ALTEC LANSING®

the sound of experience

9444B and 9444B/SA

Anniversary Series Power Amplifier

Operating and Service Instructions

ALTEC LANSING® CORPORATION

a **MARK IV** company

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1 ELECTRICAL

Two amplifier models are available. One model has a 50/60 Hz power transformer with two 120 V ac primary windings. These windings may be wired in parallel or series for operation at either 120 V ac or 220/240 V ac. The other amplifier model is for export into countries where the ac line voltage is 100 volts, 50/60 Hz. The next two sections refer to the first model with the dual 120 V ac primary windings.

1.1 120 V ac, 50/60 Hz Power Connections

The amplifier is provided with the primary of the power transformer strapped for 120 V ac operation from the factory. Refer to Figure 2a for the wiring details.

WARNING: *Verify that the power transformer's primary circuit configuration is correct for the intended ac line voltage BEFORE applying power to the amplifier.*

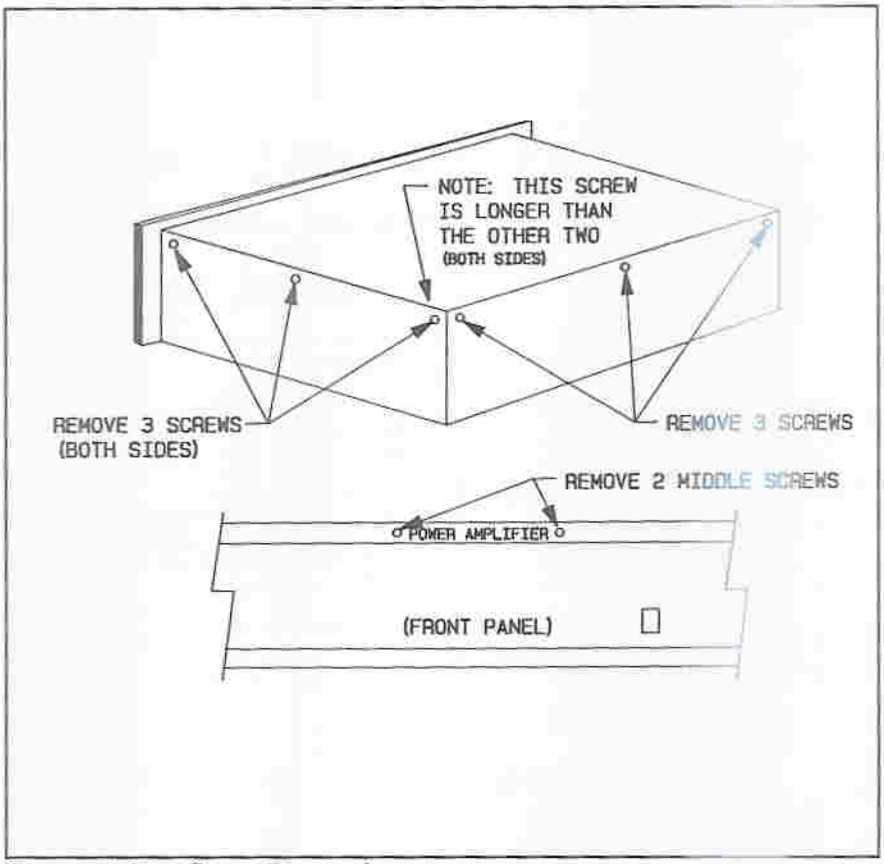

Figure 1 Top Cover Removal

1.2 220/240 V ac, 50/60 Hz Power Connections

The power transformer has two 120 volt primary windings which can be connected in parallel for 120 V ac line voltages, or in series to meet 220/240 V ac requirements. Use the following procedures to re-strap the primary of the power transformer for 220/240 V ac applications.

1. Make sure the amplifier is not connected to any power source.
2. Remove and save the eleven screws securing the top cover. There are three screws on each side and three along the top-rear edge of the chassis. In addition, you must remove the two innermost screws inset into the top bumper strip. Refer to Figure 1 for the exact screw locations.
3. Locate terminal blocks TB1 and TB2 on the side of the chassis near the rear input PC board. Reconnect the leads as shown in Figure 2b.
4. Install the top cover with the eleven screws previously removed. Two screws are longer than the others removed from the sides and rear. These longer screws install into the rearmost position on each side of the chassis.
5. Install an 5A fuse, Littelfuse Type 3AB 5A/250V slo-blo 326-series ceramic body or equiv.

2 INSTALLATION

2.1 Rack Mounting

The amplifier may be installed in a standard 19 inch equipment rack. It requires 5¼ inches of vertical rack space and secures to the rack cabinet with the four rack mount screws and cup washers provided in the hardware kit.

2.2 Ventilation

The amplifier must be adequately ventilated to avoid excessive temperature rise. It should not be used in areas where the ambient temperature exceeds 60 °C (140 °F). To determine the ambient air temperature, operate the system in the rack until the temperature stabilizes. Measure the ambient air with a bulb-type thermometer held at the bottom of the uppermost amplifier. Do not let the thermometer touch the metal chassis because the chassis will be hotter than the ambient air. If the

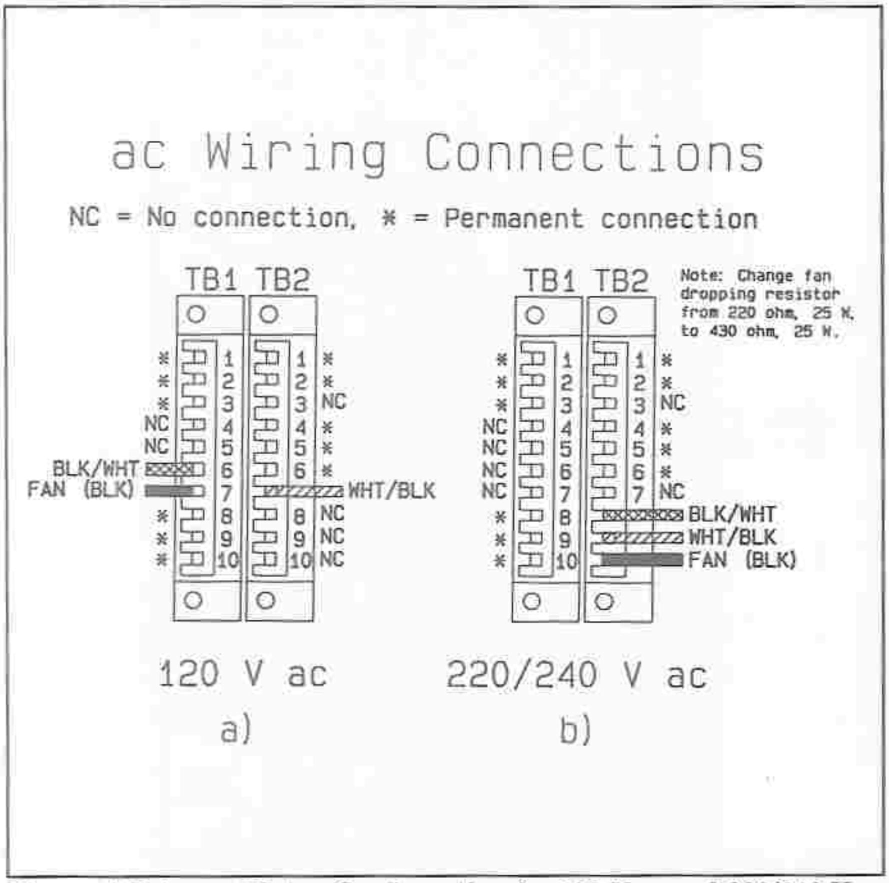

Figure 2 Primary Wiring Configuration for 120 V ac and 220/240 V ac

air temperature exceeds 60 °C (140 °F), the equipment should be spaced at least 1.75 inches apart or a blower installed to provide sufficient air movement within the cabinet.

WARNING: *Do not operate the amplifier within a completely closed unventilated housing.*

3 SIGNAL CONNECTIONS

3.1 Input Connections

Balanced input connections may be made to either the barrier strip or the female XLR connectors. For single-ended inputs, strap the low (—) input to ground (pin 3 on XLR). Otherwise, the electronically-balanced input stage will see 6 dB less input signal level than with a balanced input. Refer to Figure 3 for typical input connections.

3.2 Line Output Connections

The XLR and barrier strip connectors are wired in parallel. Pin 2 of the XLR is the (+) input on the barrier strip, and pin 3 is the (—) input. Since the input impedance of the electronically-balanced input stage is high (15 kohms), there is minimal loading on the signal source. When the input connections are made to one connector, the other may be used as an auxiliary line output to feed other high input impedance equipment. Refer to Figure 3 for possible applications.

3.3 Output Connections

Output connections are made to the four terminal barrier strip connector located on the rear of the unit. Refer to Figure 4 for typical output connections.

