2 10K
R1 17.8K
+15V
R3 23.7K
E2
C4 2.2
C5 60
CR1
CR2
CR3
CR14
R19 10
R13 23.7K
R4 23.7K
-20V
CR11
CR10
C6 0.001
R11 100K
-15V
R16 23.7K
+20V
R15 12.1K
CR6
CR7
CR12
C1 0.001
R14 4.64K
R17 56.2K
+15V
R18 56.2K
CR8
R5 511
+4.85V
C2 0.001
DWG REV. I (SHEET 3 OF 4) SEE SHEET 1 FOR NOTES.
(THIS DRAWING IS APPLICABLE TO POWER SUPPLIES WITH A DATE CODE OF 1240 OR HIGHER)

Table 7-4. Protection and Control Card A3 (02100-60109), Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R71	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A3R72	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R73	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A3R74	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459



NOTES: 1. C27 NOT USED ON CARD REV. A-1243-22.

2. C28 FIRST USED ON CARD REV. D-1320-22.

2233-2B

Table 7-5. Current Limit Card A4 (02100-60110), Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4	02100-60110	1	CURRENT LIMIT CARD	28480	02100-60110
A4C1	0160-0168	3	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C2	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C3	0160-0161	1	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A4C4	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4C5	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C6	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C7	0170-0024	2	C:FXD MY 0.022UF 20% 200VDCW	56289	192P22302
A4C8	0180-0097		C:FXD TANT. 47 UF 10% 35VDCW	56289	150D476X9035S2-DYS
A4C9	0180-0049	*	C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A4C10	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A4C11	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C12	0170-0024		C:FXD MY 0.022UF 20% 200VDCW	56289	192P22302
A4C13	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A4C14	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A4C15	0180-0049		C:FXD ELECT 20 UF +75-10% 50VDCW	56289	30D206G050CC2-DSM
A4C16	0160-0168		C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A4CR1	1901-0050	10	DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR2	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR3	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR4	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR5	1902-3290	2	DIODE BREAKDOWN:SILICON 31.6V 5%	28480	1902-3290
A4CR6	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR7	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR8	1902-3290		DIODE BREAKDOWN:SILICON 31.6V 5%	28480	1902-3290
A4CR9	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR10	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR11	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4CR12	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDA 6308
A4Q1	1853-0281		TSTR:SI PNP	80131	2N2907A
A4R1	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R2	0698-0082	10	R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R3	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R4	0757-0461		R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A4R5	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R7	0698-3162	8	R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R8	0698-3452		R:FXD MET FLM 147K OHM 1% 1/8W	28480	0698-3452
A4R9	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R10	0757-0464	1	R:FXD MET FLM 90.9K OHM 1% 1/8W	28480	0757-0464
A4R11	0698-3260	5	R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A4R12	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R13	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R14	0698-3450	1	R:FXD MET FLM 42.2K OHM 1% 1/8W	28480	0698-3450
A4R15	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R16	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A4R17	0757-0461		R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A4R18	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R19	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R20	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R21	0698-3161	1	R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A4R22	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R23	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R24	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A4R25	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A4R26	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R27	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R28	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R29	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R30	0698-3160	1	R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A4R31	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A4R31	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A4R32	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R33	0757-0461		R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A4R34	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R35	0757-0459		R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A4R36	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A4R37	0698-4037	4	R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R38	0698-4037		R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R39	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A4R40	0698-4037		R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R41	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A4R42	0698-4037		R:FXD MET FLM 46.4 OHM 1% 1/8W	28480	0698-4037
A4R43	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R44	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162

Table 7-5. Current Limit Card A4 (02100-60110), Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R45	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R46	0757-0462	1	R:FXD MET FLM 75.0K OHM 1% 1/8W	28480	0757-0462
A4R47	0698-3162		R:FXD MET FLM 46.4K OHM 1% 1/8W	28480	0698-3162
A4R48	0757-0463	1	R:FXD MET FLM 82.5K OHM 1% 1/8W	28480	0757-0463
A4R49	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A4U1	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U2	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U3	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U4	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U5	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U6	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393
A4U7	1826-0070		IC:LINEAR OPER. AMPL.	07263	U6A7741393

