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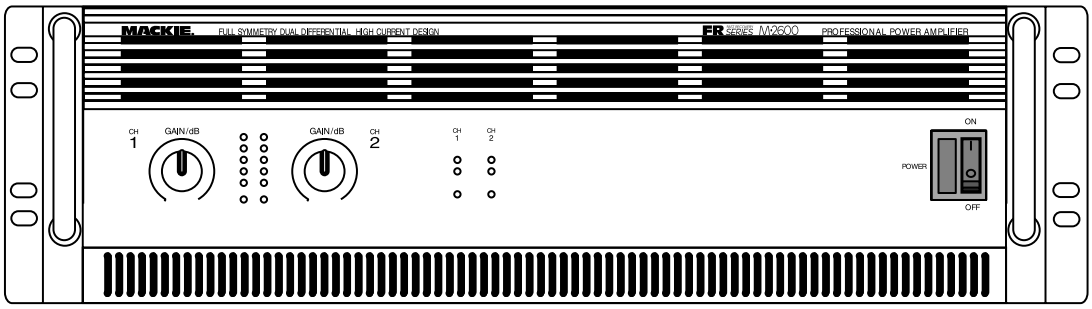
MACKIE®

M2600

FR Series Power Amplifier



SERVICE MANUAL

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820-180-00

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CONFIER L'ENTRETIEN AU PERSONNEL QUALIFIE

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RISQUE DE CHOC ELECTRIQUE
NE PAS OUVRIR

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TO PREVENT ELECTRIC SHOCK, DO NOT USE THIS POLARIZED PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENTION: POUR EVITER LES RISQUES DE CHOC ELECTRIQUE, NE PAS ENLEVER LE COUVERCLE. AUCUN ENTRETIEN DE PIECES INTERIEURES PAR L'USAGER. CONFIER L'ENTRETIEN AU PERSONNEL QUALIFIE.

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POUR PREVENIR LES CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR, UN PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS LAISSER AUCUNE PARTIE A DECOUVERT.

This apparatus does not exceed the Class A/Class B (whichever is applicable) limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

ATTENTION :Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant las limites applicables aux appareils numériques de class A/de class B (selon le cas) prescrites dans le réglement sur le brouillage radioélectrique édicté par les ministere des communications du Canada.

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

The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure, that may be of sufficient magnitude to constitute a risk of electric shock to persons.

Le symbole éclair avec point de flèche à l'intérieur d'un triangle équilatéral est utilisé pour alerter l'utilisateur de la présence à l'intérieur du coffret de "voltage dangereux" non isolé d'ampleur suffisante pour constituer un risque d'éléctrocution.

The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

Le point d'exclamation à l'intérieur d'un triangle équilatéral est employé pour alerter les utilisateurs de la présence d'instructions importantes pour le fonctionnement et l'entretien (service) dans le livret d'instruction accompagnant l'appareil.

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INTRODUCTION

ALL BOARDS

SERVICE ON THIS EQUIPMENT IS TO BE PERFORMED BY
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This manual contains basic service information. It is essential that you have a copy of the user's manual as this contains the complete operating instructions.

SERVICE TECHNICAL ASSISTANCE

Mackie Designs, Service Technical Assistance, is available 8AM - 5PM PST, Monday through Friday for Authorized Mackie Service Centers, at 1-800-258-6883. Feel free to call with any questions and speak with a carefully-calibrated technician. If one is not available, leave a detailed message and a qualified Mackoid will return your call asap.

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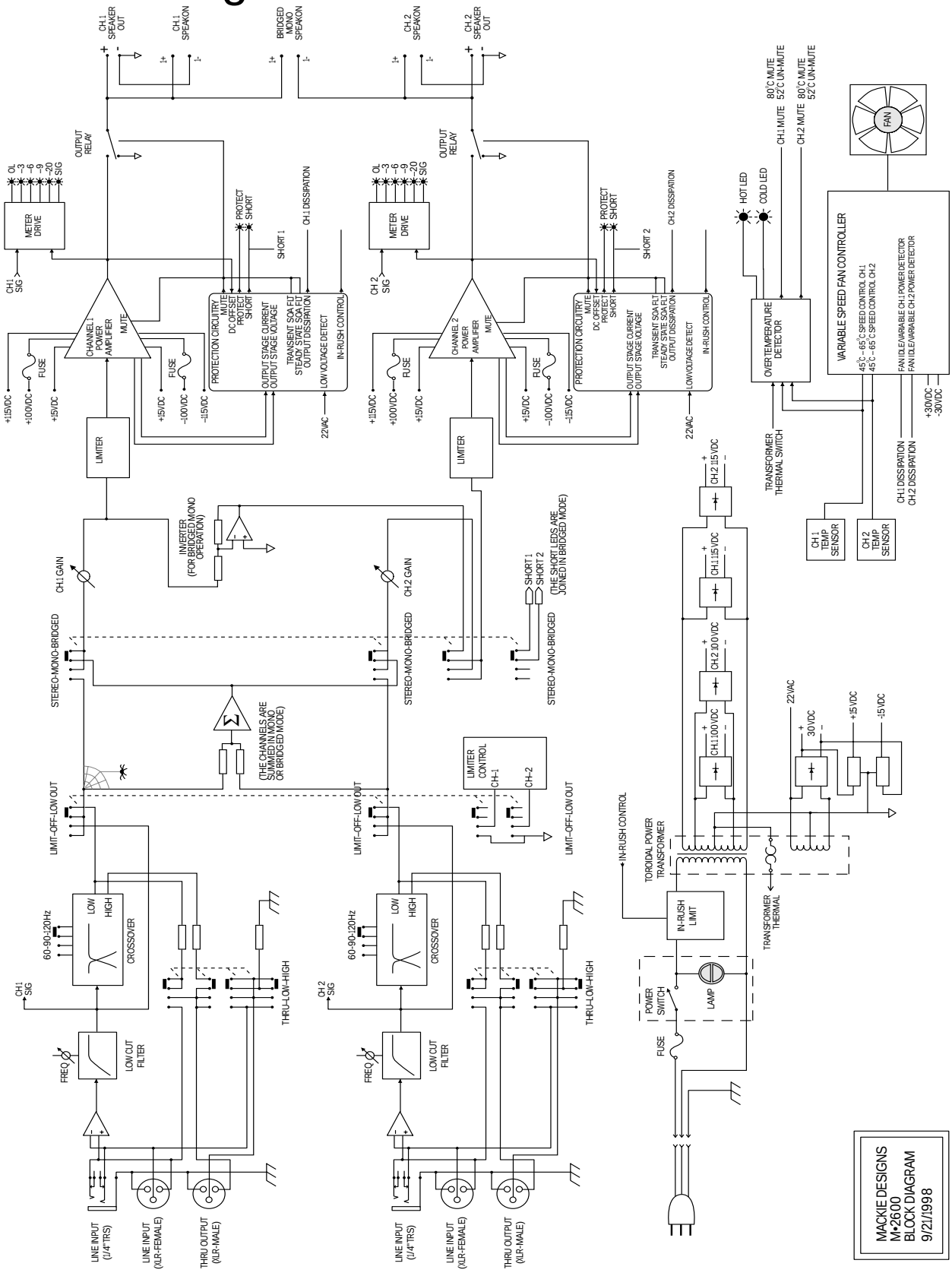
Block diagram



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Specifications

Maximum Power at 1% THD, midband:

500 watts per channel into 8Ω
850watts per channel into 4Ω
1300 watts per channel into 2Ω
1700 watts into 8Ω bridged
2600 watts into 4Ω bridged

Continuous Sine Wave Average Output Power, both channels driven:

425 watts per channel into 8Ω from 20Hz to 20kHz, with no more than 0.025% THD
700 watts per channel into 4Ω from 20Hz to 20kHz, with no more than 0.05% THD
1000 watts per channel into 2Ω from 20Hz to 20kHz, with no more than 0.1% THD

Bridged mono operation:

1,400 watts into 8Ω from 20Hz to 20kHz, with no more than 0.05% THD
2000 watts into 4Ω from 20Hz to 20kHz, with no more than 0.1% THD

Note: Power ratings are specified at 120VAC line voltages.

The M2600 power amplifier draws large amounts of current from the AC line with continuous sine wave testing. Accurate measurement of power requires a steady and stable AC supply. This means the line impedance must be very low to insure that the peak AC line voltage does not sag to less than 97% of its value.

If driving highly reactive loads, we recommend that the limiter circuit be engaged.

Power Bandwidth:

20Hz to 70kHz (+0, -3 dB) @ 700W into 4 Ω

Frequency Response:

20Hz to 40kHz (+0, -1 dB)
10Hz to 70kHz (+0, -3 dB)

Distortion:

SMPTE IMD, TIM	< 0.025% @ 8Ω
	< 0.050% @ 4Ω
	< 0.150% @ 2Ω

Signal-to-Noise Ratio:

> 107 dB below rated power into 4Ω

Channel Separation:

> 80 dB @ 1kHz

Damping Factor:

> 350 @ 400Hz

Input Impedance:

24kΩ balanced

Input Sensitivity:

1.23 volts (+4 dBu) for rated power into 4 ohms

Gain:

32.7 dB (43V/V)

Maximum Input Level:

9.75 volts (+22 dBu)

Rise Time:

< 5µs

Slew Rate:

Voltage Slew Rate > 60V/µs
Current Slew Rate > 30A/µs at 2Ω

CMRR:

> 40 dB, 20Hz to 20kHz

Load Angle:

8(±jx) time independent at 8Ω
4(±jx) time dependent, T > 6 min. at 4Ω
2(1±jx) time dependent, T > 2 min. at 2Ω

Transient Recovery:

< 1µs for 20 dB overdrive @ 1kHz

High Frequency Overload and Latching:

No latch up at any frequency or level.

High Frequency Stability:

Unconditionally stable, driving any reactive or capacitive load.

Turn On Delay:

3-5 seconds

Variable Low-Cut Filter:

10Hz (Off) to 170Hz, 2nd-Order Bessel

Internal Crossover:

Switched: 60Hz/90Hz/120Hz, 4th-Order Linkwitz-Riley
Lowpass outputs switchable to internal Subwoofer mode.
Lowpass and Highpass outputs switchable to Thru output jacks.

Limiter Section:

Complementary Positive and Negative Peak Detecting

Indicators:

6 meter LEDs per channel
SIG (Signal Present), -20, -9, -6, -3, OL (Overload)

CH 1 & 2
PROTECT LEDs
SHORT LEDs

TEMP STATUS
COLD/HOT LEDs

Physical:

(three rack spaces high, standard rack width)

Height	5.20 inches	(132mm)
Front panel Width	19.00 inches	(483mm)
Chassis Width	17.24 inches	(438mm)
Depth	15.65 inches	(398mm)
Overall Depth	16.67 inches	(423mm)
Handle Depth	1.64 inches	(42mm)
Weight	55 pounds	(25 kg)

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Troubleshooting Tips-output failures

After a catastrophic failure, it is likely that some of the supply fuses will be blown. Check and replace any fuses on the 129, 130, 133, and 171 boards. Short across the Left most lead of R1 to the right most lead of R2 on the 133 board to short out the two 15W inrush resistors (see the diagram on the next page). ***Very slowly*** bring up the Variac while monitoring line consumption. It is likely that substantial line current will be pulled due to shorted output parts. If excessive current is not pulled, but a channel still stays in "protect" mode, the unit will still need repair.

Remove the main heatsink sub-assembly from the unit and check for shorted output transistors. Once it has been determined which channel failed, remove it's respective V-amp/ Protection board (055-170-00) to make access to the channel board easier. If one bad output is found, replace **all 16** in the channel. When an output device shorts it can place high current stresses on the other output parts. These output parts can fail over time. Since long term reliability is paramount, please replace all the outputs.

All 16 of the 3W 0.33Ω emitter resistors must be verified for proper value. Any off-tolerance, or open parts, need to be replaced. An off tolerance (higher resistance) emitter resistor will prevent it's related output transistor from "doing it's share" and will place more stress on it's mates in the output section. Also verify the 16 base drive resistors (2.2Ω, 1/4W, fusible) are all OK. Verify that all eight drivers and that the pre-drivers are not shorted. If one driver is shorted replace it's mates. Do the same with the pre-drivers. Also check all the resistors surrounding the drivers and pre-drivers. Measure the resistance between the "+I-sense" and "-I-sense" lines. The resistance should be 82.5Ω +/-5%. If this resistance is higher, check for open 33Ω fusible resistors on these lines. Take your time here looking to find all damaged parts: If one part is missed it still takes the same huge amount of time to disassemble the main heatsink assembly. After replacing the outputs, drivers, and pre-driver verify that the silicon transistor insulator wasn't damaged (No shorts between collector legs and the heatsink).

On the 170 board, check the VI limiters and detectors. It is not uncommon to damage these parts when the amplifier fails in a spectacular way! Look for shorts on Q24, Q25 or open R151 or R146. It is critical that these sections are working correctly. Shorted transistors can cause some odd asymmetrical clipping problems. Open parts will not allow the current limiting to operate effectively. If problems exist in these sections the amplifier might fail into a short, or might clip prematurely when loaded to 2 Ω.