3.4 Output Cable Selection

Speaker wire size plays an important part in quality sound systems. Small wire gauges can waste power and reduce the damping factor at the speaker terminals. This can add coloration and muddiness to the sound. To help offset this problem, Table I has been assembled to enable you to calculate the power losses in the speaker cable.

3.4.1 Calculating Power Losses with 8 ohm Loads

To calculate the total power loss in the speaker cable, multiply the power loss per foot (or meter) of the 2-wire cable selected from Table I by the length of the cable in feet (or meters). For example, suppose an installer uses 160 feet of 10 GA 2-wire cable with an 8 Ω speaker system. The total power loss in the cable is:

Total Power Loss in cable

= 0.0509 watts/foot × 160 feet
= *8.1 watts*

Does this mean that whenever the amplifier produces 200 watts of output power, 191.9 watts (200 watts minus 8.1 watts) will be delivered to the 8 ohm load? NO! The actual load impedance is 8 ohms *plus* the resistance of the cable (0.00204 ohms/foot times 160 feet) for a total load impedance of 8.3264 ohms. At the 8 Ω rated output power, the output voltage is 40 V rms. Therefore, the amplifier produces *192.2* watts with this load instead of 200 watts. This was calculated by squaring the voltage and dividing by the load impedance (40^2 divided by 8.3264 ohms). As a result, the actual power delivered to the load is *184.1* watts (192.2 watts minus 8.1 watts).

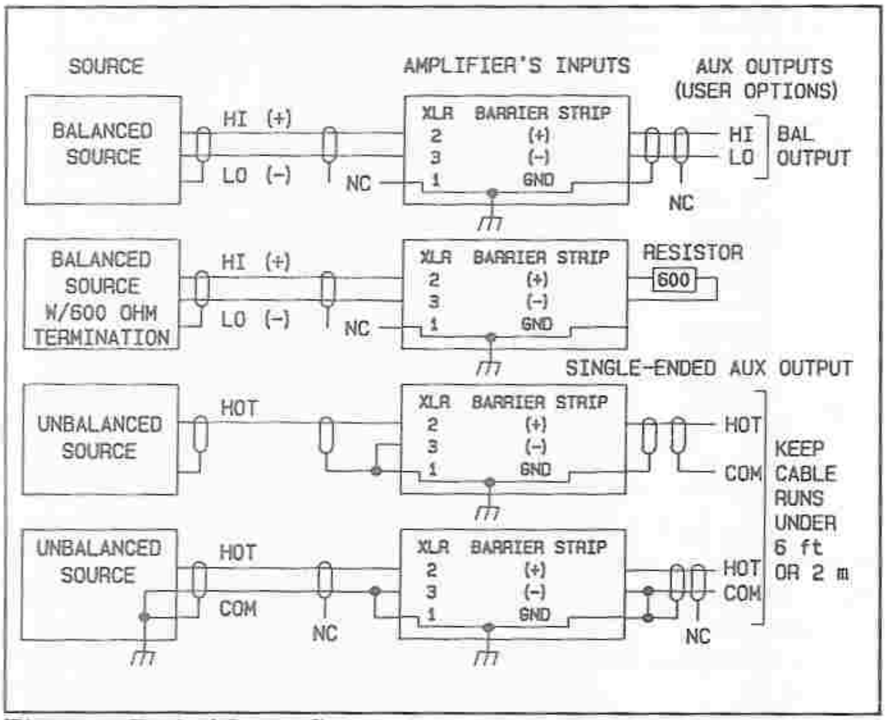

Figure 3 Typical Input Connections

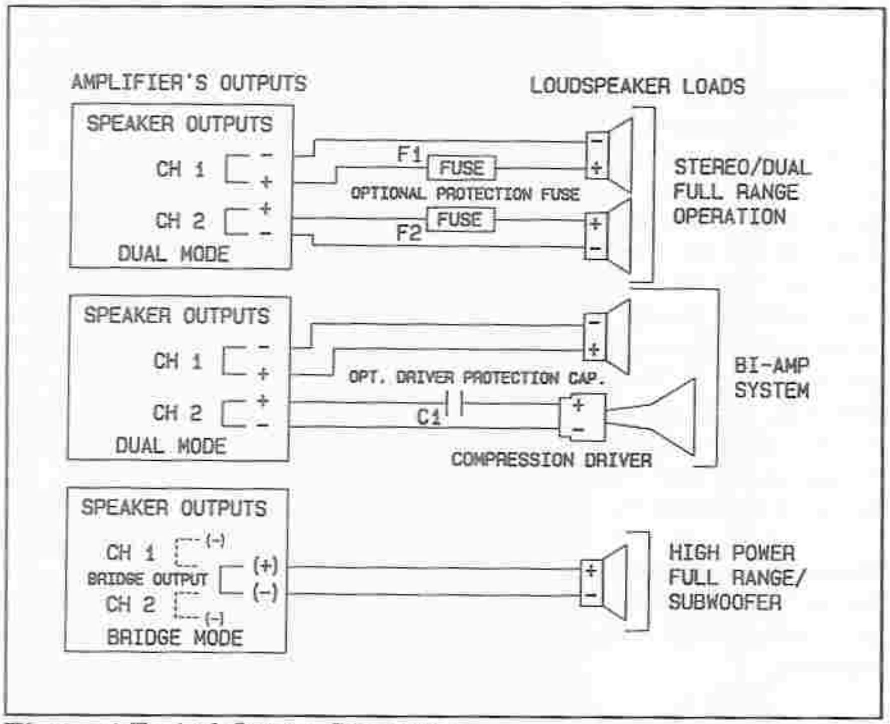

Figure 4 Typical Output Connections

Had 18 GA wire been used in the above example, the loss in the cable would have been 51.9 watts. This example illustrates the importance of using the proper wire size.

3.4.2 Calculating Power Losses with 4 ohm Loads

To calculate the losses when using a 4 ohm speaker system, multiply the loss at 8 ohms by 3. In the above example, the 10 GA wire would consume 24.3 watts of power while the 18 GA wire would waste 155.7 watts - *more than half of the amplifier's 4 ohm power rating.*

3.5 Damping Factor

The higher the damping factor rating of an amplifier, the greater the ability of the amplifier to control unwanted speaker cone movements. When a signal drives a woofer, current flowing through the voice coil creates a magnetic field. This field interacts with the permanent magnetic field in the gap and forces the combination cone and voice coil assembly to move outward. When the signal is removed, the assembly moves inward but its momentum causes it to overshoot its resting point. This overshoot will dampen itself out eventually but the unwanted movements can add considerable distortion products to the sound.

In the process of moving inward through the magnetic field, the voice coil assembly generates a current of opposite polarity to the original signal. This current induces a voltage or "back EMF" which travels through the speaker wire to the amplifier's output. The lower the amplifier's output impedance, the faster the overshoot of the voice coil will dampen out. The output impedance of an amplifier can be calculated by dividing the rated output impedance, typically 8 ohms, by the damping factor. The 9444B has a damping factor rating of 200 which corresponds to an output impedance of 0.04 ohms.

3.5.1 Calculating the Maximum Length of Cable for a Specified

Damping Factor Specification at the Load

The damping factor rating is typically never realized at the load because of the resistance of the cable (and other factors such as the contact resistance of an output relay or the resistance of an output fuse). The damping factor at the load should be 30 for general paging systems and 50 for high fidelity music systems. Economics usually dictate, however, that these numbers are cut-in-half. The resulting damping factor at the load should be based on experience and customer satisfaction. Once a minimum damping factor is determined for a particular type of installation, the following equation can calculate the maximum length of 2-wire cable which can be used to achieve the minimum damping factor specified at the load:

Max. Length of 2-wire cable in feet

$$= \frac{\frac{ZL}{DF} - Zo}{DCR/ft}$$

where

ZL is the load impedance to connect to the amplifier;
Zo is the amplifier's output impedance (0.04 ohms for the **9444B**);
DF is the minimum permissible damping factor at the load; and
DCR/ft is the DC resistance of the 2-wire cable per foot from Table I.

The same equation can be used to calculate the maximum cable length in meters by substituting the DCR per meter value from Table I.

Let's use the equation. Suppose ZL equals 8 ohms, Zo = 0.04 ohms, and the minimum damping factor at the load is 25. In addition, 18 GA cable is preferred. Then, the maximum length of 18 GA cable which can be used to achieve a damping factor of 25 at the load is:

$$\frac{\frac{8}{25} - (0.04)}{0.01302\ \Omega/ft} = \textit{21.5 feet}$$

Table I 9444B Power Losses in 2-wire Speaker Cable

AWG (GA)	DCR/ft (Ω/ft)	Power Loss/ft (watts/ft)	Cable Cross-Sectional area (mm^2)	DCR/meter (Ω/m)	Power Loss/meter (watts/m)
6	0.00081	0.0201	13.30	0.00264	0.0661
8	0.00121	0.0302	8.36	0.00421	0.1051
10	0.00204	0.0509	5.26	0.00669	0.1669
12	0.00324	0.0809	3.31	0.01063	0.2650
14	0.00515	0.1286	2.08	0.01691	0.4210
16	0.00819	0.2043	1.31	0.02685	0.6667
18	0.01302	0.3244	0.82	0.04289	1.0609
20	0.02070	0.5148	0.52	0.06764	1.6627
22	0.03292	0.8163	0.33	0.10658	2.5950

Sometimes it may be necessary to locate the speaker 100 feet or more away from the amplifier. In this situation, a much larger gauge cable is required. However, this may not be practical or economical. The size of the 2-wire cable can be greatly reduced by stepping up the output voltage of the amplifier to 70, 100, 140, or 210 volt, using an output transformer, then stepping down the voltage at the load. Such a system is shown in Figure 5.