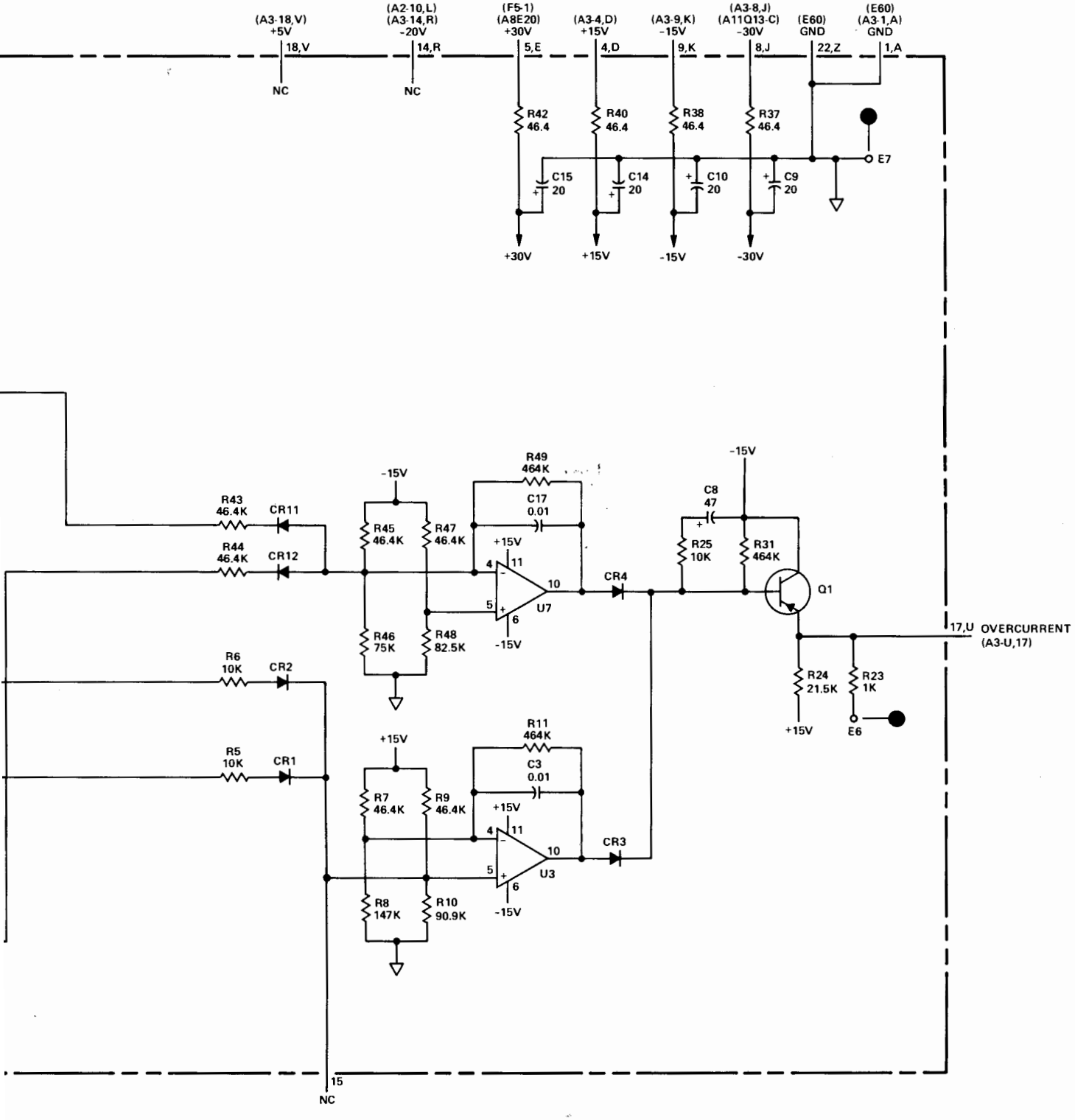
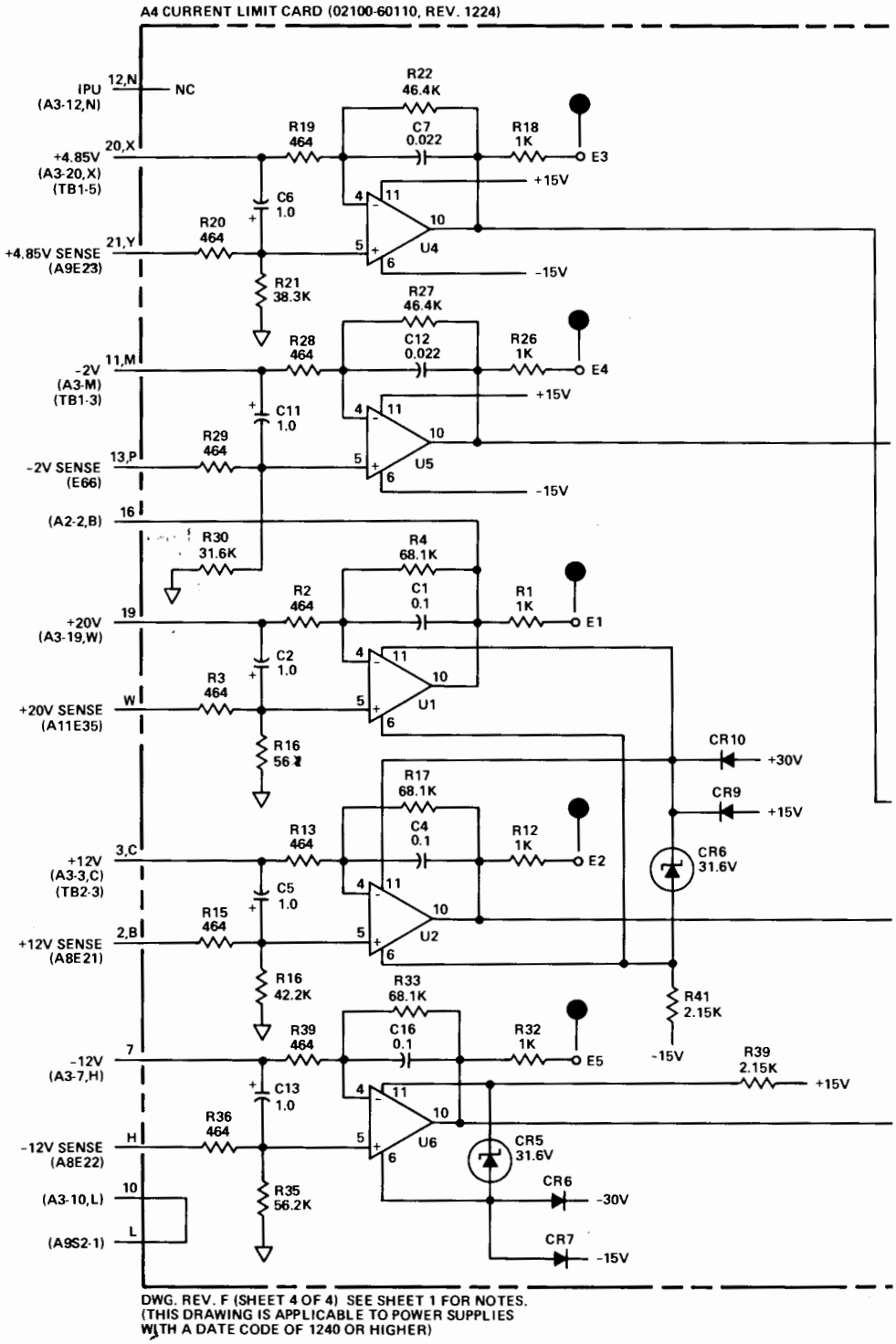