All of the above trouble shooting (not including part replacement) takes perhaps 30 to 45 minutes to do. If you take the time, and do all that is indicated above, it will allow 99% of the amplifiers to come up the first time! Trying to hurry, and skipping what is suggested, can lead to a frustrating and time consuming repair.

Reassemble the main heatsink sub-assembly and plug the two power supply cables back into the 171 board (This can be done without installing the assembly back into the unit). Slowly bring up the supply and verify that line consumption isn't excessive and that the output is centered (no DC offset). This can be measured on the "AMP-OUT" testpoint on the 170 board. It might be desirable to defeat the amplifier muting temporarily (Short "MUTE-VA" to "-15V-AMP" testpoints on the 170 board) so the channel is active even when the supplies are still very low. If the amp stays centered, power down the assembly and discharge the two main +/-100V supplies on both channels. Remove any temporary jumpers and reinstall the assembly into the chassis. Power the unit and verify that the repaired channel will pass a nice clean rail to rail sine wave. Next proceed to the "Reliability Verification" section on page 8.

WARNING: FUSIBLE RESISTORS MUST ONLY BE REPLACED BY THE EXACT REPLACEMENT PARTS. ALWAYS CHECK THE PARTS LISTS TO VERIFY WHICH RESISTORS ARE THE FUSIBLE TYPE BEFORE REPLACING ANY RESISTORS IN THIS AMPLIFIER.

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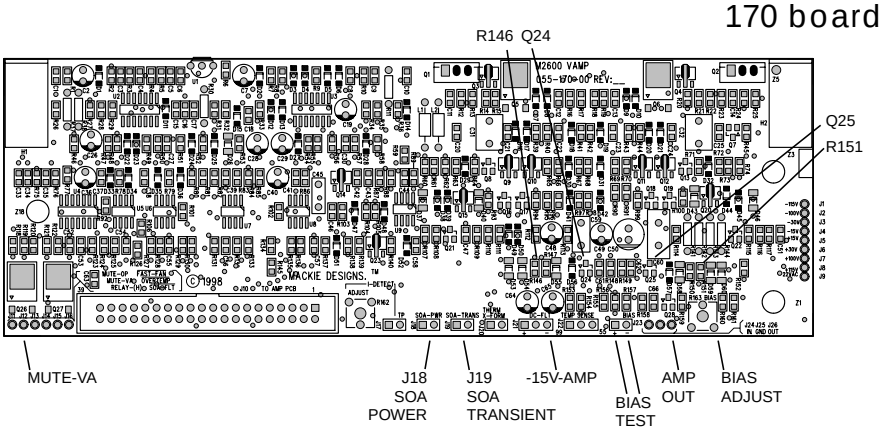
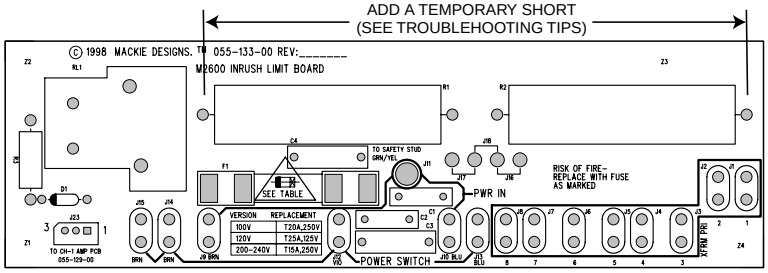
Various test points

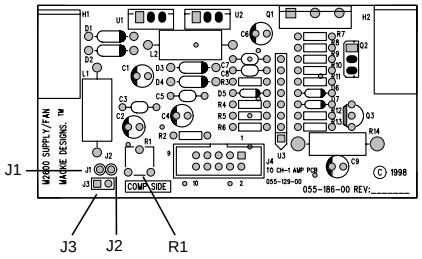
170 board (Bias and check points)



133 board (inrush bypassing)

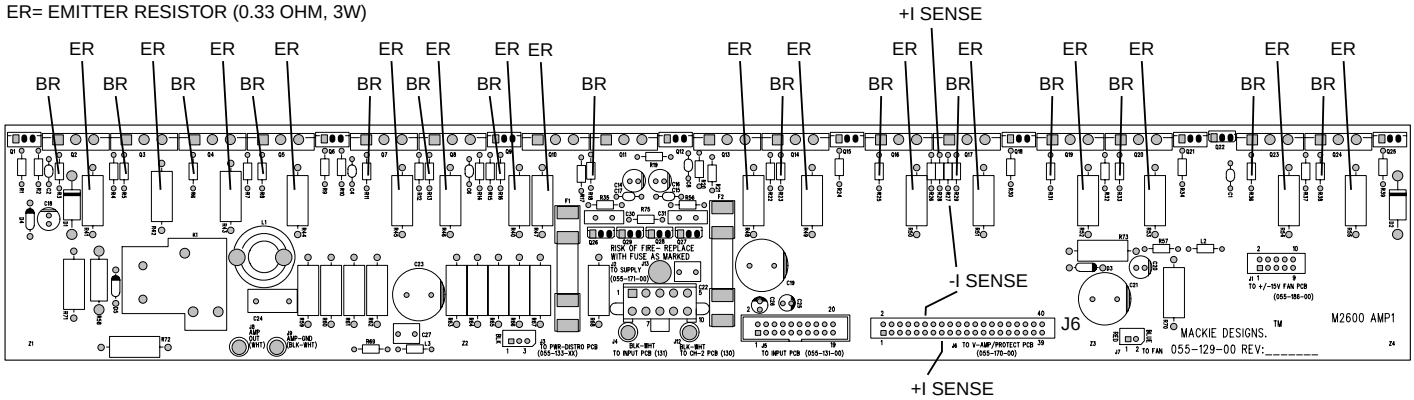


186 board (fan speed adjustment)



129 channel board

BR= BASE RESISTOR (2.2 OHM, 1/4W FUSIBLE)
ER= EMITTER RESISTOR (0.33 OHM, 3W)



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Reliability Verification Procedure

After the unit has been repaired, the following should be done to assure long term reliable operation. If a distortion analyzer is present, distortion specifications should be verified. See the previous page for the 170 and 186 boards with some test points noted.

1. Adjust the bias control (R163 on 170 Board) in both channels for 12mV +/- 1mV measured at the bias test points (J23 along 170 board back edge) after unit has idled for a few minutes. This is with no signal and no load. The Pot and test points are clearly marked on both the top and bottom sides of the 170 board.

   With Full AC line voltage applied to unit, it will pull around 130W from the line (1.6A at 120V). Measure for DC offset on both output connectors, it should be less than +/- 50mV.

2. Verify and adjust the fan speed if needed. On the 186 board, short pin 1 to pin 2 on J3. Adjust R1 for 28V (+0V -1V) across J1 and J2. Remove the shorting jumper on J3. All the test points and pots are clearly labeled on the back side of the PCB and are easily accessed with the main heatsink sub-assembly installed.

3. Apply a 1KHz sine wave to the inputs and verify that the unloaded outputs have a waveform that is symmetrical and undistorted. Drive the outputs into clipping and carefully verify symmetrical “flat-topping” on the waveform.

4. Reduce the output levels, install a 0.1µF capacitor jumper from the output to ground connections, and verify that clipping behavior is proper. Verify that no high frequency oscillation occurs near and at clipping (parasitic oscillation).

5. Remove capacitive loading and minimize sine output. Verify and re-adjust the bias if required. Note that the bias will not drift appreciably in a unit that is functioning properly.

6. Connect the amplifier directly to the AC line and connect an 8Ω dummy load to both channels. Each 8Ω dummy load should have a minimum power rating of 500W. Bring the sine wave level up on both channels and verify symmetrical clipping. The output will clip somewhere between 150V - 180V pk/pk depending on how stiff the line is. Clipping should be as described above. Add the 0.1µF capacitive loading and verify clipping is still well behaved.

7. Individually load Channel 1 and Channel 2 with 2Ω . Each 2Ω dummy load should have minimum power rating of 1500W. Clipping should be symmetrical, well behaved , and occur somewhere around 120V - 140V pk/pk. Verify that clipping is well behaved after adding the 0.1µF capacitive loading. Reduce the output level to zero and remove the loading.

8. Next verify the two different short detectors. Perform these tests first on channel-1 and then repeat for channel-2. On the 170 board, short J18 pins 1 and 2 (this defeats the average power SOA detector and allows the transient SOA detector to be tested). Adjust the output level to 60V pk/pk and short the channel-1 output line. Channel-1’s front panel “short” and “protect” LEDs should turn on and the respective channel will mute for about 5 seconds. On the 170 board, remove the short on J18 and install a short on J19 pins 1 and 2 (this defeats the transient SOA detector and allows the average power SOA detector to be tested). Adjust the output level to 60V pk/pk and short the channel output line. Channel-1’s front panel “short” and “protect” LEDs should turn on and the respective channel will mute for about 5 seconds. Remove the shorting jumpers on channel-1 and repeat above testing on channel-2.

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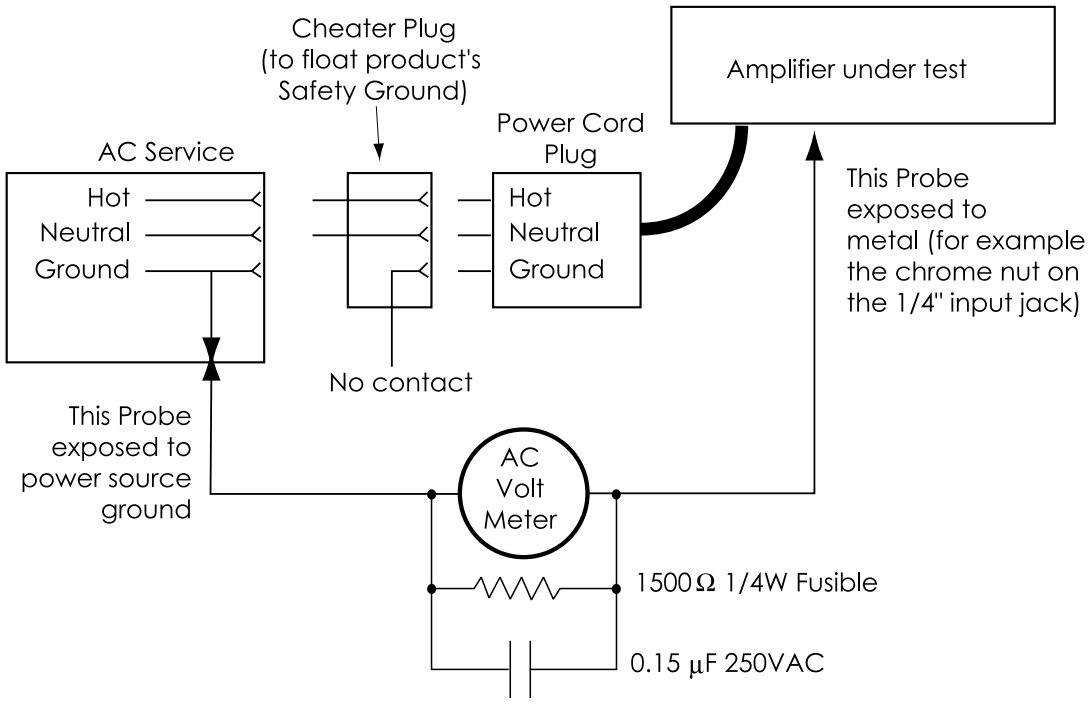
9. Place the amplifier in bridge mode and connect 4Ω loading to the bridge outputs (across both "+" output binding posts). The 4Ω dummy load should have a minimum power rating of 2000W. Slip some card stock between the heatsink-outlets and chassis sides to temporarily restrict the airflow. Monitor one of the outputs and adjust for a 60V pk/pk signal. Short across both outputs and verify that all four 'Short" and "Protect" LEDs light and the amplifier mutes for 5 seconds.

10. Remove the short, monitor one of the outputs, and adjust for a 90V pk/pk sine output (1000W of output power bridged). After a few minutes the fan will begin running faster and faster (heatsink between 45°C and 65°C) and a short time later the amplifier will mute (heatsink at 80°C). The "Hot" and "protect" LEDs will come on. Remove the card stock and after a few minutes the amplifier will come out of mute mode and the "cold" LED will return.

11. Disconnect the loading and remove the input signals. Reconnect the amplifier to a Variac and confirm that the idle consumption is roughly 130W or 1.6A, as before. Connect the amplifier to speakers and verify that it sounds OK with music.

12. Perform the following leakage test before returning the amplifier to your customer:

    1. Connect the amplifier under test to an AC power source using a ground-lift adaptor, leaving the amplifier's safety ground floating. Turn the amplifier on.
    2. Make a small loading RC circuit as shown in the diagram below, and connect the AC volt meter between the AC power source ground and any exposed metal on the unit under test.
    3. The meter reading should be less than 750mV AC (note: this is equivalent to 0.5mA of leakage current).
    4. Flip the plug over in the receptical so the hot and neutral are swapped. Verify that the reading is still less then 750 mV AC.