The maximum length of 2-wire cable in this situation can be approximated from the following equation:

Max. Length of 2-wire cable in feet

$$\frac{V^2}{(Pout)(DCR/ft)} \quad \frac{1}{DF} - \frac{Zo}{ZL}$$

where

V is the stepped-up voltage of the system;
Pout is the rated output power of the amplifier;
Zo is the output impedance of the amplifier (0.04 ohms for the **9444B**);
ZL is the load impedance;
DCR/ft is the DC resistance of the 2-wire cable per foot from Table I; and
DF is the minimum permissible damping factor at the load.

Suppose a 210 volt system were used at a 600 watt power level to drive an 8 ohm load with a minimum damping factor of 25. Using the same 18 GA cable as before, the maximum length can now be 198 feet. Power companies use this technique to transfer large amounts of power over great distances.

3.6 Speaker Protection Fuse Selection

Sometimes it may be desirable to use in-line fuses (fuses in series with the output) to protect loudspeaker systems (or the amplifier). It is difficult, however, to determine the proper fuse value with the correct time lag and overload characteristics to match the limitations of a speaker system. The values shown in Table II should serve only as a guide. To

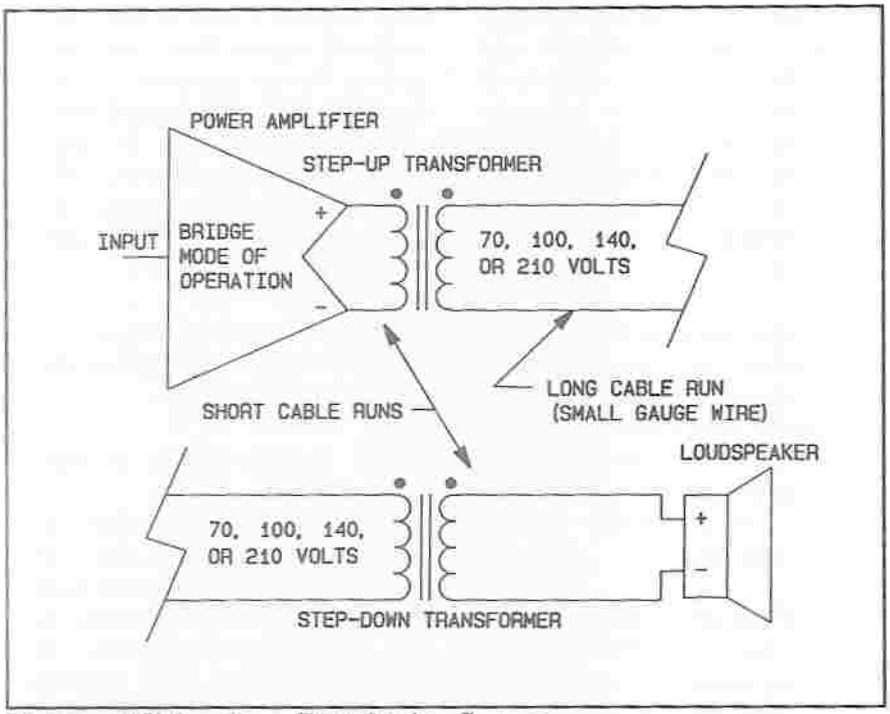

Figure 5 High-voltage Distribution System

use, determine the power rating and load value. Then, select a standard value fuse of the next smaller value to the one listed in the table.

Table II Calculated Output Fuse Values

Power (watts)	4 Ω Load	8 Ω Load	16 Ω Load
100	3.70	2.62	1.85
150	4.54	3.21	2.27
200	5.24	3.70	2.62
300	6.42	4.54	3.21
400	7.41	5.24	3.70
600	9.07	6.42	4.54

The values are calculated for fast-blow fuses which carry 135% of their current rating for an hour but will blow within 1 second at 200%. Other fuse values may be calculated for different power levels from the following equation:

Fuse value =

$$\frac{(Pout \times ZL)^{1/2}}{ZL \times 1.35} \text{ amps}$$

where

Pout is the output power rating of the amplifier; and

ZL is the load impedance.

Use 32 volt fuses if possible; they typically have the lowest internal resistance which will help minimize deterioration of the damping factor at the load. Refer to the example in Figure 4.

3.7 Compression Driver Protection Capacitors

Compression drivers, used for mid to high frequency sound reproduction, are much more susceptible to damage from low frequencies than large cone loudspeakers. Even though an electronic crossover may be employed, problems may arise in the cables between the crossover and the power amplifier, or from misadjustment of the crossover. Either of these situations could apply low frequency signals or hum to the driver and cause damage. To prevent a potential mishap, Altec Lansing recommends using a capacitor between the amplifier and the compression driver to suppress low frequencies and possible DC. Refer to the example in Figure 4.

In choosing a value, one must be careful not to interfere with the crossover frequency. *As a general rule, select a capacitor whose break frequency, with respect to the load, is 3 dB down at approximately ½ of the high pass corner frequency.*

Mylar capacitors with at least a 100 volt ac rating are recommended. Table III shows the recommended capacitor values for use with 8 and 16 ohm drivers at popular crossover frequencies.

Table III Compression Driver Protection Capacitors

Crossover Frequency	8 Ω Driver	16 Ω Driver
500 Hz	80 μF	40 μF
800 Hz	50 μF	25 μF
1000 Hz	40 μF	20 μF
1250 Hz	33 μF	16 μF
2000 Hz	20 μF	10 μF
3150 Hz	12 μF	6 μF
6300 Hz	6 μF	3 μF

4 OCTAL ACCESSORY SOCKETS

Two octal sockets permit a variety of plug-in accessories to be used with the amplifier. Normally, one "U" jumper is inserted between octal socket pins 8 and 1, and another between pins 7 and 6. *These jumpers must remain in place for the amplifier to operate when not using any accessory modules.* To use with an accessory module, remove (and save) the jumpers and install the module making sure the key on its center post aligns with the groove in the female socket. For operation, refer to the instructions provided with the module. Schematically, the module will be inserted between the input connector and the balanced input stage.

Electronic modules are powered from a bipolar 15 volt supply in the amplifier. The supply is capable of supplying up to 25 ma DC of current. Currents in excess of 25 ma DC may prevent the amplifier from disengaging from its built-in protection mechanisms.

5 PROTECTION SYSTEMS

5.1 Load Protection Circuitry

Each channel independently protects its load from startup/shutdown transients, DC, and large subsonic signals.

5.2 Amplifier Protection Circuitry

A unique current-limiting circuit was designed specifically for the amplifier. It features a variable current limit which is a function of the output signal voltage. As a result, the amplifier can deliver the rated currents into rated loads but substantially limits the current into low impedance or shorted loads (shorted output terminals). Once the short is removed, however, the amplifier will resume normal operation.

A dual speed fan is also incorporated to provide efficient cooling under the most demanding conditions. When the heatsink temperature at the fin tips reaches approximately 88 °C (190 °F), the fan automatically switches to high speed operation. As the temperature cools to approximately 78 °C (172 °F), low speed operation is once again resumed.

The heatsink is also thermally equalized to prevent the output devices nearest the fan from operating at a cooler temperature than the devices at the opposite end. This minimizes the thermal gradient across the heatsink and forces the devices to operate at more nearly the same temperature. This equalizes the lifetimes and reliability characteristics of the output devices so that no one device becomes the weak link in the chain.

Should the heatsink temperature of a channel remain excessively high, the affected channel will shut down automatically. When the output devices cool to a safe operating temperature, the channel will automatically resume normal operation.

5.3 Protect Indicator

The "PROTECT" LED does not turn-on abruptly as others may do; its intensity is allowed to vary. As a result, its degree of brightness serves as a relative indicator of the severity of the current operating conditions e.g., the brighter the LED, the greater the stress on the channel(s). This provides a visual notification well in advance of any impending shutdown.

Although the channel may still operate with the LED apparently at full brightness, a total shutdown will occur within a few seconds unless the operating conditions improve. If a shutdown does occur, the channel will resume normal operation as soon as its devices have cooled to an acceptable temperature.