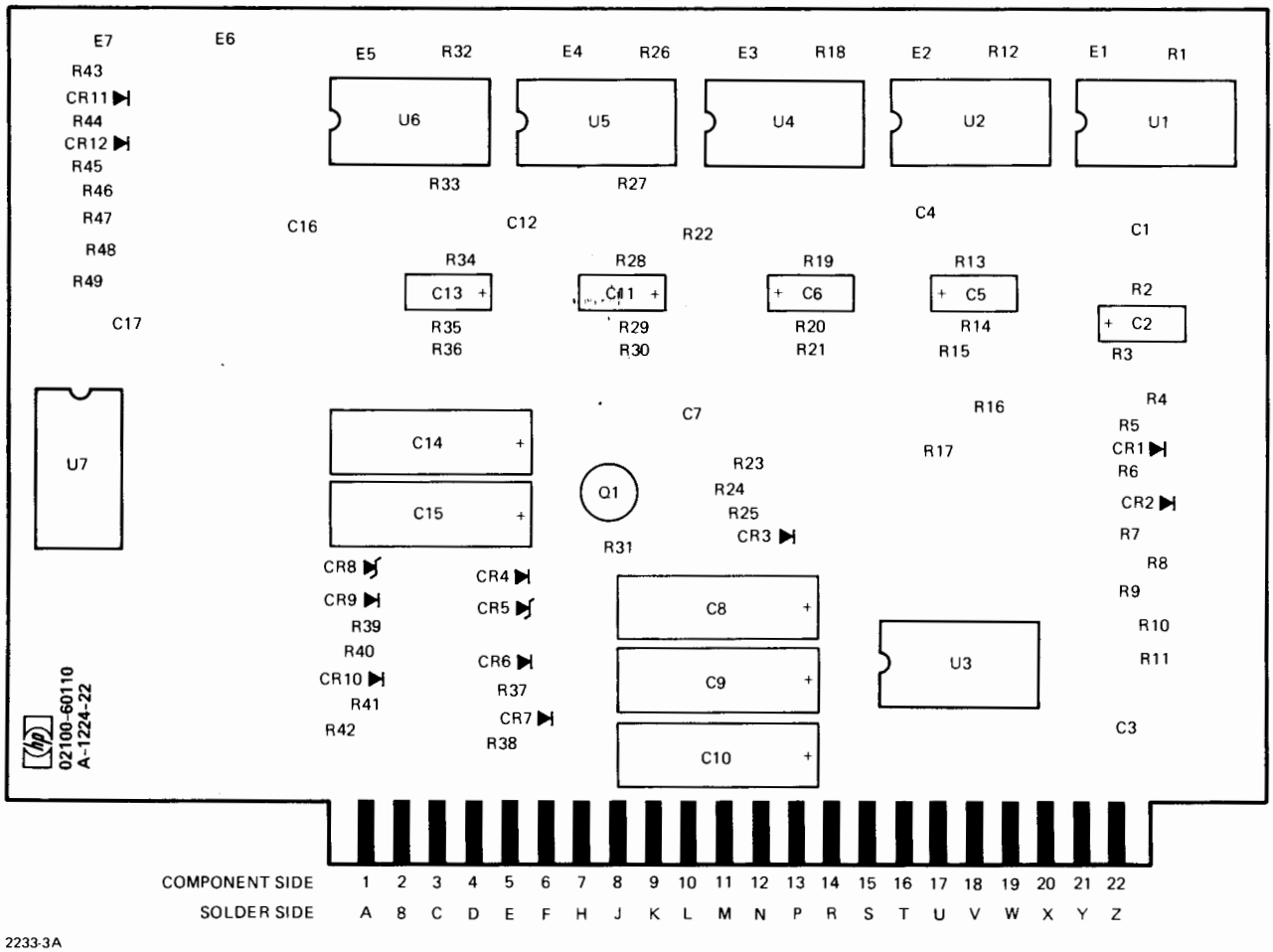