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Circuit Theory

Much of the circuitry in the M•2600 we hope is self explanatory from the schematics. This section will explain the unique circuits and architecture. Examples in this section will refer to Channel 1 for circuitry that is identical on both channels.

INPUT CIRCUITRY

The signal path begins with the INPUT BOARD (055-131-00). Following Channel 1's input, signal is fed to a unity gain differential op-amp, U1A. The signal is next sent to U1B which serves as a 12dB/Oct. highpass filter. If not in SUBWOOFER mode, and if running in STEREO mode, the summing amp (U3B) and 24dB/Oct. Likwitz-Riley Crossover (U3A, U2, U4) are bypassed. The signal is sent via J11 to the gain control on the DISPLAY BOARD (055-132-00). After the gain control, the signal is buffered by U1A, returned to the INPUT BOARD and routed to the Channel-1 amplifier board via J6.

Channel 2's input signal path is electrically identical to Channel 1's in STEREO mode.

In PARALLEL MONO mode, Channel-1's and Channel 2's input signal is summed via U3B and is sent to both channel's front panel level controls via SW3A and SW3B.

For BRIDGE MONO operation, these summed inputs are sent to the channel-1 front panel level control which in turn feeds the channel-1 amplifier and also the inverter U10A. The output of U10A is routed to the channel-2 amplifier via SW3C. Also in BRIDGE mode, SW3D connects both channel-1's and channel-2's protection circuits together. The result being that when one amplifier detects a short circuit condition it will mute and immediately tell channel-2 to mute. Muting lasts around 5 seconds and the amplifier un-mutes until the next shorted condition is detected.

The limiters (U6, U5, U7 and their associated components) are always in the signal path. When the limiter is switched off (via SW4) the LDR (Light Dependant Resistor) is in parallel with the source resistor (R39) and will not reduce signal amplitude. When the limiter is switched on, the LDR (U5B) is switched as a shunting element to ground. The Baker clamp in the power amplifier detects clipping and the LDR shunts away driving voltage until clipping almost disappears. This type of limiter is know as a feedback style (As opposed to feedforward style) of limiter.

U6 is also used for the amplifier input slew clamps, comprised of local +/-5V supplies (D7, D8 and associated) and clamping diodes (D13 and D14). These diodes clamp the voltage feeding the power amp to around 10V pk/pk or about 6dB above the amplifier's clipping point. This ultimately limits the risetime of the signal presented to the power amplifier, controlling common-mode conduction in the power amplifier output stage.

Output from each crossover can be routed to the rear panel THRU jacks via SW2 and SW6. In the THRU position the THRU jack is hardwired to the input jacks. In LOW and HIGH output modes, the lowpass and highpass outputs of the crossover respectively are fed to the THRU jack. In these modes the output is impedance balanced via R28, R29 and R23.

POWER AMPLIFIER CIRCUITRY

The M•2600 use a class AB triple darlington output stage with complementary output devices. The output stage and the bias trackers are on the channel boards (129 and 130 boards) while the voltage amplifier and amplifier protection circuits are housed on two identical v-amp / protection (055-170-00) boards. Each channel has local main +/- 100V power supplies, and a +/- 115V stacked supply for the front end circuitry. Each amplifier also has floating +/-16V supplies

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that float along with the amplifier output line (D3 & D4 and associated parts on the 129 board). Common +/-15V supplies are shared throughout the product.

Referring now to the 170 schematic: The amplifier is muted for 3 seconds on power up as C29 charges via R56. When this voltage has charged above 11.6V, U3C goes low turning on Q7, providing current for the differential pairs. The output of U3C, labeled "MUTE-VA", when low turns on the **V**oltage **A**mplifier. Two seconds after MUTE-VA goes low, mute "MUTE-OP" goes low (Q27) closing the **O**ut**P**ut relay passing signal along to the output terminals. (Wait a minute! Differential Pairs? Read on...)

An immediately obvious departure from standard designs is the *Differentials* and *Symmetrical Voltage Amps*. The reasoning behind this front end architecture is actually quite simple. Transistor transfer characteristics are not entirely linear, so even the best conventional front end design will introduce some distortion. Most amplifiers use negative feedback to reduce this problem (creating a few more in the process). Mackie FR Series amplifiers take a different approach. By using two complementary "mirror image" front end circuits, any distortion caused by non-linear transistor curves is effectively canceled out in the bias string, without feedback!

Another design feature unique to Mackie FR Series Amplifiers is the *Baker Clamp*. The *Baker Clamp* has two functions; 1) Prevent output transistors saturating, 2) Drive the LIMITER LDR. Referring to the again to the 170 schematic: Q20 is a common base amplifier, it will turn on if Q2's collector rises more than three diode drops above the +100V supply, preventing Q2's collector from rising further. There are three diode drops between Q2's collector and the base of pre-driver transistor (Q26 on 129 board). Once the output from the collector of Q2 makes it to the emitter of the output devices, there will be a total of six diode drops in series. Three "drops" up and six down: As a result, the output transistor emitters will never see a voltage greater than three diode drop below the +100V supply (even if the +100V supply fluctuates) and will never saturate. This will consequently remove saturation of the output stage, as a source common mode conduction. When the amplifier clips, Q20 and Q15 also send out "clipping pulses" at their collectors that is coincident with baker clamp conduction. These clipping pulses are cross-coupled to Q21 and Q22 and are stored in C47 and C51. These stored pulses allow for quick attack and slow release required by a peak limiter. Output from Q21 and Q22 is coupled to the LDR LED section via R110 and R152.

PROTECTION CIRCUITS

The M•2600 has several protection circuits in addition to main rail fuses on each channel. Circuits mute the amp if the output devices are loaded beyond their safe operating area (SOA). If there is DC on the output line, output relays open, disconnecting the load. The amplifier will also mute if the power transformer or main heatsink get too hot, if the input AC line voltage is low, or if either of the +/-15V supplies fails.

Turn-On Inrush Current Limiter

For the first second of operation there are two 15W power resistors (located on the 133 board) in series with the power transformer which eliminates what would otherwise be an extremely high turn-on current. After 1 second these resistors are shunted with a relay. This relay is turned on when the collector of Q26 (170 board) goes high. Note that either or both Q26's on the two 170 boards can turn on this relay.

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SOA protection

There are two SOA detectors in the M-2600: One that monitors steady state output stage dissipation and one that monitors transient high current events. Both detectors need to monitor the output stage current.

A voltage, representing output stage current, is derived by first sampling the voltage drop across the output transistor emitter resistors. These voltages are rectified via U9A R87, R88, R59 and R89. The rectified voltage is converted to a current via U9B, Q23, and associated. This current is referenced to the output line and must first be re-referenced to the +115V supply via Q14, D47 and associated. The current available at the connector of Q14 is converted to a voltage that is ground referenced via R138 and R162. This is buffered via U8A and adjusted via R162 such that 1 amp of output stage current is equal to 100mV of detected output.

This current is compared to what represents a safe operating current at U4A (part of the transient SOA-Fault detector). If the current is greater than allowed for more than 10mS (Timing determined by R77 and C36), U4B sends out a fault indication which mutes the amplifier via U3C and associated, and fires the short led for 5.5 seconds (U3B and associated).

While the output stage is quite tolerant of very high current demands for a very short time, it would destroy itself if it had to provide these currents on a long-term basis. The second detector actually looks at long-term dissipation in the output stage, and if excessive, will mute the amplifier. We already have a signal that is proportional to output stage current as described above. This signal is fed to one input of analog multiplier U7 via R80 and R84.

U6A and U6B and their associated components look at the -100V supply and the amplifier output line. These voltages are converted to currents via R101, R129 and R130 and are rectified and summed such that for every volt between the output line and the supply rail, 100mV is presented as output. This second signal is presented to the other input of multiplier U7 via R133 and R82. Output from U7 is in the form of a current and is converted to a voltage via R136 and U8B. The gain of this multiplier is such that for 200 watts of output stage dissipation, 1 volt of output is obtained. The output of U8B is instantaneous power and is long-term averaged via R135 and C40. The cutoff of the filter is quite low in frequency, such that even a 20Hz signal on the amplifier output results in very little ripple voltage at C40. If the voltage on C40 is greater than 5V (equivalent to 1000W of output stage dissipation), U4C will toggle, muting the amplifier and firing the SHORT LED as above. Approximately 200mS of dissipation above 1000W is required to cause a fault.

DC Fault Detection

The amplifier output drives the subsonic lowpass filter of the DC fault detector (R154, C65 and C64). If the amplifier were to fail and short to the +100V rail, C64/C65 will charge to more that 5V in a few hundred milliseconds. Local +/-5.1V references on U2C and U2D set the threshold where: when the amplifier output voltage is “stuck” to greater than +/-5.1V, either comparator output will go low. This will open Q27, and in turn open the speaker relay on the respective channel board. When the amplifier is initialized, “MUTE-VA” is high and this biases C64/C65 above 5.1V via D14 and R36. This offset results in a delay of about 2 seconds from when the amplifier turns on (“MUTE-VA” low) and when the speaker relay closes.

Low Voltage Detector

D15, D2, and R7 supply a local 5V reference and are supplied current from the unregulated +30V supply via R32. 22VAC from the +/-30V windings is half-wave rectified via D26 and stored by C18. R53 limits the absolute peak current to protect D26. The voltage on C18 is divided down

HOME

via R33 and R8 and compared against the 5V reference at U3A. If the AC line voltage falls to around 60% of nominal (around 70VAC), the output of U3A goes low, resetting the mute and short monostables via D5 and D12. If the +15V supply fails, D3 and D4 bias the U3A inputs such that the amplifier is also muted. In the event of the -15V supply failing, R7 is no longer able to pull the anode of D15 low, and this also causes U3A to go low and mute the amplifier.

THERMAL MANAGEMENT

The T-Design Heatsink/Fan cools the output devices evenly and does not collect dust on the circuitry. The fan operates at variable speeds, controlled by output stage dissipation and temperature data supplied from both LM35DZ's mounted on the heatsink.

Fan Control Circuit

Referring to the 186 board: The fan voltage comes from a feedback regulator circuit formed by U3B, Q2, Q1 and associated components. The fan supply is actually referenced to the -30V supply, so U3A and Q3 act to shift the ground-referenced control voltage "FAST-FAN" to a -30V supply reference. The output voltage of this regulator is adjusted via R1. D7 and C9 give the fan an initial full fan voltage "kick" (28V) to insure the fan starts spinning. The "FAST-FAN" control line varies from -1.6V (Slow) to -15V (Fast). Short J3 temporarily and adjust R1 for a voltage across the fan equal to 28V.

Referring to the 170 board: The fan is never allowed to go faster than idle speed (Slow) unless the output stage dissipation is greater than 136 watts and the heatsink temperature is above 45°C. When the output stage dissipation is greater than 136W, U4D goes low. This eliminates D1 from supplying current to U2A. This decreases the reference voltage on U2A pin7, allowing it to work as a linear amplifier. With D1 conducting, U2A is effectively biased such that it's output is high and the resulting fan speed is low.

With 136W of output stage dissipation, U2A is allowed to linearly amplify the temperature sensor voltage on U1 via R2 and R5. C5, C15, C16, and C17 provide high frequency stability to this stage. The amplifier will linearly decrease the "FAST-FAN" voltage (increasing fan speed) between 45°C and 65°C. Above 65°C, U2A is saturated with the fan speed maximized. D11 isolates the Channel-1 and Channel-2 U2A circuits from each other. The connection of the U2A controllers is such that whichever channel is being used the hardest will determine the ultimate fan speed.

Thermal Shutdown

Heatsink temperature is sensed by U1 mounted to the main heatsink (one for each channel). The output of the sensor (10mV / °C) is compared to a 800mV reference at U2B. When the sensor is over 800mV (80°C) the output of U2B goes low, muting the amplifier via D27 and associated, and running the fan fast via D24. Hysteresis is built into the comparator via R3, such that the sensor voltage must reduce to 520mV (52°C) before the comparator goes back high and the amplifier un-mutes.

A thermostat is built into the power transformer. If the power transformer temperature exceeds 130°C the thermostat closes and brings the "THERM" line to ground via Q1 and it's associated parts on the 171 board. This shorts out the 800mV reference, and the U2B output goes low, muting the amplifier. Note that overheating of the power transformer is very unlikely but if it does occur, the amplifier will stay muted for over an hour before the transformer cools and the amplifier un-mutes itself.