6 OPERATION

6.1 Dual Mode of Operation

In the dual mode of operation, the channels may be operated independently. After installation and hookup, verify that the mode switch, located on the rear panel, is in the "DUAL" position and rotate the level controls fully counterclockwise (full attenuation). Input a 0 dBu (0.775 V rms) nominal signal level and apply power. Slowly increase the level controls until the desired output power is obtained. If either "CLIP" LED illuminates, reduce the output with the channel level control or reduce the input signal level at its source.

WARNING: *Never attempt to connect the outputs of the two channels in parallel.*

6.2 Bridge Mode of Operation

After installation and hookup, verify that the mode switch, located on the rear panel, is in the "BRIDGE" position. Rotate both levels controls fully counterclockwise (full attenuation). Input a 0 dBu (0.775 V rms) nominal signal level into channel 1 only and apply power. Slowly increase the level control of channel 1 until the desired output power is obtained. If either "CLIP" LED illuminates, reduce the output level with the level control or reduce the input signal level at its source.

CAUTION: *Be sure that no input connections are made to channel 2 and that its level control is fully counterclockwise (OFF).*

WARNING: *The bridged output mode provides a true balanced-to-ground output. Do not use any test equipment to test or evaluate this amplifier which does not have floating grounds.*

7 In Case of Problems

Please check the following items:

1. Verify that the amplifier is properly connected to an ac power source and that the source is active.

2. Verify that the input connections are properly

made. Refer to Figure 3.

3. Verify that the output connections are properly made. Refer to Figure 4.

4. Check the input and output cables for proper wiring and continuity.

5. Check the signal source and the load.

6. Insure that the two jumpers for each octal socket are properly installed (if not using optional plug-in modules).

7. Insure that any accessory modules installed do not draw more than 25 ma DC of current.

8. Check that the mode switch is in the desired position.

NOTICE: *Repairs performed by other than authorized warranty stations (Dealers) or qualified personnel shall void the warranty period of this unit. To avoid loss of warranty, see your nearest Altec Lansing authorized dealer, or call Altec Lansing Customer Service directly at (405) 324-5311, FAX (405) 324-8981, or write:*

Altec Lansing Customer Service/Repair
10500 W. Reno
Oklahoma City, OK 73128
U.S.A.

8 SPECIFICATIONS

Conditions:
1. 0 dBu = 0.775 volts rms.
2. Dual mode ratings are for each channel.
3. Both channels operating at rated output power unless noted.
4. 120 volt ac line input voltage maintained for all tests unless noted.

Continuous Rated Output Power:
(20 Hz - 20 kHz at less than 0.1% THD)

Dual mode, 4 Ω:	300 watts/ch
Bridge mode, 8 Ω:	600 watts
Dual mode, 8 Ω:	200 watts/ch
Bridge mode, 16 Ω:	400 watts

Continuous Rated Output Power to Subwoofer:
(20 Hz - 1 kHz at less than 0.1% THD)

Dual mode, 4 Ω:	375 watts/ch
Bridge mode, 8 Ω:	750 watts
Dual mode, 8 Ω:	225 watts/ch
Bridge mode, 16 Ω:	450 watts

Maximum Midband Output Power:
(Ref. 1 kHz, 1% THD, @120 volts ac line voltage)

Dual mode, 4 Ω:	>400 watts/ch
Bridge mode, 8 Ω:	>800 watts
Dual mode, 8 Ω:	>250 watts/ch
Bridge mode, 16 Ω:	>500 watts

(Ref. 1 kHz, 1% THD, @108 volts ac (10% sag))

Dual mode, 4 Ω:	>325 watts/ch
Bridge mode, 8 Ω:	>650 watts
Dual mode, 8 Ω:	>200 watts/ch
Bridge mode, 16 Ω:	>400 watts

(Ref. 1 kHz, 1% THD, @100 volts ac (17% sag))

Dual mode, 4 Ω:	>230 watts/ch
Bridge mode, 8 Ω:	>460 watts
Dual mode, 8 Ω:	>175 watts/ch
Bridge mode, 16 Ω:	>350 watts

Headroom (Before clip): ≥1 dB
(Ref. 1 kHz, 1% THD, any mode)

Frequency Response: 10 Hz - 90 kHz
(Ref. 1 kHz, 1 watt output, +0/—3 dB)

Power Bandwidth: 20 Hz - 20 kHz
(Ref. 1 kHz, +0/—1 dBr where 0 dBr = rated output power in any mode)

Voltage Gain:
(Ref. 1 kHz)

Dual mode, 4 Ω or 8 Ω:	33 dB
Bridge mode, 8 or 16 Ω:	39 dB

Input Sensitivity for Rated Output Power:
(Ref. 1 kHz, ±0.15 dB)

Dual mode, 4 Ω:	+0.1 dBu (0.78 V rms)
Bridge mode, 8 Ω:	+0.1 dBu (0.78 V rms)
Dual mode, 8 Ω:	+1.2 dBu (0.89 V rms)
Bridge mode, 16 Ω:	+1.2 dBu (0.89 V rms)

Maximum Input Level: +20 dBu (7.75 V rms)
(Ref. 1 kHz)

Input Impedance:
(Ref. 1 kHz)

Balanced:	15 kΩ
Unbalanced:	15 kΩ

Polarity: Positive-going signal applied to pin 2 of XLR or (+) of barrier strip produces positive-going signal at (+) output terminal.

Phase Response:
(Any mode)

20 Hz:	<+25°
20 kHz:	>—15°

THD: <0.1% (Typ. <0.01%)
(Any mode, 30 kHz measurement bandwidth)

IMD (SMPTE 4:1): <0.05% (Typ. <0.01%)
(Any mode)

TIM (DIM 100): <0.05%
(Any mode)

Rise Time: <6 μsec
(Any mode, 10% to 90%)

Slew Rate:

Dual mode, 4 or 8 Ω:	>30 V/μsec
Bridge mode, 8 or 16 Ω:	>60 V/μsec

Damping Factor:
(Dual mode, 8 Ω)

20 Hz - 1 kHz:	>200
20 kHz:	>75

Crosstalk: <75 dBr
(Ref. 1 kHz, 0 dBr = rated output power into 8 ohms, single channel operating)

Noise: >100 dB
(Below rated output power, A-weighting filter, 8 Ω

dual mode, 50/60 Hz ac line frequency)

Amplifier Protection: Shorted output terminals, Over-temperature, RF interference

Load Protection: Startup/shutdown transients, DC faults, Subsonic signals

Cooling:
Heatsink: Thermally equalized 3/16 in aluminum black anodized heatsink

Fan: Thermostatically controlled dual speed fan. Approximately 50 CFM at low speed and 100 CFM at high speed. Ball bearing fan has minimum life rating of 50,000 hours at 25 °C ambient temperature

Output Topology: True complementary symmetry with grounded collectors (no mica insulators means better heat transfer)

Output Type:
Dual mode: Unbalanced, each channel
Bridge mode: Balanced

Output Devices:
Total number: 16 devices
Pdmax rating: 250 watts
Vceo: 250 volts DC
Ic: 16 amps DC
Tjmax: 200 °C

Controls and Switches:
Rear: Mode switch, Two input level controls
Front: Power switch

Front Panel Indicators: Power LED, Clip LED (x 2),Protect LED (x 2)

Connections:
Input: 6 terminal barrier strip, Female XLR (x 2), Octal accessory socket (x 2), powered with ±15 volts DC at 25 ma.

Output: Barrier strip

Power: 6 ft (1.83 m), 3-wire, 16 GA power cord with NEMA 5-15 plug/IEC

Fuse Type: Littelfuse Type 3AB 10 A/250 V Slo-Blo® 326-series ceramic cartridge body, or equivalent (for 120 V ac use)

Power Requirements: 120 V ac, 50/60 Hz, 1000 watts (configurable to 220/240 V ac). 100 V ac, 50/60 Hz model available.

Operating ac Voltage Range: Operates from line voltages as low as 90 volts (at reduced output power) assuming a 120 V ac nominal line.

Power Consumption/ Heat Produced:
(Both channels operating in dual mode with 1 kHz sinewave input signal at stated output power into 4 Ω loads)

idle: 72 watts/0.245 kBTU/h

1/8th max midband power: 720 watts/2.100 kBTU/h

1/3rd max midband power: 1,068 watts/2.702 kBTU/h

Rated output power: 1,464 watts/2.938 kBTU/h

Max midband power: 1,680 watts/2.873 kBTU/h

Operating Temperature Range: Up to 60 °C (140 °F) ambient

Dimensions (Rear of rack ears to max depth):
5.25 in H x 19 in W x 13 in D
(13.3 cm H x 48.3 cm W x 33 cm D)

Shipping Weight:	42 lbs (19.1 kg)
Net Weight:	34 lbs (15.5 kg)
Color:	Black
Enclosure:	Rack mount chassis, 16 GA steel, 3/16 in 5052 aluminum alloy front panel
Standard Accessories:	4 - "U" jumper plugs for octal sockets (2 per socket, installed) 1 - Operating Instructions and Service Manual 1 - 5 A/250 V fuse (for 220/240 V ac use)
Optional Accessories:	**14712A** Power Limiter **15515A** Input Bridging Transformer with Pad **15524A** 300 watt 70 volt Transformer **15525A** 600 watt 70 volt Transformer **15567A** 300 watt Autoformer **15581A** 24 dB/oct Linkwitz-RileyCrossover **15594A-xxx** 18 dB/oct Low Pass Filters **15595A-xxx** 18 dB/oct High Pass Filters

The "-xxx" represents various corner frequencies available for the corresponding filter.

