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subject

PROCEDURES FOR REPLACEMENT OF POWER TRANSISTOR AND ADJUSTMENT OF POWER AMPLIFIER BIAS AND DC BALANCE

In most cases, the failure of power transistors is accompanied by the failure of associated components as well. This can include driver transistors, bias transistors and resistors. To avoid damage to newly installed parts and loss of additional time, always check the components preceding the power transistors.

After verifying that all circuit components have not been damaged, it will then be necessary to readjust bias and DC balance (offset), in the amplifier. To make these important adjustments, it is necessary to have the following test instruments:

A. DC millivoltmeter capable of reading 5 millivolts DC or a calibrated oscilloscope with DC amplifier capable of such reading.

NOTE: 1. Terminals of meter or scope must be floating above ground, since the points to be measured are at +B or -B potential.

2. If a millivoltmeter or the DC scope are not available, a milliammeter of 200 milliamperes full scale can be used. However, in this case one end of the resistor indicated on Table I, Column 5 must be disconnected and the milliammeter connected in series with the resistor.

B. An AC line wattmeter with a range of 0-150 watts.

C. An AC line voltmeter, for appropriate line voltage.

D. Variable Autotransformer (Variac).

General Bias Adjustment Procedure

Outlined below for your reference, is a simplified common bias adjustment procedure. For specific data about adjustment pots, voltage drops, etc., please refer to the attached table.

NOTE: Do not connect any signal source to the equipment under test. If possible, short the input jack with a shorting plug or similar device.

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A. Connect the unit under test to the variable autotransformer (variac), and the AC line wattmeter. Before applying power set the variac to 0 volts.

B. Slowly advance the control on the variac while observing the AC wattmeter. Many Marantz components incorporate special time-delay circuitry to prevent transient surges to the loudspeakers when power is applied. You will note this when slowly advancing the variac as the unit under test will show a "jump" in line consumption (or a relay will actuate), when a certain minimum input voltage is reached. All adjustments are performed at 120 volts or 220 volts, or 240 volts AC input, whichever is appropriate.

   The wattmeter should never indicate a reading beyond the rated idle power consumption of the unit under test. If it does, and cannot be adjusted by following steps D and E, shut the unit off and recheck circuitry for malfunctions.

C. Connect the millivoltmeter or oscilloscope across the appropriate emitter resistor indicated on Column 5 of Table I, on one channel or connect the milliammeter in series with the resistor.

D. Adjust the bias pot* until the proper voltage drop* or bias current* is obtained.

E. Repeat steps D and E for the remaining channel.

Alternate Procedure For Setting Up The DC Bias

For Models 15, 16, and 16B where idle power consumption can be measured independently for each channel, sometimes it is more convenient to adjust the proper bias by measuring the idle power consumption of the unit and adjusting the bias so that the consumption reaches the value indicated in Column I of Table I.

For the units which combine the two power amplifiers from a single power supply, this procedure cannot be adhered to, but nevertheless, after the bias has been adjusted by the procedure given previously, the total power consumption of the unit must be checked against the figure given in Column I, Table I.

*SEE DATA TABLE

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DC Balance Adjustment Procedure

A. Do not connect any signal source to the equipment under test. If possible, short the input jack with a shorting plug or similar device.

B. Connect the millivoltmeter across the speaker output terminal of one channel.

C. Apply power to the unit under test. The millivoltmeter should indicate 0 volts DC. If not, adjust the DC balance pot* until you obtain a reading of 5 millivolts or less.

D. Connect the millivoltmeter across the remaining speaker output termainals and repeat step three.

*SEE DATA TABLE

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When removing power transistors in all Marantz components for replacement or tests, always observe the following procedures. This will insure maximum reliability and performance from the instrument:

A. The power transistor mounting surface must be cleaned of any foreign matter. This especially includes solder splashes and other materials that could cause a short against the heatsink edges. Also check for metal burrs and if there are any, remove them carefully.

B. To prevent shorts against the heatsinks, be sure that the transistor pin terminals are straight.

C. For proper heat conduction, always apply a thin coat of THERMAL COMPOUND to the surface of the transistor facing the heatsink. We recommend Wakefield Thermal Compound #1281 manufactured by Wakefield Engineering, Inc., a division of Delta, (or use an equivalent).

D. After applying the compound, install a MICA INSULATOR directly on the transistor mounting surface, over the compound. Make sure the MICA INSULATOR is free of foreign matter and then apply another thin coat of THERMAL COMPOUND on the MICA INSULATOR. The end result should be a sandwich consisting of the transistor, thermal compound, mica insulator and more thermal compound.

E. Carefully reinstall power transistors and be sure that the pin terminals are not touching the heatsink. Fasten both mounting screws tightly, (do not overtighten them), and be certain the transistors lie evenly against the heatsink (this is important for good heat dissipation). Also, verify that the transistor being replaced is the correct one. In many cases, you will encounter circuitry where both PNP and NPN types are in use, e.g., in a complementary symmetry configuration. Be sure that the part number on the transistor is correct.

Bias & DC Balance Table

Model	Idle Power Consumption (Watts)	Bias Current (mA)	Bias Voltage (mv)	Read Voltage Drop Across	Bias Adjust. Pot.	DC Balance Adjustment Pot
15	30/Channel	170	80	R 27 0.47 Ohm	R 30	R 19
16, 16B	35/Channel	100/trans.	15	R 30 & R 26 0.15 Ohm	R 20	R 8
18	65	170	80	CH 1-R 34 0.47 Ohm CH 2-R 42 0.47 Ohm	CH 1-R 26 CH 2-R 27	CH 1-R 1016 CH 2-R 1016
22	25	50	10	CH 1-R 651 0.2 Ohm CH 2-R 654 0.2 Ohm	CH 1-R 961 CH 2-R 962	CH 1-R 615 CH 2-R 616
25	15	29	7	CH 1-R 550 0.24 Ohm CH 2-R 547 0.24 Ohm	CH 1-R 552 CH 2-R 551	CH 1-R 510 CH 2-R 509
26	9	21	5	CH 1-R 450 0.24 Ohm CH 2-R 447 0.24 Ohm	CH 1-R 458 CH 2-R 457	CH 1-R 456 CH 2-R 455
27	15	29	7	CH 1-R 550 0.24 Ohm CH 2-R 547 0.24 Ohm	CH 1-R 552 CH 2-R 551	CH 1-R 510 CH 2-R 509
28	8	21	5	CH 1-R 450 0.24 Ohm CH 2-R 447 0. 24 Ohm	CH 1-R 458 CH 2-R 457	CH 1-R 456 CH 2-R 455