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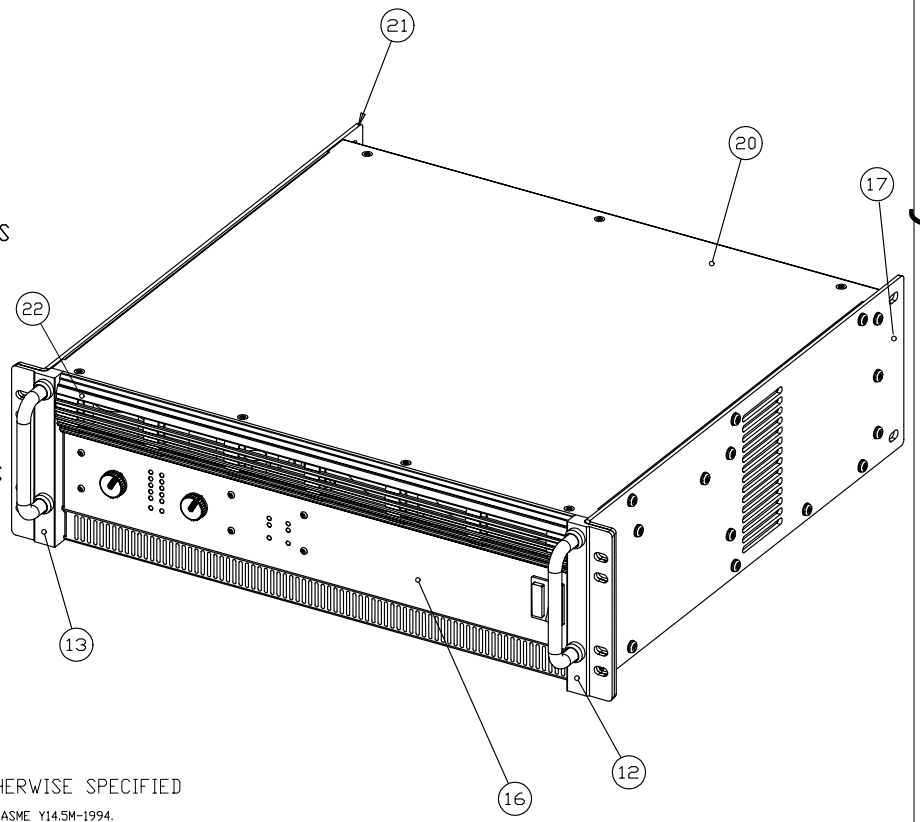
CABLE CONNECTIONS (NOT SHOWN)		
ITEM	FROM / REF DES	TO / REF DES
②	AC H	055-133-00 J9
③	AC N	055-133-00 J10
④	AC GND	CHASSIS GND
⑤	SWITCH BRN BRN VIO BLU	055-133-00 J14 J15 J12 J13
①	055-129-00 J3	055-133-00 J23
-	055-129-00 J2	055-171-00 J2
-	055-130-00 J1	055-171-00 J1
-	600-025-XX	055-171-00 J6
-	600-025-XX RED	055-171-00 J5
-	600-025-XX RED	055-171-00 J4
-	600-025-XX RED/Y	055-171-00 J3
-	600-025-00 YEL	055-133-00 J1
-	600-025-00 BLK	055-133-00 J8
-	FAN	055-186-00 J7
-	055-131-00 J1	055-129-00 J4
-	055-131-00 J11	055-132-00 J1
-	055-131-00 J6	055-129-00 J5
-	055-131-00 J5	055-130-00 J2
	055-129-00 J12	055-130-00 J4
-	055-129-00 J1	055-186-00 J4
-	055-129-00 J6	055-170-00 J10
-	055-129-00 J8	055-172-00 J5
-	055-129-00 J9	055-172-00 J6
-	055-130-00 J3	055-170-00 J10
-	055-130-00 J5	055-172-00 J7
-	055-130-00 J6	055-172-00 J8
-	055-133-00 J11	CHASSIS GND

The circled item numbers are shown in the parts list on page 20

2 BRN WIRE DESTINATIONS ARE INTERCHANGEABLE

RED WIRE DESTINATIONS ARE INTERCHANGEABLE 5

4



NOTE: UNLESS OTHERWISE SPECIFIED

1. INTERPRET DRAWING PER ASME Y14.5M-1994.
2. USE (36) TO LOCK TO CHASSIS STUD.
3. APPLY (48) TO BOTH SIDES OF ITEM 18.
4. USE (36) TO LOCK TO CHASSIS STUD.
5. CONSULT SCHEMATIC 990-133-00 DRAWING FOR -01 AND -02 TRANSFORMER PRIMARY CONNECTIONS.
6. USE (49) AND (53) TO BUNDLE AND ROUTE WIRES PER MANUFACTURING ASSY INSTRUCTIONS.

FOR PARTS LIST, SEE MANFACT BOM

DIMENSION AND TOLERANCES ARE IN ACCORDANCE WITH ASME Y14.5-1994

THE INFORMATION CONTAINED HEREIN IS PROPRIETARY AND CONFIDENTIAL PROPERTY OF MACKIE DESIGNS INC.

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES ALL ANGLES ARE 90° TOLERANCES ARE: FRACTIONS ± DECIMALS .XX± .XXX± ANGLES ±

MATERIAL: N/A

FINISH: N/A

APPROVALS	DATE
DRAWN JH	6.30.98
CHECKED	
NP ENGINEERING	
MATERIAL	
MANUFACTURING	
MFG ENGINEERING	
ISSUED	

MACKIE.™ Mackie Designs Inc. Woodinville, Wa

FINAL ASSY, M2600

SIZE D | SCALE .5 | DWG. NO. 090-078-00 | REV. A

DWG FILE 090-078-00 | SHEET 1 OF 3

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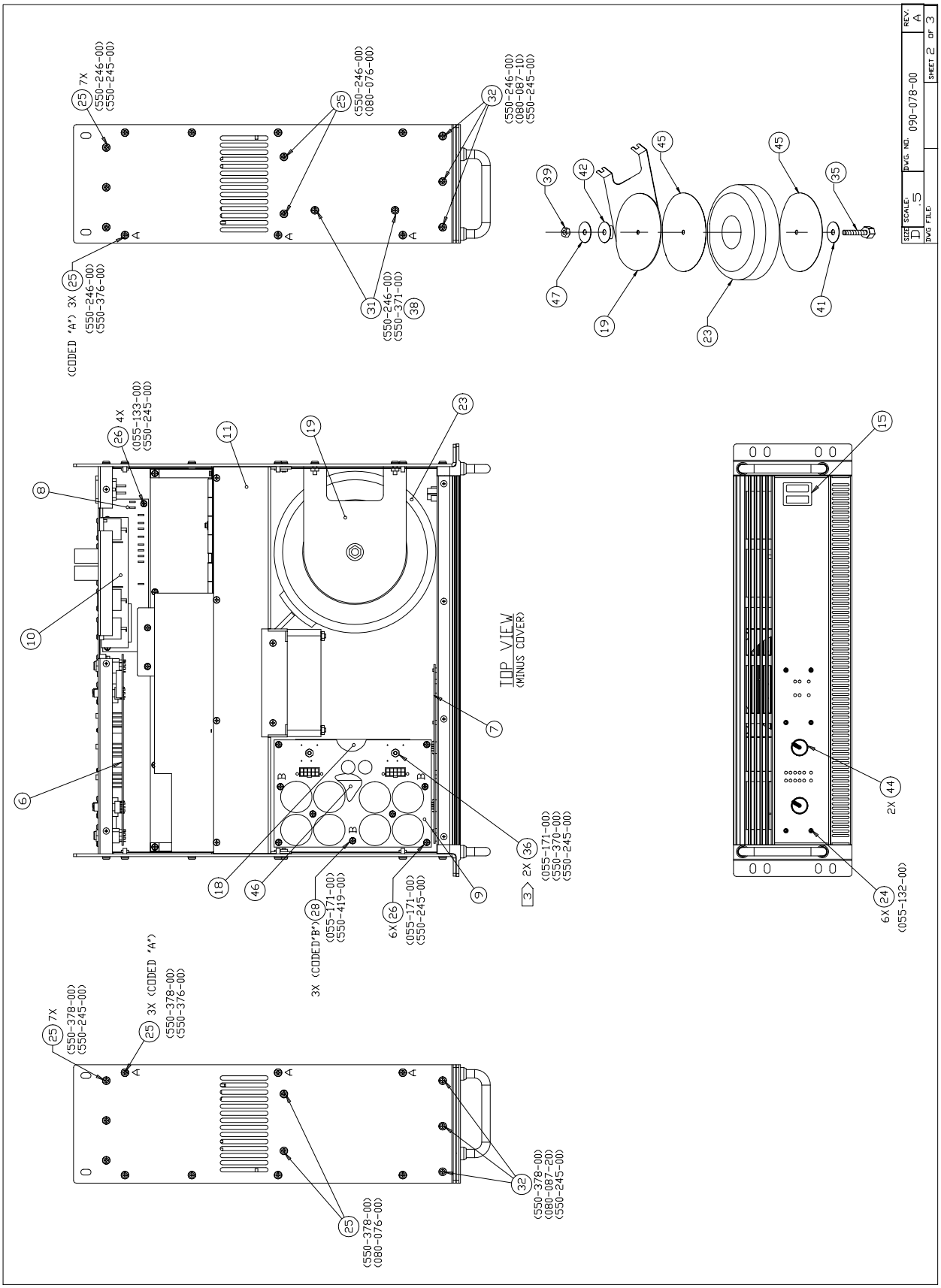
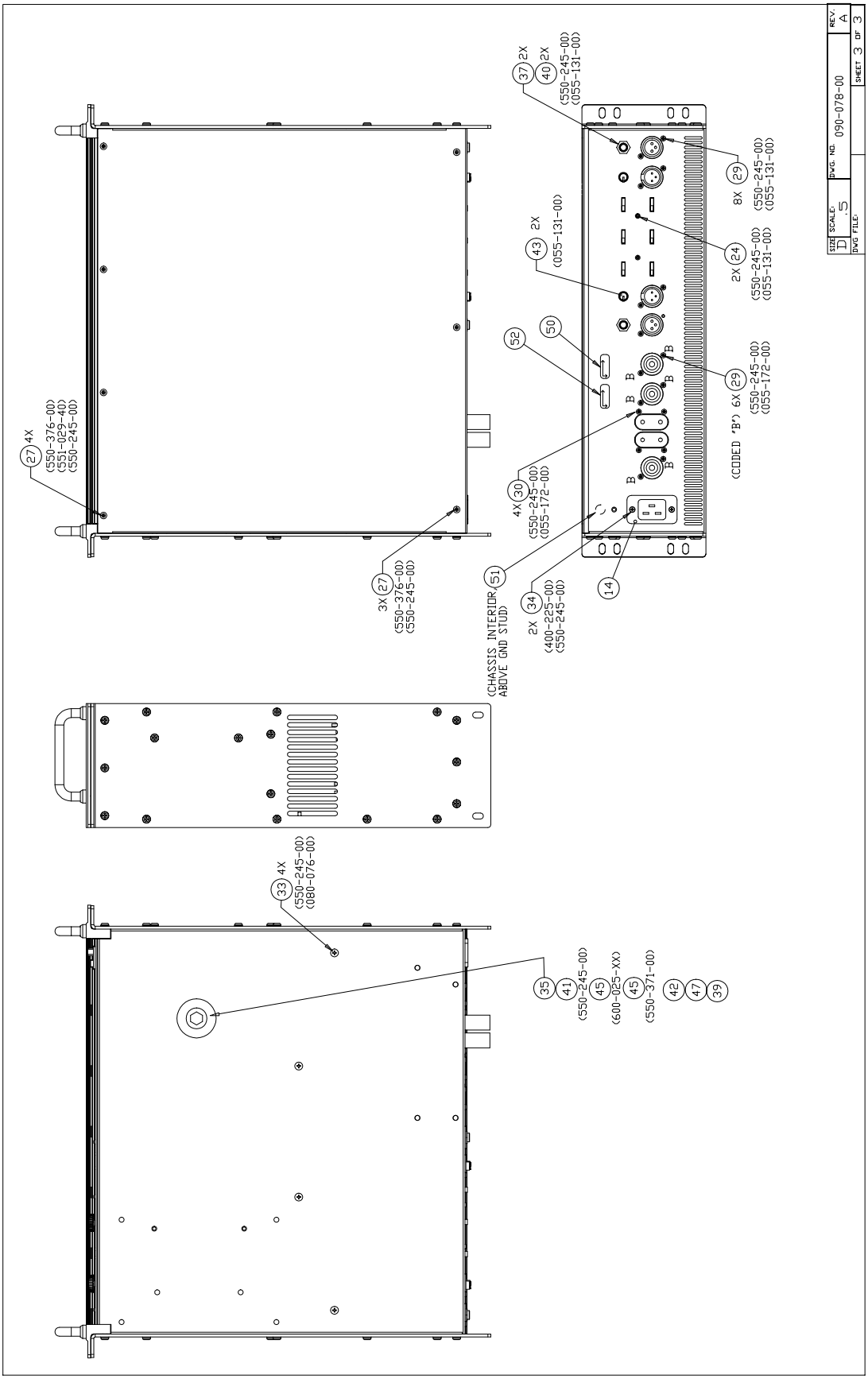