ALTEC LANSING CORPORATION continually strives to improve products and performance. Therefore, the specifications are subject to change without notice.

Slo-Blo® is a registered trademark of Littelfuse, Inc.

ALTEC LANSING®

the sound of experience

9444B Power Amplifier

SERVICE INSTRUCTIONS

*** * * CAUTION * * ***

NO USER SERVICEABLE PARTS INSIDE. EXTREMELY HAZARDOUS VOLTAGES AND CURRENTS MAY BE ENCOUNTERED WITHIN THE CHASSIS. THE SERVICING INFORMATION CONTAINED WITHIN THIS DOCUMENT IS ONLY FOR USE BY ALTEC LANSING AUTHORIZED WARRANTY REPAIR STATIONS AND QUALIFIED SERVICE PERSONNEL. TO AVOID ELECTRIC SHOCK, DO NO PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. OTHERWISE, REFER ALL SERVICING TO QUALIFIED SERVICE PERSONNEL.

9 SERVICE INFORMATION

WARNING: *No user servicable parts inside. Extremely hazardous voltages and currents may be encountered within the chassis. The servicing information contained within this document is only for use by Altec Lansing authorized warranty repair stations and qualified service personnel. To avoid electric shock DO NOT perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Otherwise, refer all servicing to qualified service personnel.*

NOTICE: *Modifications to Altec Lansing products are not recommended. Such modifications shall be at the sole expense of the person(s) or company responsible, and any damage resulting therefrom shall not be covered under warranty or otherwise.*

9.1 Trimpot Adjustments

Figure 12 is a component layout of the main circuit board for one channel (both channels use the same board). The schematic of the amplifier is shown in Figure 13. Several trimpots are provided for adjustment. Resistor R26 adjusts the bias. Resistor R23 sets the negative current limit and resistor R24 sets the positive current limit. These two resistors also affect the symmetry of clipping. The LF Cancel trimpot, R39, minimizes distortion caused by ripple on the power supply lines.

9.2 Equipment Needed

To precisely adjust the trimpots, you must have the following equipment:

- 1 — Oscilloscope (Tektronix 2445 or equivalent)
- 1 — Distortion analyzer (Sound Technology 1700B or equivalent)
- 1 — 15 amp ac ammeter
- 1 — 4 Ω load rated at 600 watts
- 1 — 8 Ω load rated at 300 watts
- 1 — Small non-conducting flat-blade screwdriver or set of plastic TV alignment tools
- 1 — 12 in jumper cable with alligator clips on each end
- Miscellaneous handtools (to remove the top cover)

NOTE: *If you need to verify the amplifier's performance against the rated specifications, you must be able to maintain the ac line voltage constant at 120 V ac (or 240 V ac if wired according to Figure 2b). Therefore, we recommend a suitably rated variac (50 ampere rating at 120 V ac).*

9.3 Adjusting R39, the LF Cancel Trimpot

Shown in Figure 6 is a distortion waveform resulting from an improperly adjusted R39. Notice the near sawtooth appearance of the waveform. The trace in Figure 7 shows the resulting waveform after R39 is properly adjusted. Notice the reduction in ripple.

To adjust R39 for minimum ripple, follow the procedures below:

1. Turn power off and disconnect the unit from its power source. Make sure the unit is in the Dual mode with 8 Ω loads connected to each channel.

2. Remove the eleven screws securing the top cover. Refer to Figure 1 for the screw locations.

3. Connect the sinewave generator output of the analyzer to the input of Channel 1. Rotate the input level control of Channel 1 to its full clockwise position. Rotate the input level control of Channel 2 to its full counter-clockwise position.

4. Apply power to the amplifier and adjust the sinewave generator for a 60 Hz, 0 dBu (0.775 V rms) output level. For this adjustment, it is not necessary to maintain a constant 120 V ac line input voltage under load.

5. Find R39 on the component layout in Figure 12. With a non-conducting or plastic-shaft screwdriver, adjust R39 for least amount of ripple as shown in Figure 7.

6. Repeat steps 3 through 5 for Channel 2.

7. Turn off the generator's output signal. If you have concluded with the test and alignment procedures, disconnect the amplifier from its power source and re-install the top cover with the eleven screws previously removed.

9.4 Adjusting R26, the BIAS Trimpot

Shown in Figure 8 is a distortion waveform resulting from an improperly adjusted R26. Notice the pronounced spikes at the crossover point in the waveform. The trace in Figure 9 shows the waveform with less pronounced spikes after R39 is properly adjusted.

To adjust R26 for the proper bias, follow the procedures below:

1. Turn power off and disconnect the unit from its power source. Make sure the unit is in the Dual

mode with 8 Ω loads connected to each channel.

2. Remove the eleven screws securing the top cover. Refer to Figure 1 for the screw locations.

3. Connect the sinewave generator output of the analyzer to the input of Channel 1. Rotate the input level control of Channel 1 to its full clockwise position. Rotate the input level control of Channel 2 to its full counter-clockwise position.

4. Apply power to the amplifier and adjust the sinewave generator for a 1 kHz, 0 dBu (0.775 V rms) output level. For this adjustment, it is not necessary to maintain a constant 120 V ac line input voltage under load.

5. Find R26 on the component layout in Figure 12. Rotate the shaft of R26 slowly clockwise until the spikes are minimized in the distortion waveform as shown in Figure 9.

6. Repeat steps 3 through 5 for Channel 2.

7. Check the ac idle current draw. With both channels at idle, the ac line current should be approximately 0.6 amps rms. If the idle current draw is significantly greater, rotate R26 counter-clockwise slightly on both channels until the idle current is approximately 0.6 amps rms.

8. Turn off the generator's output signal. If you have concluded with the test and alignment procedures, disconnect the amplifier from its power source and re-install the top cover with the eleven screws previously removed.

9.5 Adjusting R23 and R24, the Negative and Positive Current Limit Trimpots

Shown in Figure 11 is an asymmetrically clipped waveform caused by an improperly adjusted positive current limit as determined by R24. Had R23 been improperly adjusted, the negative half of the waveform would be clipped as well, but its degree of clipping is a function of R23 only and is independent of R24.

In the following procedures, you will be adjusting the current limit thresholds by varying R23 and R24 in such a way so as to insure symmetrical clipping.

1. Turn power off and disconnect unit from power source. Make sure the unit is in the Dual mode with a 4 Ω load connected to the channel under test.

2. Remove the eleven screws securing the top cover. Refer to Figure 1 for the screw locations.

3. Connect the sinewave generator output of the analyzer to the input of Channel 1. Rotate the input level control of Channel 1 to its full clockwise position. Rotate the input level control of Channel 2 to its full counter-clockwise position.

4. Find R23 and R24 on the component layout in Figure 12. With a small non-conducting screwdriver, rotate R23 and R24 to their full clockwise positions.

5. Apply power to the amplifier and adjust the sinewave generator for a 1 kHz, -10 dBu (0.245 V rms) output level. For this adjustment, it is not necessary to maintain a constant 120 V ac line input under load.

6. Increase the level of the generator until the output of the amplifier reaches 34.6 V rms (which corresponds to 300 watts output into the 4 Ω load).

7. While monitoring the distortion waveform on the oscilloscope, rotate R23 counter-clockwise until the negative half of the waveform just begins to visibly clip (more pronounced spikes will appear on the distortion waveform). Then, rotate slightly clockwise just until the visible clipping disappears and the spikes in the distortion waveform reduce to their pre-clip level.

8. Repeat Step 7 for the positive current limit pot R24. You may have to slightly re-adjust R23.

9. If R23 and R24 are properly adjusted, the channel should clip symmetrically (@ 1% THD) at approximately 450 watts as shown in Figure 11.

10. Repeat Steps 3 through 9 for Channel 2.

11. Turn off the generator's output signal. If you have concluded with the test and alignment procedures, disconnect the amplifier

from its power source and re-install the top cover with the eleven screws previously removed.

9.6 Checking the Short Circuit Current

With one channel operating at full rated power into an 4 Ω load, carefully short the output terminals using the 12 inch jumper cable while monitoring the ac line current. The ac line current draw under a short circuit condition should be at least 3.5 amps, but no more than 4 amps rms). If it exceeds 4 amps, re-adjust R23 and R24 by rotating them slightly counter-clockwise, both by approximately the same amount, until the ac line current is typically 3.5 amps. Repeat this procedure for Channel 2.