Figure 7-4. Power Supply (Current Limit) Parts Location and Schematic Diagrams, Date Codes 1240 and Higher (Sheet 4 of 4)


A4 CURRENT LIMIT CARD (02100-60110, REV. 1224)
IPU (A3-12,N)
12,N
NC
R22 46.4K
R19 464
C7 0.022
R18 1K
E3
+4.85V (A3-20,X) (TB1-5)
20,X
+15V
C6 1.0
R20 464
+4.85V SENSE (A9E23)
21,Y
U4
-15V
R21 38.3K
R27 46.4K
R28 464
C12 0.022
R26 1K
E4
-2V (A3-M) (TB1-3)
11,M
+15V
C11 1.0
R29 464
-2V SENSE (E66)
13,P
U5
-15V
(A2-2,B)
16
R30 31.6K
R4 68.1K
R2 464
C1 0.1
R1 1K
E1
+20V (A3-19,W)
19
C2 1.0
R3 464
+20V SENSE (A11E35)
W
U1
R16 56.2
CR10
+30V
R17 68.1K
CR9
+15V
R13 464
C4 0.1
R12 1K
E2
CR6 31.6V
+12V (A3-3,C) (TB2-3)
3,C
C5 1.0
R15 464
+12V SENSE (A8E21)
2,B
U2
R16 42.2K
R33 68.1K
R41 2.15K
R39 464
C16 0.1
R32 1K
E5
-15V
-12V (A3-7,H)
7
R39 2.15K
+15V
C13 1.0
R36 464
-12V SENSE (A8E22)
H
U6
CR5 31.6V
CR6
-30V
(A3-10,L)
10
R35 56.2K
(A9S2-1)
L
CR7
-15V
DWG. REV. F (SHEET 4 OF 4) SEE SHEET 1 FOR NOTES.
(THIS DRAWING IS APPLICABLE TO POWER SUPPLIES WITH A DATE CODE OF 1240 OR HIGHER)


E7
E6
E5
R32
E4
R26
E3
R18
E2
R12
E1
R1
R43
CR11
R44
CR12
R45
R46
R47
R48
R49
U6
U5
U4
U2
U1
R33
R27
C16
C12
C4
R22
C1
R34
R28
R19
R13
R2
C13 +
C11 +
+ C6
+ C5
+ C2
C17
R35
R36
R29
R30
R20
R21
R14
R15
R3
U7
C14 +
C7
R16
R4
R5
CR1
R17
C15 +
Q1
R23
R24
R25
CR3
R6
CR2
R7
R31
CR8
CR9
R39
R40
CR10
R41
R42
CR4
CR5
CR6
R37
CR7
R38
C8 +
C9 +
C10 +
U3
R8
R9
R10
R11
C3
02100-60110
A-1224-22
COMPONENT SIDE 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
SOLDER SIDE A B C D E F H J K L M N P R S T U V W X Y Z

2233-3A

MANUAL PART NO. 5951-3038
MICROFICHE PART NO. 5951-4427

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