The circled item numbers are shown in the parts list on page 20

HOME



Final Assembly

The circled item numbers are shown in the parts list on page 20

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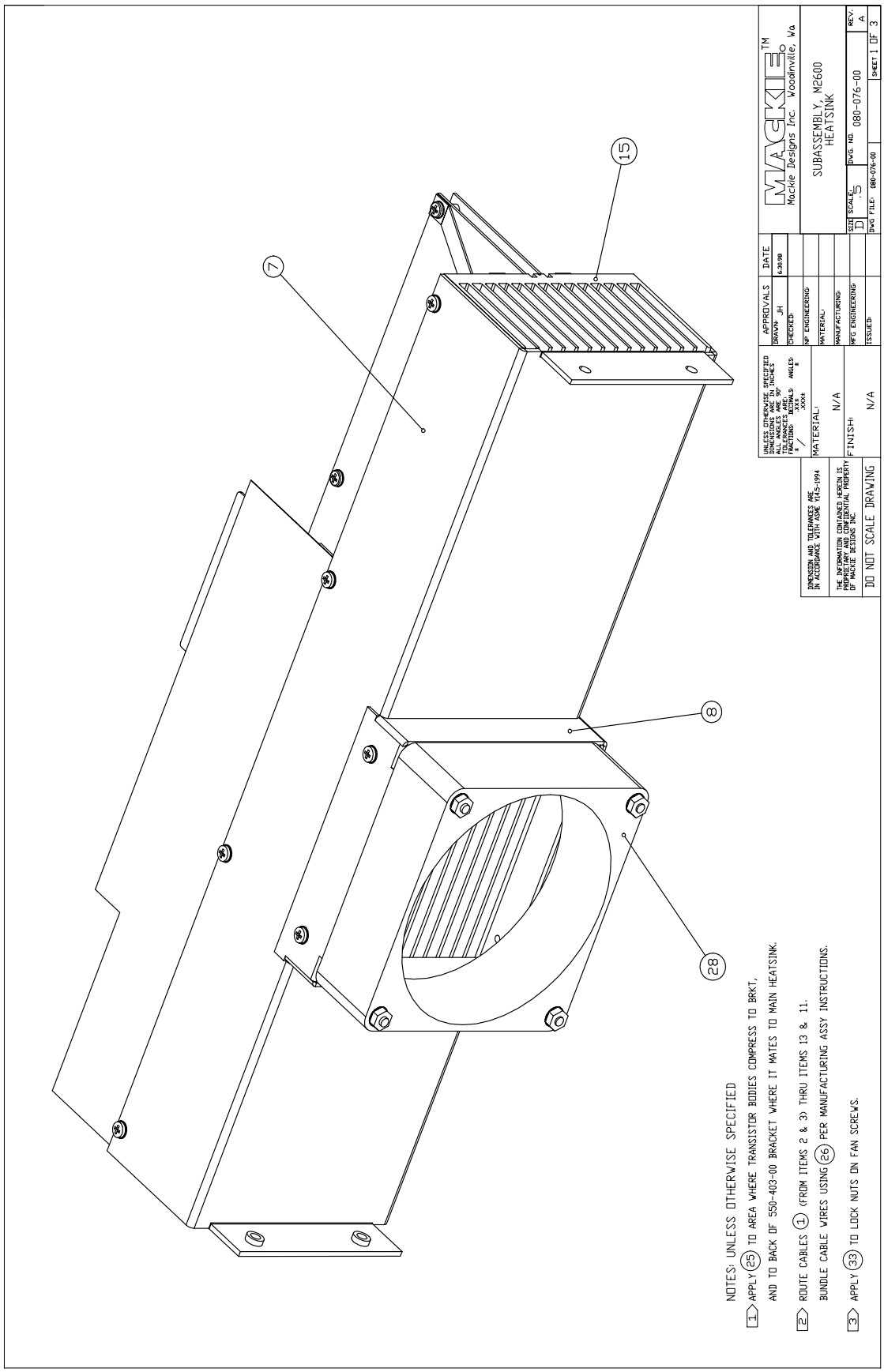
Amplifier/Heatsink Assembly

The circled item numbers are shown in the parts list on page 21



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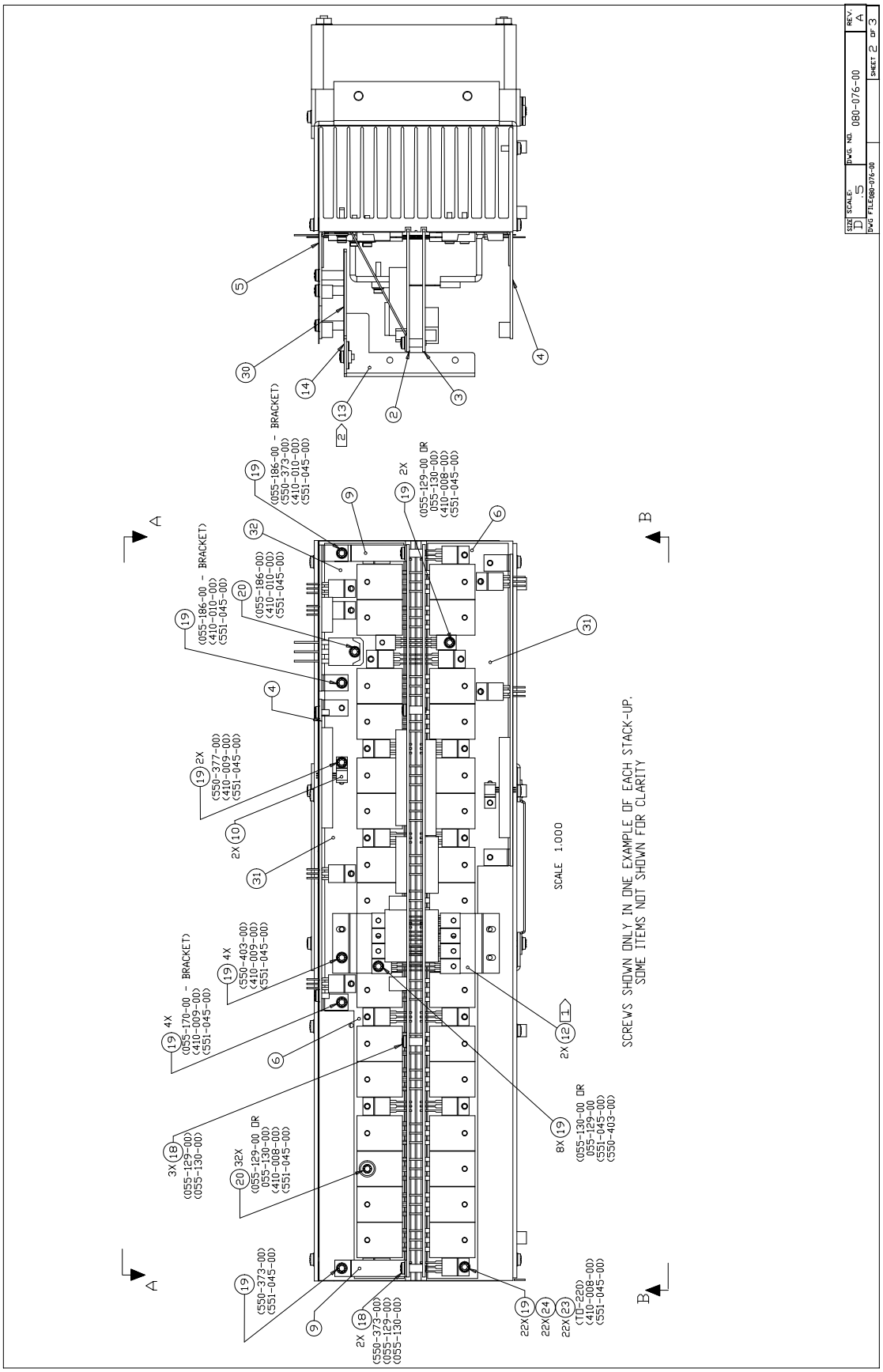
Amplifier/Heatsink Assembly

The circled item numbers are shown in the parts list on page 21



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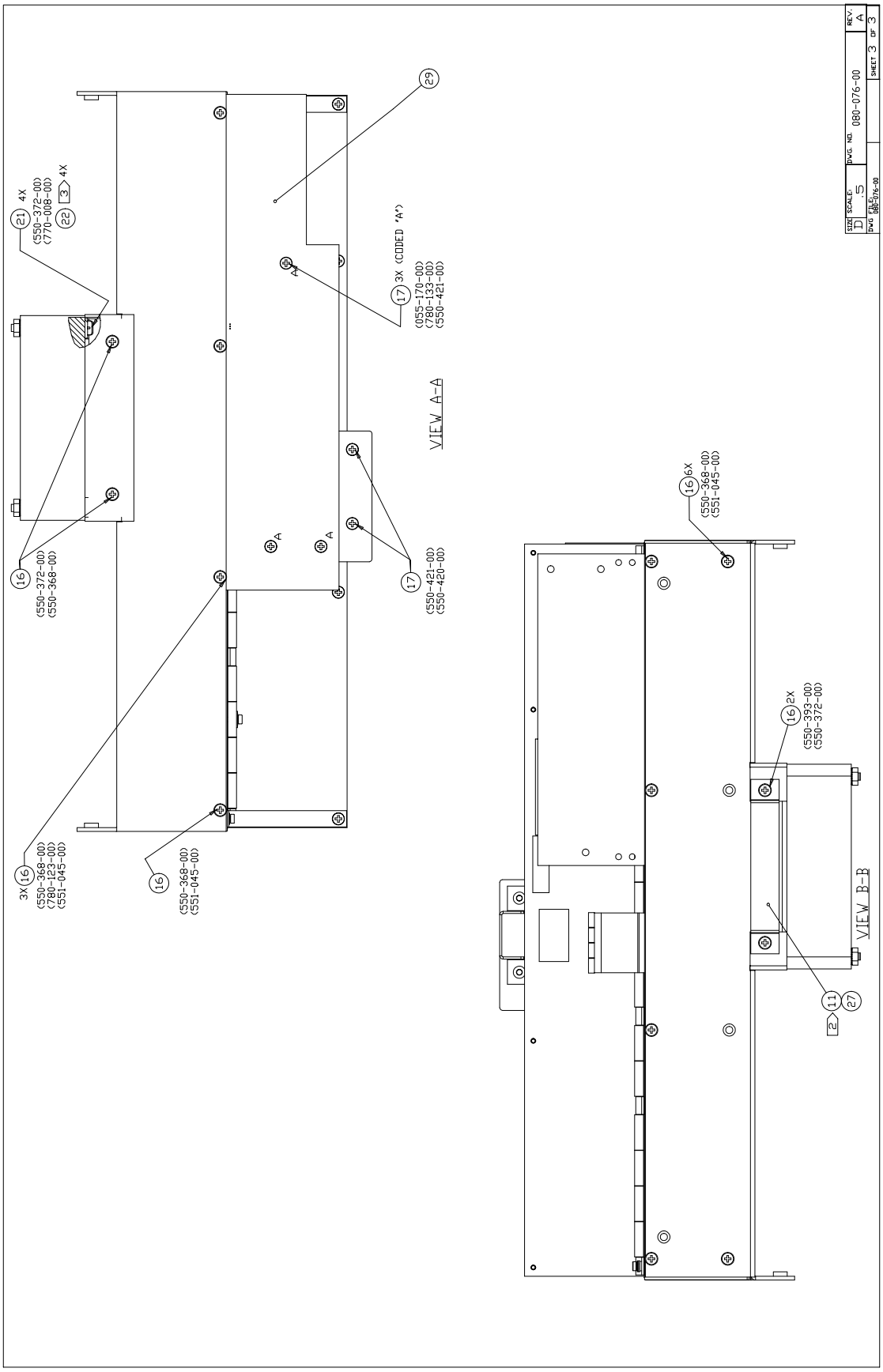
Amplifier/Heatsink Assembly

The circled item numbers are shown in the parts list on page 21



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Master Parts List 090-078-00 M2600 Assembly, 120v