9.7 Ordering Replacement Parts

To order replacement parts, look up the ordering number from the component parts listing and call (405) 324-5311, FAX (405) 324-8981, or write:

Altec Lansing
Replacement Parts Sales
P.O. Box 26105
Oklahoma City, OK 73126-0105
U.S.A.

9.8 Factory Service

If factory service is required, ship the unit in its original packing prepaid to:

Altec Lansing Customer
Service/Repair
10500 W. Reno
Oklahoma City, OK 73128
U.S.A.

Enclose a note describing the problem in as much detail as possible. Include any additional helpful information such as test conditions, where used, how used, etc.

9.9 Technical Assistance

For applications assistance or other technical information, contact the Technical Services Manager. You can call (405) 324-5311, FAX (405) 324-8981, or write:

Altec Lansing
Technical Services Manager
P.O. Box 26105
Oklahoma City, OK 73126-0105
U.S.A.

10 THE 9444B/SA (MODEL WITH STEPPED ATTENUATORS)

In the 9444B/SA, the standard input level controls are replaced with precision stepped attenuators. The stepped attenuators have the following characteristics (from the full clockwise position):

Click Position (CP)

1 → 20:	1 dB step sizes (-20 dB @ CP 20)
20 → 25:	2 dB step sizes (-30 dB @ CP 25)
25 → 26:	3 dB step size (-33 dB @ CP 26)
26 → 29:	4 dB step sizes (-45 dB @ CP 29)
29 → 30:	5 dB step size (-50 dB @ CP 30)
30 → 31:	OFF (full attenuation @ CP 31)

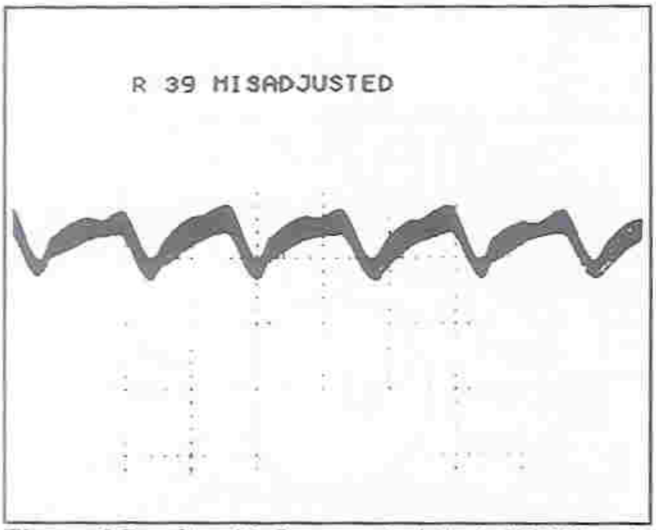

Figure 6 Results with Improperly Adjusted LF Cancel

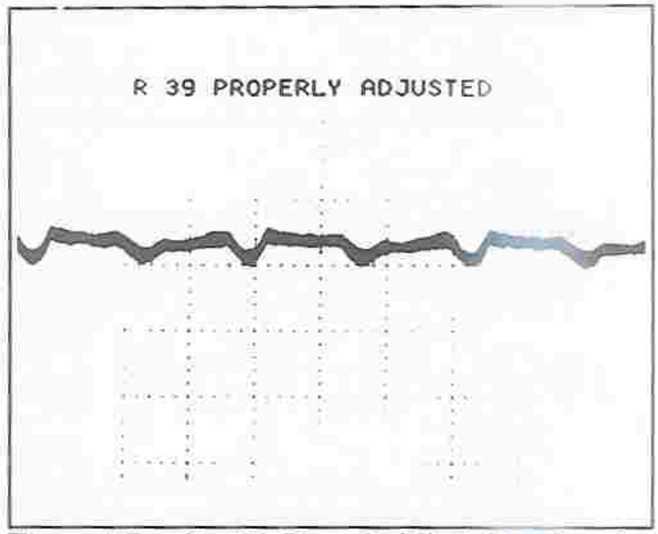

Figure 7 Results with Properly Adjusted LF Cancel

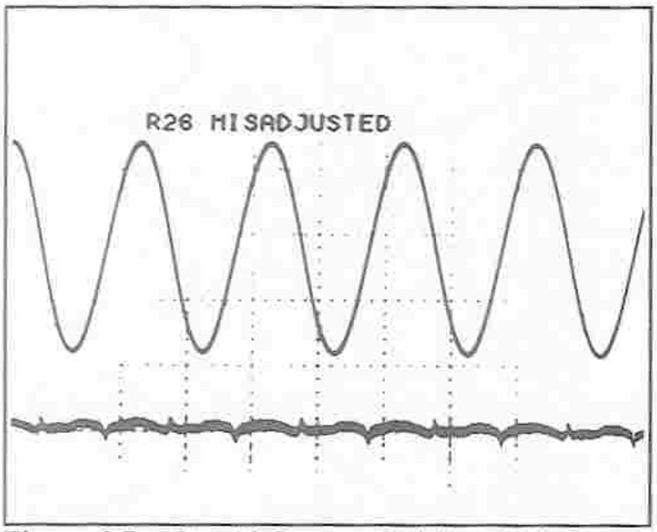

Figure 8 Results with Improperly Adjusted Bias

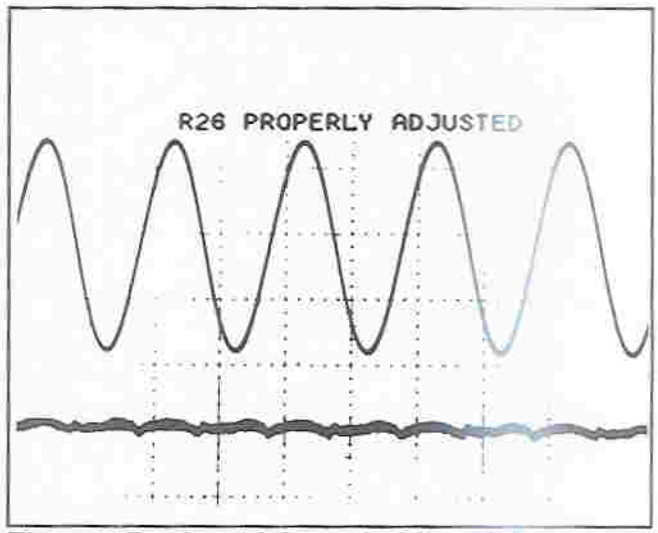

Figure 9 Results with Properly Adjusted Bias

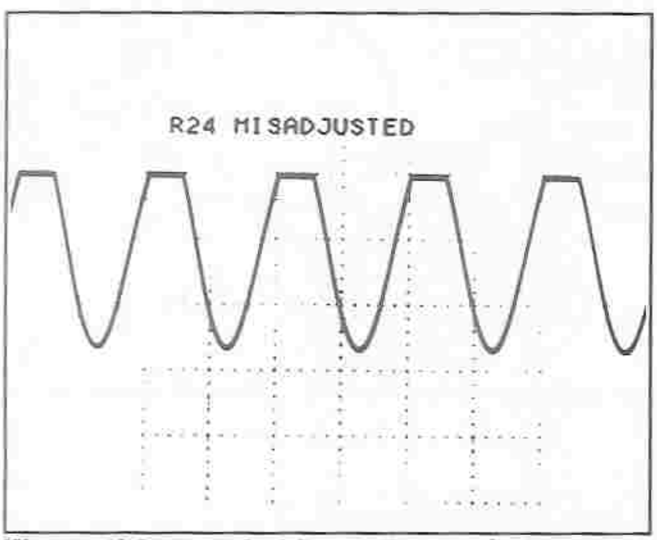

Figure 10 Improperly Adjusted Positive Current Limit

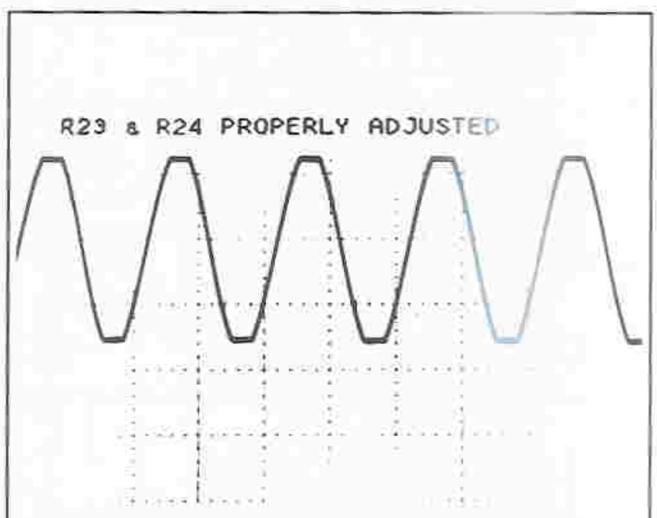

Figure 11 Properly Adjusted Pos and Neg Current Limit

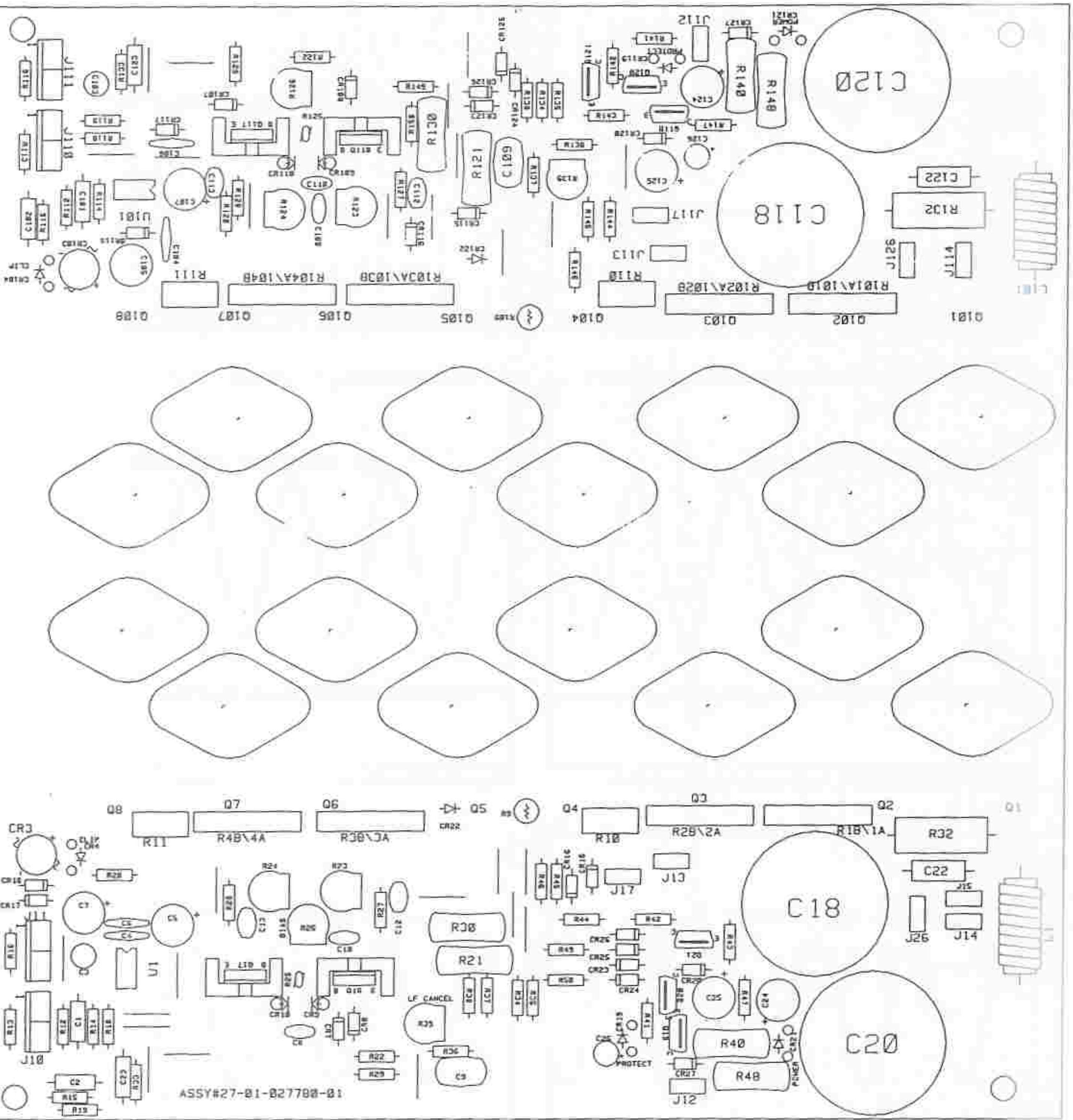

Figure 12 Component Layout of Dual Channel Board

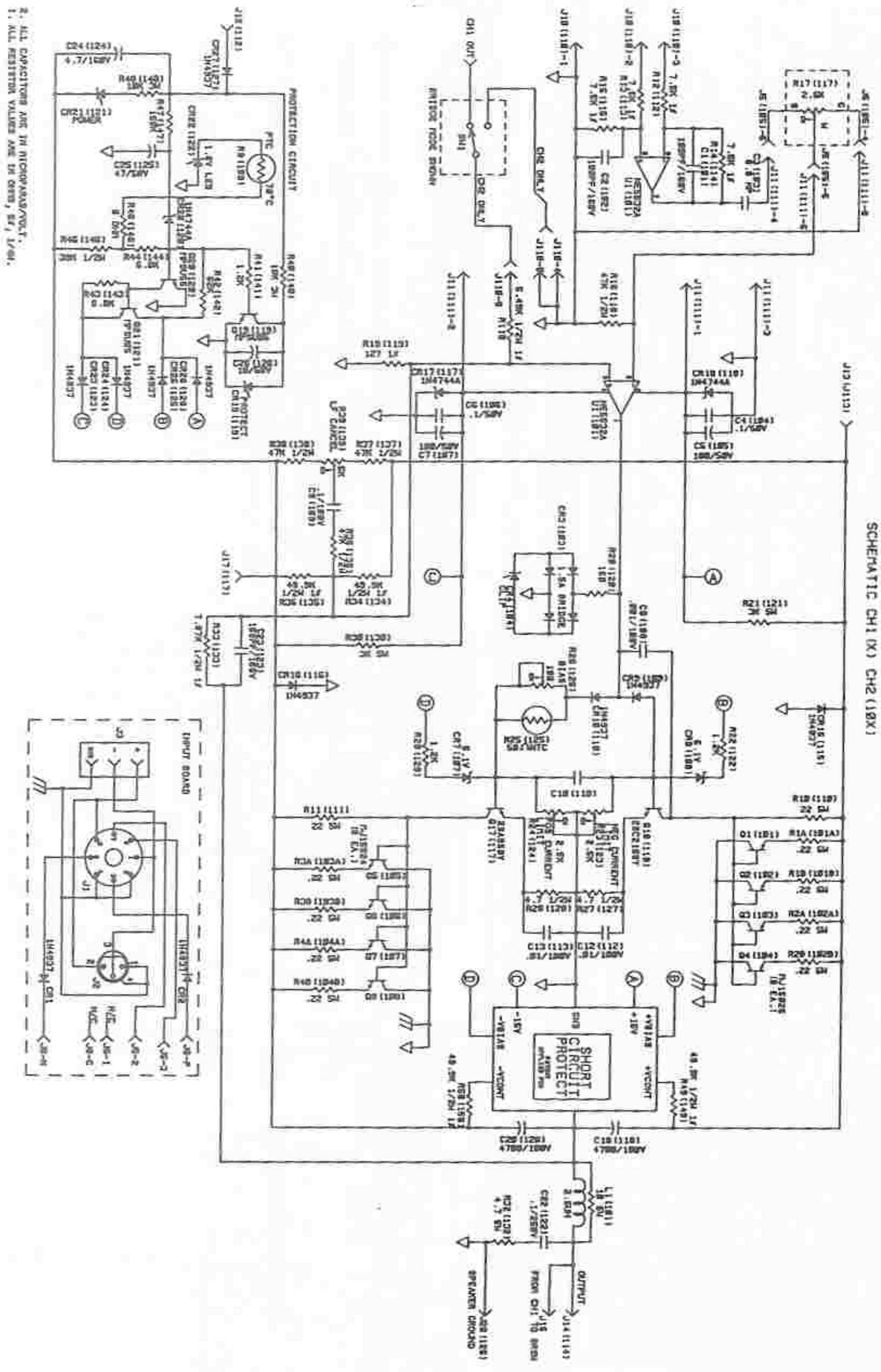

Figure 13 Schematic of 9444B, Sheet 1 of 2

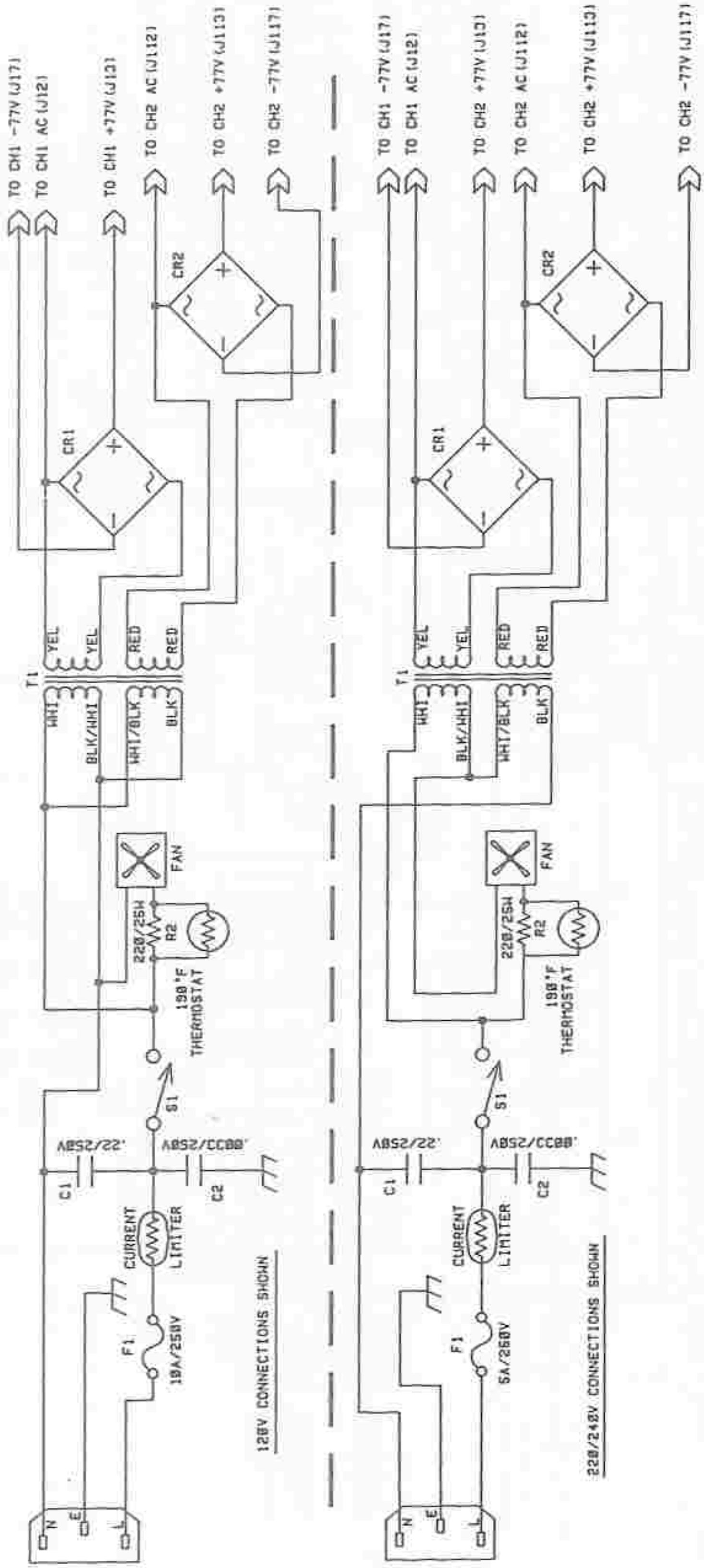

Figure 13 Schematic of 9444B, Sheet 2 of 2

Component Parts Listing for the 9444B

Reference Designator	Ordering Number	Name and Description
R1, R2, R3, R4	47-09-125029	Resistor, 2 × 0.22 Ω, 5 watt, 5%
R9	47-09-125181	Resistor, 100 Ω @25 °C, Positive Temperature Coefficient
R10, R11	47-01-125064	Resistor, 22 Ω, 5 watt, 5%
R12, R13, R14, R15	47-03-124805	Resistor, 7.5 kΩ, 0.25 watt, 1%, metal film
R16, R36, R37, R38	47-01-102119	Resistor, 47 kΩ, 0.25 watt, 5%, carbon film
R17 (9444B)	47-06-124795	Potentiometer, 2.5 kΩ, log taper, 20%
R17 (9444B/SA)	47-06-124578	Stepped attenuator, 2.5 kΩ
R18	47-03-125185	Resistor, 5.49 kΩ, 0.5 watt, 1% metal film
R19	47-01-125099	Resistor, 127 Ω, 0.25 watt, 1% metal film
R20	47-01-102059	Resistor, 160 Ω, 0.25 watt, 5% carbon film
R21, R30	47-01-125102	Resistor, 3 kΩ, 5 watt, 5%
R22, R29, R41	47-01-102080	Resistor, 1.2 kΩ, 0.25 watt, 5% carbon film
R23, R24	47-06-027458	Trimpot, 2.5 kΩ, 0.15 watt, horizontal mount
R25	47-09-125021	Resistor, 50 Ω @25 °C, Negative Temperature Coefficient
R26	47-06-036008	Trimpot, 100 Ω, 0.15 watt, horizontal mount
R27, R28	47-01-102208	Resistor, 4.7 Ω, 0.5 watt, 5%
R31	47-01-125028	Resistor, 450 Ω, 5 watt, 5%
R32	47-01-124834	Resistor, 4.7 Ω, 5 watt, 5%
R33	47-03-125106	Resistor, 7.87 kΩ, 0.5 watt, 1% metal film
R34, R35, R49, R50	47-03-125033	Resistor, 49.9 kΩ, 0.5 watt, 1% metal film
R39	47-06-027459	Trimpot, 5 kΩ, 0.15 watt, hoizontal mount
R40, R48	47-01-125066	Resistor, 10 kΩ, 3 watt, 5%
R42	47-01-102122	Resistor, 62 kΩ, 0.25 watt, 5% carbon film