Item#	Part #	Description	Rev	Qty	
1	040-257-00	CBL ASSY 24GA 3P .098 6IN	B	1	
2	040-272-00	DIS 14G 1010 BRN 7.5 QDX2	B	1	
3	040-273-00	DIS 14G 1010 BLU 6.5 QDX2	A	1	
5	040-301-00	CBL ASSY SW PWR 23IN	A	1	
6	055-131-00-01	PCB ASSY INPUT - 2600	A	1	
7	055-132-00-01	PCB ASSY DISPLAY M2600	A2	1	
8	055-133-00-01	PCB ASSY PWR DIST 120V	A1	1	
9	055-171-00-01	PCB ASSY PWR SPLY M2600	A	1	
10	055-172-00-01	PCB ASSY SPKR OUTPUT 2600	A	1	
11	080-076-00	SA AMP M2600	A6	1	
12	080-087-10	SA HANDLE RIGHT M2600	A	1	
13	080-087-20	SA HANDLE LEFT M2600	A	1	
	080-115-00	ASSY WIRE RCPT GND	A	1	
23	080-117-00	SA XFMR M2600 120V	A	1	
	400-331-00	INSERT JACK BAN M-MAN RED	A	AR	
	400-332-00	INSERT JACK BAN M-MAN BLK	A	AR	
15	500-022-00	SW RCKR ILLUMINATED	A	1	
	510-044-00	FUSE SB 30A 3AB	A	1	
16	550-245-00	SCRN CHASSIS M2600	B	1	
17	550-246-00	PNT SIDE RAIL RT- M2600	A	1	
18	550-370-00	BRKT BRIDGE RECT HEATSINK	A	1	
19	550-371-00	BRKT XFMR MOUNT M2600	A	1	(transformer bracket)
20	550-376-00	PNT COVER TOP M2600	A	1	
21	550-378-00	PNT SIDE RAIL LT - M2600	A	1	
46	550-419-00	FAB BRKT CBLE SHLD M2600	A	1	
22	551-029-40	EXTR SCRN DSPLY BZL-M2600	C	1	
49	640-009-00	LC IEC SJT 20A/125V 12AWG	A	1	
31	700-005-00	SEMS 8-32X1/2 PHP BLKZC	A	2	
24	700-011-00	MCH 4-40X1/4 BTNSKT BLKOX	A	8	
25	700-027-00	SEMS 8-32X3/8 PHP BLKZC	A	24	
26	700-028-00	SEMS 6-32X1/4 PHP BLKZC	B	13	
27	700-041-04	MCH 6-32X3/8 FL 100DG BLK	A	7	
30	700-085-03	SCR PHP M3X6 STL BLK ZC	A	4	
32	700-091-00	SEMS 8-32X3/4 PHP BLKZC	A	6	
34	700-094-04	MCH 4-40X3/8 82DEG FL BLK	A	2	
35	700-096-00	BOLT HEX 5/16X3-3/4 GR5 Z	A	1	(transformer bolt)
33	700-097-00	MCH 8-32X1/4 FL 82DG UCUT	A	4	
29	701-016-00	5-20X5/16 PHPII TYP B BLK	A	14	
36	705-001-00	KEPNUT 6-32	A	4	
37	705-003-00	NUT HEX-SPLD W/400-214-00	A	AR	
38	705-008-00	NUT LOCK 8-32	A	2	
39	705-019-00	NUT STOVER LOCK 5/16X18	A	1	(transformer nut)
40	710-002-00	WASHER-SPLD W/400-214-00	A	AR	
41	710-024-00	WASH FLAT 5/16 HARD (USS)	A	1	(transformer bottom washer)
47	710-034-00	WASH STL .063X.344X.688	A	1	(transformer top washer)
48	730-001-00	THERMAL JOINT COMPOUND	A	AR	
49	740-003-00	TYRAP 8IN BLK	A	4	
42	710-032-00	WASH SHLD FIBRE .317X.750	A	1	(transformer shoulder washer)
53	720-007-00	TAPE DS 30MIL X 1.0W URTH	A	AR	
	730-016-00	LOCTITE 242	A	AR	
	750-001-00	BUMPON ROUND BLK .63X.31	A	4	
43	760-048-01	KNOB 9MM LT GRY	B	2	
44	760-061-00	KNOB VOLUME AMPS	A	2	
45	780-111-00	WASH RUB (W/TRANSFORMER)	A	2	(transformer insulator washers)
	790-002-00	BAG POLY 12 X 18 2MIL	A	1	

NOTE:The Item numbers in the first column of this page refer to the Final Assemby Drawings on pages 14-16

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Item#	Part #	Description	Rev	Qty
	790-022-00	POLY-SHEET 52CF X 26 4MIL	A	1
	800-087-00	BOX - M2600	A	1
	800-107-00	BOX SLEEVE M2600	A	1
	810-076-00	INSERT - M2600	A	2
	810-082-00	FOAM CORNER M2600	A	4
	820-078-00	OWN MANUAL M2600 ENG/DOM	A	1

080-076-00 Amplifier/Heatsink subassembly

Item	Part#	Description	Rev	Qty
	080-076-00	SA AMP M2600	A6	1
1	040-263-00	DIS 16GA 10C .165X2 19.5	A	2
2	055-129-00-01	PCB ASSY CHANNEL 1 - 2600	A3	1
3	055-130-00-01	PCB ASSY CHANNEL 2 - 2600	A2	1
	055-170-00-02	PCB ASSY V-AMP PROT M2600	A3	2
5	055-186-00-01	PCB ASSY PREDRV/FAN M2600	A2	1
	080-116-00	FAN ASSY M2600	A1	1
34	410-013-00	SILPAD CUT M2600 NEW	A	1
33	410-014-00	SILPAD CUT M2600 NEW	A	1
7	550-368-00	COWLING HEATSINK M2600	A	1
8	550-372-00	BRKT FAN SHROUD M2600	A	1
9	550-373-00	BRKT SUPPORT PCB 28DEG	A	2
10	550-377-00	BRKT TO-92 MOUNTING	A	2
11	550-393-00	BRKT WIRE HARNESS M2600	A	1
12	550-403-00	FAB SEC HEATSINK M2600	A	2
13	550-420-00	FAB BRKT WIRE SHLD M2600	A	1
14	550-421-00	FAB BRKT VAMP SHLD M2600	A	1
15	551-045-00	FAB HEATSINK M2600	B	1
	700-005-00	SEMS 8-32X1/2 PHP BLKZC	A	4
16	700-010-04	TF 6-32X3/8 PHP BLKZC	A	14
17	700-028-00	SEMS 6-32X1/4 PHP BLKZC	B	5
18	700-034-00	SEMS 4-40X1/4 PHP BLKZC	A	5
19	700-087-00	TF 4-40X5/8 TORX 1/4 WASH	A	23
20	700-088-00	TF 4-40X5/8 TORX 3/8 WASH	A	33
	700-110-00	MCH 3-48X1/2 SKTCP SS	A	22
22	705-008-00	NUT LOCK 8-32	A	4
	710-020-00	WASH NO.4 COMPRESSION	A	44
23	710-036-00	WASH FLT STL NO.4 .030THK	A	22
24	710-044-00	WASH SHLDR TO-220 DELRIN	A	22
25	730-001-00	THERMAL JOINT COMPOUND	A	AR
33	730-025-00	LOCTITE 222	A	AR
26	740-003-00	TYRAP 8IN BLK	A	3
27	740-011-00	HEATSHRINK TUBE 2:1 .50ID	B	AR
29	780-123-00	INSULATOR PCB M2600	A	1
30	780-133-00	INSULATOR VAMP SHLD M2600	A	1

NOTE: The Item numbers in the first column refer to the Amplfier/Heatsink Assemby Drawings on pages 17-19

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055-129-00 Rev A Channel 1 board

Part #	Description	Value		Reference Designator
040-261-00	RIB 28GA TRAN 10C .1 3IN			J1
040-262-00	RIB 28GA TRAN 40C 3IN			J6
040-265-00	DIS 14GA BLK/ WHT 4.5IN QD			J4
040-266-00	DIS 14GA BLK/ WHT 6IN QDX2			J12
040-267-00	DIS 14GA WHT 6IN QDX2			J8
040-268-00	DIS 14GA BLKWHT 6IN QDX2			J9
121-077-00	RESISTOR MOF	150	5%	R58
123-013-00	RESISTOR MOF	0.33	5%	R40-55
123-045-00	RESISTOR MOF	6.8	5%	R60-68
123-056-00	RESISTOR MOF	20	5%	R59
123-125-00	RES MO 3W 5% 15K OHM	15K	5%	R70-73
⚠150-009-00	RES FUS .25W 5% 2.2 OHM	2.2	5%	R3 R5-6 R8 R11 R13 R16 R18 R21 R23 R25 R29 R31 R33 R36 R38
⚠150-037-00	RES FUS .25W 5% 33 OHM	33	5%	R1 R4 R7 R9 R12 R14 R17 R19 R22 R24 R26-28 R30 R32 R34 R37 R39 R57 R69
⚠150-045-00	RES FUS .25W 5% 68 OHM	68	5%	R2 R10 R15 R20 R35 R56
⚠150-066-00	RESISTOR, FUSABLE, 1/4W	510	5%	R75
200-036-02	CAP, METALIZED POLY, T/R	.1uF	10%	C22 C27
200-041-00	CAPACITOR POLY HI-CURRENT	0.01	10%	C24
205-003-02	MICA 330PF 5% 500V	330pF	5%	C30-31
211-003-00	CER .001UF 10% 50V AX	0.001	10%	C1
211-009-00	CAPACITOR CERAMIC AXIAL	0.1	10%	C2 C4 C6 C8 C15 C17
220-011-02	CAPACITOR LYTIC RADIAL T&R	100UF	10%	C14 C16 C18 C20
220-025-00	CAPACITOR LYTIC RADIAL	1,000UF	10%	C21
220-027-02	CAPACITOR LYTIC RADIAL T&R	10UF	10%	C25-26
220-047-00	LYT 47UF 20% 160V RAD	47UF	20%	C19 C23
301-009-00	DIODE POWER	1N4004		D5
301-010-00	DIODE POWER	1N5404		D1-2
302-003-00	DIODE ZENER	1N4745		D3-4
310-033-00	TRANSISTOR PNP	MJL21193		Q13-14 Q16-17 Q19-20 Q23-24
310-034-00	TRANSISTOR NPN	MJL21194		Q2-5 Q7-8 Q10-11
310-042-00	TRANSISTOR NPN	MJE15032		Q1 Q6 Q9 Q12
310-043-00	TRANSISTOR PNP	MJE15033		Q15 Q18 Q21 Q25
310-049-00	XSTR PNP 2SA794A	2SA794A		Q29
310-050-00	XSTR NPN 2SC1567A	2SC1567A		Q22 Q28
310-055-00	XSTR NPN 2SA1480	2SA1480		Q27
310-056-00	XSTR PNP 2SC3790	2SC3790		Q26
400-077-00	HEADER STR LCK SHRD 20P .100 X 2			J5
400-129-00	FUSE CLIP 0.25 DIA PC MNT			Z1-4
400-231-00	HEADER, 2X5, MATE-N-LOCK			J2
400-242-00	CONNECTOR,STR,3P,.098 X 1,SHRD			J3
400-243-00	CONNECTOR,STR,2P,.098 X 1,SHRD			J7
450-129-00	PCB, M2600 CH-1 AMP			Z5
490-021-00	MAGNET, .2THK .5DIA			Z6
501-003-00	RELAY, SPDT	T9AS5D12-24		K1
⚠510-041-00	FUSE 25A FB 3AG	25A		F1-2
601-006-00	INDUCTOR, AIR CORE	1uH	10%	L1
601-008-00	INDUCTOR	10uH		L2-3

⚠ Components noted with this symbol shall be replaced only by the component specified.This is required to maintain product safety.

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055-130-00 Rev A Channel 2 board

Part #	Description	Value		Reference Designator
040-262-00	RIB 28GA TRAN 40C 3IN			J3
040-269-00	DIS 14GA RED 6 IN QDX2			J5
040-270-00	DIS 14GA BLKRED 6IN QDX2			J6
121-077-00	RESISTOR MOF	150	5%	R60
123-013-00	RESISTOR MOF	0.33	5%	R40-55
123-045-00	RESISTOR MOF	6.8	5%	R61-69
123-056-00	RESISTOR MOF	20	5%	R70
123-125-00	RES MO 3W 5% 15K OHM	15K	5%	R58-59 R73-74
⚠150-009-00	RESISTOR, FUSABLE, 1/4W	2.2	5%	R2 R4 R7 R9 R11 R15 R17 R19 R22 R24 R27 R29 R32 R34-35 R37
⚠150-037-00	RES FUS .25W 5% 33 OHM	33	5%	R1 R3 R5 R8 R10 R12-14 R16 R18 R20 R23 R25 R28 R30 R33 R36 R38 R56-57
⚠150-045-00	RES FUS .25W 5% 68 OHM	68	5%	R6 R21 R26 R31 R39 R71
⚠150-066-00	RESISTOR, FUSABLE, 1/4W	510	5%	R75
200-036-02	CAP, METALIZED POLY, T/R	.1uF	10%	C21 C26
200-041-00	CAPACITOR POLY HI-CURRENT	0.01	10%	C25
205-003-02	MICA 330PF 5% 500V	330pF	5%	C29-30
211-003-00	CER .001UF 10% 50V AX	0.001	10%	C1
211-009-00	CAPACITOR CERAMIC AXIAL	0.1	10%	C7 C9 C11 C13 C15 C17
220-011-02	CAPACITOR LYTIC RADIAL T&R	100UF	10%	C14 C16 C18 C20
220-027-02	CAPACITOR LYTIC RADIAL T&R	10UF	10%	C23-24
220-047-00	LYT 47UF 20% 160V RAD	47UF	20%	C19 C22
301-009-00	DIODE POWER	1N4004		D4
301-010-00	DIODE POWER	1N5404		D1-2
302-003-00	DIODE ZENER	1N4745		D3 D5
310-033-00	TRANSISTOR PNP	MJL21193		Q15-16 Q18-19 Q21-24
310-034-00	TRANSISTOR NPN	MJL21194		Q2-3 Q6-7 Q9-10 Q12-13
310-042-00	TRANSISTOR NPN	MJE15032		Q1 Q5 Q8 Q11
310-043-00	TRANSISTOR PNP	MJE15033		Q14 Q17 Q20 Q25
310-049-00	XSTR PNP 2SA794A	2SA794A		Q29
310-050-00	XSTR NPN 2SC1567A	2SC1567A		Q4 Q28
310-055-00	XSTR NPN 2SA1480	2SA1480		Q27
310-056-00	XSTR PNP 2SC3790	2SC3790		Q26
400-077-00	HEADER STR LCK SHRD 20P .100 X 2			J2
400-129-00	FUSE CLIP 0.25 DIA PC MNT			Z1-3 Z5
400-173-00	CONN QUICK DISC .250 W/STABLE-LOK TABS			J4
400-231-00	HEADER, 2X5, MATE-N-LOCK			J1
450-130-00	PCB M2600 CH-2 AMP			Z4
490-021-00	MAGNET .200 THK X .50 DIA			Z6
501-003-00	RELAY, SPDT	T9AS5D12-24		K1
⚠510-041-00	FUSE 25A FB 3AG	25A		F1-2
601-006-00	INDUCTOR, AIR CORE	1uH	10%	L1
601-008-00	INDUCTOR	10uH		L2-3
706-033-05	STANDOFF, SWAGE, 4-40 X .312L			H1-4 H6

⚠ Components noted with this symbol shall be replaced only by the component specified.This is required to maintain product safety.

HOME

055-131-00-01 Rev A Input board

Part #	Description	Value		Reference Designator
	DO NOT STUFF			C22 C24
040-258-00	RIB 28GA TRAN 20C .1 5IN			J6
040-259-00	RIB 28GA TRAN 20C .1 6IN			J5
040-260-00	RIB 28GA TRAN 20C .1 20IN			J11
100-027-00	RESISTOR CF	120	5%	R23 R28-29 R50-51 R65
130-062-02	RES POT 12MM HORIZ DUAL	50KC		R11 R66
140-078-00	RESISTOR TF SMT	1K6	5%	R7 R67
140-082-00	RES TF SM .1W 5% 2K4 OHM	2K4	5%	R9 R69
140-089-00	RESISTOR CF	4K7	5%	R24-27 R52-53
140-090-00	RES TF SM .1W 5% 5K1 OHM	5K1	5%	R80-81
140-095-00	RES TF SM .1W 5% 8K2 OHM	8K2	5%	R8 R68
140-123-00	RES TF SM .1W 5% 100K OHM	100K	5%	R77-79
145-318-00	RESISTOR MF SMT	2K00	1%	R4 R6 R38-41 R72 R74
145-331-00	RESISTOR MF SMT	2K49	1%	R35 R59
145-346-00	RESISTOR MF SMT	3K57	1%	R14 R17 R44 R47
145-389-00	RESISTOR MF	10K0	1%	R3 R5 R21-22 R32 R56 R63-64 R71 R73
145-397-00	RESISTOR MF	12K1	1%	R1-2 R12-13 R16 R18 R30-31 R36-37 R42-43 R46 R48 R54-55 R60-61 R75-76
145-406-00	RESISTOR MF SMT	15K0	1%	R20 R62
145-426-00	RESISTOR MF SMT	24K3	1%	R15 R19 R33-34 R45 R49 R57-58
200-025-02	CAPACITOR MYLAR T&R	0.56		C10-11 C38-39
200-029-02	CAPACITOR MYLAR T&R	0.22		C12-13 C20-21 C28-29 C36-37
212-001-00	CAPACITOR CERAMIC SMT	0.01	10%	C4-5 C14-19 C23 C25 C30-35 C41-42
212-004-00	CAPACITOR CERAMIC SMT	220PF	5%	C3 C6-7 C40 C43-44
212-009-00	CAPACITOR CERAMIC SMT	47PF	5%	C1-2 C45-46
220-001-02	CAPACITOR LYTIC RADIAL T&R	22UF	10%	C8-9 C26-27 C47-48
300-003-00	DIODE SIGNAL SMD	DL4148		D1-6 D9-16
302-002-03	4.7V	DL5230B		D7-8
320-006-00	OPAMP 2068E	NJM 2068		U1 U11
320-012-00	OPAMP NJM4560M	NJM4560M		U2-4 U6 U8-10
329-012-00	OPTO-ISOLATOR,LED/CDS	VTL5C10		U5 U7
400-041-00	CONNECTOR XLR PC MTG VERT MALE			J7 J10
400-214-00	CONNECTOR JACK 1/4" VERT PC MOUNT W/1MM LW			J3 J12
400-223-00	CONNECTOR XLR PC MTG VERT FML			J4 J13
400-269-00	TERM QDISC RTA .250 PCMT			J1
450-131-00	PCB, M-2600 INPUT			Z1
500-023-00	SWITCH	4P3T		SW1-6
706-013-00	STDF NO.4 X .978L M/F			H1-2

HOME

055-132-00-01 Rev A Display board

Part #	Description	Value		Reference Designator
130-070-00	RESISTOR POT 9MM HORIZ	5KB	20%	R2 R34
140-057-00	RESISTOR CF	220	5%	R17
140-065-00	RESISTOR CF	470	5%	R35 R41
140-068-00	RESISTOR TF SMT	620	5%	R11 R24
140-076-00	RESISTOR CF	1K3	5%	R25 R43-49 R51
140-081-00	RESISTOR CF	2K2	5%	R1 R33
140-083-00	RESISTOR TF SMT	2K7	5%	R12-13 R19-21 R50 R52
140-087-00	RESISTOR CF	3K9	5%	R16
140-092-00	RESISTOR CF	6K2	5%	R15
140-094-00	RESISTOR CF	7K5	5%	R18
140-106-00	RESISTOR TF SMT	24K	5%	R5 R10 R29 R31
145-389-00	RESISTOR MF SMT	10K0	1%	R4 R7 R23 R27-28
145-454-00	RESISTOR MF SMT	47K5	1%	R37 R39-40 R42
145-472-00	RESISTOR MF SMT	73K2	1%	R8 R26
145-480-00	RES MF SM .1W 1% 88K7 OHM	88K7	1%	R3 R22
145-527-00	RESISTOR MF SMT	274K	1%	R14
145-547-00	RESISTOR MF SMT	442K	1%	R6 R9 R30 R32 R36 R38
212-001-00	CAPACITOR CERAMIC SMT	0.01	10%	C1 C3 C6 C10-11 C14 C19-20 C22-23
212-025-00	CAP CER .1UF 25V 10% X7R	.1UF	10%	C7-9 C12-13 C15-16
220-002-02	CAPACITOR LYTIC RADIAL T&R	47UF	20%	C2 C4-5 C17
220-014-00	CAPACITOR LYTIC RADIAL KS	2.2UF	10%	C18 C21
300-003-00	DIODE SIGNAL SMD	DL4148		D13-20 D27
304-070-02	LED RED T1 W/.550 SPCR T/R	RED		D1 D7 D21-22 D24-26
304-071-02	LED GRN T1 W/.550 SPCR T/R	GRN		D2-6 D8-12 D23
311-002-00	X-SISTOR PNP SMD	IMBT4403		Q1-2
320-012-00	OPAMP NJM4560M	NJM4560M		U1 U6
323-002-00	I.C. QUAD COMPARATOR SMD	LM339		U2-5 U7
400-077-00	HEADER STR LCK SHRD 20P .100 X 2			J1
450-132-00	PCB, M2600 DISPLAY			Z8
706-033-08	STANDOFF, SWAGE, 4-40 X .665L			H1-3 H5-7

HOME

055-133-00-01 Rev A Power distribution 120V

Part #	Description	Value		Reference Designator	
040-137-00	DIS 18GA GN/YL 96IN QD LUG			J11	
121-077-00	RESISTOR MOF	150	5%	R3	
125-020-00	RESISTOR WIRE WOUND	82	5%	R1-2	
200-023-00	CAPACITOR, POLY BOX	.001uF	20%	C1-2	
200-024-00	CAPACITOR, POLY BOX	.01uF	20%	C3-4	
301-009-00	DIODE POWER	1N4004		D1	
400-129-00	FUSE CLIP 0.25 DIA PC MNT			Z1-2	
400-173-00	CONN QUICK DISC .250			J1-10 J12-15	
400-173-00	CONN QUICK DISC .250 -00 AND -02 ASSY ONLY			J16-17	
400-173-00	CONN QUICK DISC .250 -01 ASSY ONLY			J18	
400-242-00	CONNECTOR,STR,3P,.098 X 1,SHRD			J23	
450-133-00	PCB, M2600 PWR DISTRO & AC-INRUSH			Z3	
501-003-00	RELAY, SPDT	T9AS5D12-24		RL1	
⚠510-017-00	FUSE 20A SLO-BLO -02 ASSY ONLY	F1		Z4	(100 VOLT MODELS ONLY)
⚠510-018-00	FUSE 15A SLO-BLO -01 ASSY ONLY	F1		Z6	(240 VOLT MODELS ONLY)
⚠510-033-00	FUSE 25A SLO-BLO -00 ASSY ONLY	F1		Z5	(120 VOLT MODELS ONLY)

Components noted with this symbol shall be replaced only by the component specified.This is required to maintain product safety.

HOME

055-170-00 Rev A, Voltage amplifier and protection

Part #	Description	Value		Reference Designator
	TEST POINT, PART OF PCB			J1-9 J11-16 J24-26
100-025-00	RESISTOR CF	100	5%	R11 R30 R37-38
105-369-00	RES MF .125W 1% 6K19 OHM	6K19	1%	R141-144
130-021-00	RESISTOR POT TRIM HORIZ	10KB		R162
130-053-00	RESISTOR POT TRIM HORIZ	200		R163
140-053-00	RESISTOR TF SMT	150	5%	R12-13 R22-23
140-057-00	RESISTOR TF SMT	220	5%	R6
140-061-00	RES TF SM .1W 5% 330 OHM	330	5%	R159
140-073-00	RES TF SM .1W 5% 1K0 OHM	1K0	5%	R16 R19
140-076-00	RES TF SM .1W 5% 1K3 OHM	1K3	5%	R160
140-077-00	RESISTOR TF SMT	1K5	5%	R105
140-082-00	RESISTOR TF SMT	2K4	5%	R104 R140 R156
140-084-00	RESISTOR TF SMT	3K0	5%	R103 R139
140-090-00	RESISTOR TF SMT	5K1	5%	R48-49 R53 R77 R86 R102
140-092-00	RES TF SM .1W 5% 6K2 OHM	6K2	5%	R110 R152
140-093-00	RES TF SM .1W 5% 6K8 OHM	6K8	5%	R121
140-095-00	RESISTOR CF	8K2	5%	R7 R47 R51
140-099-00	RESISTOR TF	12K	5%	R41-42 R67-68 R97-98
140-111-00	RESISTOR TF SMT	36K	5%	R10 R26 R57 R76
140-113-00	RES TF SM .1W 5% 43K OHM	43K	5%	R122
140-116-00	RESISTOR TF SMT	56K	5%	R120 R158
140-117-00	RESISTOR TF SMT	62K	5%	R59 R88 R155
140-120-00	RES TF SM .1W 5% 82K OHM	82K	5%	R147 R150
140-123-00	RESISTOR TF SMT	100K	5%	R45 R60 R123 R148-149
140-126-00	RESISTOR TF SMT	150K	5%	R3 R31 R36 R54 R107 R116
140-130-00	RESISTOR TF SMT	200K	5%	R1 R101 R106 R126 R129-130
140-140-00	RESISTOR TF SMT	510K	5%	R8 R55-56 R108 R115
140-143-00	RESISTOR TF SMT	680K	5%	R28
140-147-00	RESISTOR TF SMT	1M	5%	R9 R33 R92
140-152-00	RESISTOR TF SMT	1M6	5%	R5
145-000-00	RES TF SM .1W 0 OHM	0	5%	R15 R20 R40 R43
145-182-00	RESISTOR MF SMT	76.8	1%	R93-94 R99-100 R145
145-266-00	RESISTOR MF SMT	576	1%	R112 R114
145-308-00	RES MF SM .1W 1% 1K58 OHM	1K58	1%	R46
145-318-00	RESISTOR MF SMT	2K00	1%	R14 R21 R39 R44 R63 R72 R146 R151 R157
145-331-00	RESISTOR MF SMT	2K49	1%	R52 R64 R71 R111
145-389-00	RESISTOR MF SMT	10K0	1%	R50 R58 R61-62 R73-74 R124 R128 R136 R138
145-414-00	RESISTOR MF SMT	18K2	1%	R83 R132
145-418-00	RESISTOR MF SMT	20K0	1%	R25 R29 R32 R34-35 R75 R78-80 R82 R84 R127 R133 R137
145-422-00	RES MF SM .1W 1% 22K1 OHM	22K1	1%	R119 R125
145-426-00	RESISTOR MF SMT	24K3	1%	R2 R4 R65-66 R69-70 R90-91 R95-96 R109 R117
145-427-00	RESISTOR MF SMT	24K9	1%	R113
145-435-00	RES MF SM .1W 1% 30K1 OHM	30K1	1%	R118
145-439-00	RESISTOR MF SMT	33K2	1%	R17-18 R24 R27
145-469-00	RESISTOR MF SMT	68K1	1%	R87 R89 R135 R161
145-531-00	RESISTOR MF SMT	301K	1%	R81 R85 R131 R134 R153-154