R43, R44	47-01-102098	Resistor, 6.8 kΩ, 0.25 watt, 5% carbon film
R45	47-01-028531	Resistor, 39 kΩ, 0.5 watt, 5% carbon film
R46	21-01-110310	Resistor, 0 Ω jumper
R47	47-01-102126	Resistor, 91 kΩ, 0.25 watt, 5% carbon film
C1, C2, C23	15-06-037468	Capacitor, 100 pF, 160 volt, 5%, polypropylene
C3	15-01-125026	Capacitor, 6.8 µF, 50 VDC, non-polar, Aluminum
C4, C6	15-02-124437	Capacitor, 0.1 µF, 50 VDC, ceramic disk
C5, C7	15-01-124503	Capacitor, 100 µF, 50 VDC, Aluminum
C8	15-06-124587	Capacitor, 0.001 µF, 100 VDC, 5%, polypropylene
C9	15-06-124637	Capacitor, 0.1 µF, 100 VDC, 5%, polypropylene
C12, C13	15-06-124588	Capacitor, 0.01 µF, 100 VDC, 5%, polypropylene
C18, C20	15-01-036110	Capacitor, 4700 µF, 100 VDC, Aluminum, 10%
C22	15-06-100113	Capacitor, 0.1 µF, 250 VDC, 10%, Polyester
C24	15-01-125024	Capacitor, 4.7 µF, 160 VDC, Aluminum
C25	15-01-124508	Capacitor, 47 µF, 50 VDC, Aluminum
C26	15-01-124502	Capacitor, 10 µF, 50 VDC, Aluminum
L1	56-01-026510	Inductor, 2.0 µH, choke
CR1, CR2, CR9, CR5, CR6 CR10, CR12, CR14, CR15, CR16 CR23, CR24, CR25, CR26, CR27	48-01-125067	Diode, 1N4937, fast recovery rectifier
CR3	48-02-037580	Bridge Rectifier, 1.5 Amp, 70 V
CR4, CR19, CR21	39-01-124540	LED, red, with 12 inch leads
CR7, CR8	48-01-122988	Zener, 1N5231B, 5.1 volt, 0.5 watt, 5%
CR11, CR13, CR17, CR18, CR20	48-01-125098	Zener, 1N4744A, 15.0 volt, 1 watt, 5%
CR22	39-01-121926	LED, red, T1-3/4
U1	17-01-122832	IC, NE5532A

Reference Designator	Ordering Number	Name and Description
Q1, Q2, Q3, Q4	48-03-122979	Transistor, MJ15025, PNP
Q5, Q6, Q7, Q8	48-03-122978	Transistor, MJ15024, NPN
Q17	48-03-124475	Transistor, 2SA958Y, PNP
Q18	48-03-124474	Transistor, 2SC2168Y, NPN
Q19, Q21	48-03-028711	Transistor, MPS-U05, NPN
Q20	48-03-028712	Transistor, MPS-U55, PNP
C1	15-02-124994	Capacitor, 0.22 μF, 250 VAC
C2	15-02-124993	Capacitor, 0.0033 μF, 250 VAC
CR1, CR2	48-02-122651	Bridge Rectifier, 25 amp, 400 volt
F1	51-04-105890	Fuse, 10 amp, 250 volt, NB-UL-CER
(F1)	51-04-100470	Fuse, 5 amp, 250 volt, NB-UL-GLS
R2	47-02-123106	Resistor, 300 Ω, 25 watt, 5%
	53-02-125179	Surge suppressor, NTC Thermistor
S1	51-02-124582	Switch, power
T1	56-08-027782	Transformer, power
TS1	53-01-027945	Thermostat, 190 °F, normally open
	28-13-026422	Hardware, rack mount
	35-01-124521	Fan, equipment cooling, 100 CFM
	24-04-124846	Knob, black
	21-01-013567	Jumper, octal socket, gold flash