HOME

055-170-00 Rev A, continued

Part #	Description	Value		Reference Designator
200-011-02	CAPACITOR MYLAR T&R	0.0022	5%	C59
200-036-02	CAP, METALIZED POLY, T/R	.1uF	10%	C31-32
205-006-02	MICA 30PF 5% 500V T/A	30pF	5%	C60
210-017-02	CAPACITOR, CERAMIC, T/R	470pF	5%/Y5E	C45
212-001-00	CER .01UF 10% 50V X7R SM	0.01	10%	C20 C25
212-006-00	CAPACITOR CERAMIC SMT	470PF	5%	C46
212-007-00	CAPACITOR CERAMIC SMT	0.047	5%	C4 C6 C8-10 C12-13 C22-23 C27 C30 C33 C35 C37-39 C41-42 C52-58 C61-62
212-008-00	CER .22UF +80/-20% 25V SM	0.22	5%	C1 C3 C47 C51 C63
212-016-00	CAPACITOR CERAMIC SMT	1000PF	5%	C5 C21 C24
212-018-00	CAPACITOR CERAMIC SMT	10PF	5%	C43-44
212-019-00	CER 150PF 5% 50V SM	150PF	5%	C11 C14
212-025-00	CAP CER .1UF 25V 10% X7R	.1UF	10%	C15-18 C66
212-029-00	CAPACITOR CERAMIC SMT	270PF	5%	C34
220-001-02	CAPACITOR LYTIC RADIAL T&R	22UF	10%	C7 C48-49 C64-65
220-004-02	CAPACITOR LYTIC RADIAL T&R	470UF	10%	C50
220-014-00	CAPACITOR LYTIC RADIAL KS	2.2UF	10%	C2 C19 C26 C28-29 C36 C40
300-003-00	DIODE SIGNAL SMD	DL4148		D1-6 D11-14 D16-25 D27-36 D38-39 D41-42 D44-45 D47-52 D56-57
300-010-00	DIODE SIGNAL SMD	RLS245		D26 D37 D40 D43 D46 D53-55 D58-60
302-009-00	DIODE ZENER SMD	DL5260B		D7 D10
302-010-03	DIODE ZENER SMD	DL5232		D8-9 D15
310-042-00	XSTR NPN MJE15032	MJE15032		Q1
310-043-00	XSTR PNP MJE15033	MJE15033		Q2
311-001-00	X-SISTOR NPN SMD	IMBT4401		Q13 Q22 Q25
311-002-00	X-SISTOR PNP SMD	IMBT4403		Q7-8 Q21 Q24 Q28
311-007-00	TRANSISTOR PNP SMD	2SA1415		Q4 Q9-10 Q20
311-008-00	TRANSISTOR NPN SMD	2SC3645		Q3 Q11-12 Q15
311-009-00	TRANSISTOR PNP SMD	2SA1552		Q6 Q26
311-010-00	TRANSISTOR NPN SMD	2SC4027		Q5 Q27
311-011-00	TRANSISTOR PNP SMD	2SA1740		Q14
311-012-00	TRANSISTOR NPN SMD	2SC4548		Q23
311-019-00	TRANSISTOR PNP SMD	2SB792		Q16-17
311-020-00	TRANSISTOR NPN SMD	2SD814		Q18-19
320-012-00	OPAMP NJM4560M	NJM4560M		U5-6 U8-9
323-002-00	I.C. QUAD COMPARATOR SMD	LM339		U2-4
329-014-00	IC, DEG C TEMP SENSOR	LM35DZ		U1
329-036-03	NJM4200M ANLG MULTR SM	NJM4200		U7
400-143-00	CONN, HDR, 3-PIN, UN-SHROUDED 0 .100			J21-22
400-171-00	CONN, HDR, 2-PIN, UN-SHROUDED, 0 .100			J17-20 J23
400-186-00	CONN HDR 40P .100 X 2 STR SHRD			J10
450-170-00	PCB, M2600 V-AMP & PROTECTION			Z1
550-369-00	BRACKET, L			H1-2
601-008-00	INDUCTOR	10uH		L1-2
712-021-01	RIVET			Z4-7

HOME

055-171-00-01 Rev A Power supply board

Part #	Description	Value		Reference Designator
100-077-00	RES CF .125W 5% 15K OHM	15K	5%	R10-12
123-109-00	RESISTOR MOF	3.3K	5%	R1-8
⚠150-037-00	RESISTOR, FUSABLE, 1/4W	33	5%	R9
200-036-02	CAP, METALIZED POLY, T/R	.1uF	10%	C15-22
211-009-00	CAPACITOR CERAMIC AXIAL	0.1	10%	C23-24
220-006-00	CAPACITOR LYTIC RADIAL	2200UF	10%	C9-12
220-029-00	CAPACITOR LYTIC RADIAL	2200UF	20%	C13-14
220-041-00	CAPACITOR LYTIC RADIAL	15,000uF	20%	C1-8
300-001-00	DIO SIG 1N4148 100V 500MW	1N4148		D19-20
301-009-00	DIODE POWER	1N4004		D1-5 D10-16
301-010-00	DIODE POWER	1N5404		D6-9
301-015-00	DIODE BRIDGE	25A		D17-18
310-007-00	XSTR NPN 2N4401	2N4401		Q1
400-060-00	FUSE CLIP PCMT 5MM DIA			Z1-3 Z5
400-133-00	HEADER, 2X3, MATE-N-LOCK			J6
400-173-00	CONN QUICK DISC .250 W/STABLE-LOK TABS			J3-5
400-231-00	HEADER, 2X5, MATE-N-LOCK			J1-2
450-171-00	PCB, M2600, POWER SUPPLY			Z4
⚠510-026-00	FUSE 5X20	T-3.15A		F1-2

055-172-00-01 Rev A Speaker output board

Part #	Description	Value	Reference Designator
400-138-01	SPEAKONS HORIZ 4 CKT		J2-4
400-173-00	CONN QUICK DISC .250 W/STABLE-LOK TABS		J5-8
400-237-00	CONNECTOR, QUAD BANANA		J1
450-172-00	PCB, M2600, OUTPUT		Z1

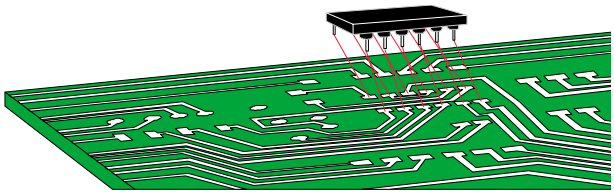
⚠ Components noted with this symbol shall be replaced only by the component specified.This is required to maintain product safety.

HOME

055-186-00 Rev A 15 Volt supply/fan drive board

Part #	Description	Value		Reference Designator
	TEST POINT, PART OF PCB			J1-2
100-031-00	RESISTOR CF	180	5%	R8
100-049-00	RESISTOR CF	1K	5%	R7
100-056-00	RESISTOR CF	2K	5%	R10
100-061-00	RESISTOR CF	3K3	5%	R6
100-066-00	RESISTOR CF	5K1	5%	R2
100-068-00	RES CF .125W 5% 6K2 OHM	6K2	5%	R5
100-069-00	RESISTOR CF	6K8	5%	R4
100-073-00	RESISTOR CF	10K	5%	R9
100-078-00	RESISTOR CF	16K	5%	R3
100-080-00	RESISTOR CF	20K	5%	R13
100-090-00	RES CF .125W 5% 51K OHM	51K	5%	R12
100-097-00	RESISTOR CF	100K	5%	R11
121-081-00	RESISTOR MF	2K2	5%	R14
130-021-00	RESISTOR POT TRIM HORIZ	10KB		R1
211-009-00	CAPACITOR CERAMIC AXIAL	0.1	10%	C3 C5 C7-8
220-001-02	CAPACITOR LYTIC RADIAL T&R	22UF	10%	C2 C4 C9
220-027-02	CAPACITOR LYTIC RADIAL T&R	10UF	10%	C1 C6
300-001-00	DIODE SIGNAL	1N4148		D5-7
301-009-00	DIODE POWER	1N4004		D1-4
310-002-00	TRANSISTOR PNP	2N4403		Q3
310-024-00	TRANSISTOR PNP	2SB817		Q1
310-050-00	TRANSISTOR NPN	2SC1567A		Q2
320-011-00	I.C. LINEAR	NJM 4560		U3
321-001-00	I.C. LINEAR NEG 3 TERM VOLTAGE REGULATOR	LM 7915		U1
321-002-00	I.C. LINEAR POS 3 TERM VOLTAGE REGULATOR	LM 7815		U2
400-078-00	CONNECTOR STR LCK SHRD 10P .100 X 2			J4
400-171-00	CONN, HDR, 2-PIN, UN-SHROUDED, 0 .100			J3
450-186-00	PCB, M2600, +/-15V SUPPLY & FAN DRIVE			Z1
550-369-00	BRACKET, L			H1-2
601-013-00	CHOKE, POWER AXIAL	470uH		L1-2
712-021-01	RIVET			Z4-7

HOME



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M•2600 amplifier modification instructions

Models affected: All M•2600 amplifiers with serial numbers "AU" or those less than DX10017.

Add this mod as part of your normal repair procedures.

Symptom: No signal, dead channel or distorted output.

Possible Cause:

1: Transistor Q5 on the V-amp protection boards may be shorted to an adjacent trace.
2: Transistors Q3 and Q4 on the V-amp protection boards may oscillate under certain conditions, causing V-amp board failure, and/or failure of R57 on Ch.1 amp board and R56 on CH.2 amp board (33Ω fuse).

Solution: Rework **both** V-amp circuit boards (055-170-00) as follows:

1: Replace Q5 with a new transistor and make sure it is postioned further down, away from the trace, **or :** cut two traces and add a jumper wire (to bypass any possiblity of a short).
2: Replace R14, R15, R20 and R21 with new value resistors (to improve the reliability of the final class A stage, comprising of transistors Q1 to Q6 and associated resistors, diodes and caps).

Safety Warning:

Caution! These instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing unless you are qualified to do so. Refer all service to qualified personnel.

Tools Required:

Sharp pointed X-acto knife, Phillips screwdriver, Torx and Allen drivers, needle nose pliers, safety glasses, soldering iron suitable for surface mount work.

Parts Required:

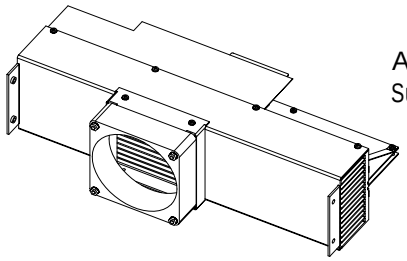
Insulated jumper wire

311-010-00	2SC4027	Transistor, NPN, SMD	Q5
140-057-00	220Ω	Resistor, 0.1W, 5%, Thick film, SMT 0805	R15 and R20
140-084-00	3KΩ	Resistor, 0.1W, 5%, Thick film, SMT 0805	R14 and R21

Procedure: (The following modifications must be performed on **both** V-amp boards)

1/ Remove all cords (including the power cable and speaker outputs) from the amplifier.
2/ Remove the amplifier subassembly from the chassis.
3/ Remove the two V-amp boards (055-170-00) from the amplifier subassembly.
4/ Replace R15 and R20 (from 0Ω to 220Ω).
5/ Replace R14 and R21 (from 2kΩ to 3kΩ).
6/ Follow step A, **or** follow step B, whichever you find easiest.
   A/ If you have a new transistor in stock, replace Q5 and make sure it is positioned further down, so the left leg is fully on its pad and not over the trace. Note: a new transistor is required because unsoldering and repositioning the original transistor will thermal-stress and weaken the part.
   B/ Carefully cut the trace in two places on each board. See the diagram on the second page. The trace should be cut exactly in the locations shown. It is not easy to get to, and you may have to scrape off some of the white silkscreen lines in order to see the trace. Solder a jumper wire in the position shown, on each board.
7/ Reassemble the V-amp boards onto the amplifier subassembly.
8/ Reassemble the amplifier subassembly into the chassis.
9/ Perform a complete specification and safety test. Refer to the service manual for details.

HOME



Amplifier
Subassembly

055-170-00 V-AMP board