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Mackie SWA 1801 Service Notes

After a recent failure on a Mackie SWA 1801, I thought I'd share a number of common ailments that occur when the Power Amp fails..

In-rush Current Limit resistor R2 usually burns open before the HV power supply fuses F1 & F4 (10A) can react., as well as the AC mains fuse on this same AC Mains PCB Assy F1 (T8A). Maybe the fault current causes the relay to open (P/S sag), and the resistor becomes the fuse. Once it's burned open, nothing powers up again.

On this same PCB, invariably I find radial solder joint fractures on the IEC 320 AC mains connector...usually on all three solder contacts. Same goes with the Transformer Primary connector in use (whether 120V or 240V). De-soldering and re-soldering these is the proper solution...not just applying more solder.

Often the leads of R2 (22 ohm 20W) of this large cement filled bathtub WW resistor have snapped off, unless it had been glued down. I add a small film of RTV when installing replacement resistor, and fold over the leads prior to good soldering. It's only in circuit until the relay REL1 closes. I also find solder fractures on that relay. ALL the AC Mains current is flowing thru that, so it's a critical connection for the system.

Also on the AC Mains board is J4, a tiny 2-pin connector, usually gooped with RTV to hold the heavy cable in place. It provides the power for the AC Mains Relay, and has been responsible for abrupt output disruptions of the system from vibration if the solder joints and/or connection from the power amp board isn't secure. A critical weak link in the system. I've been hoodwinked by that connection before, when everything ran proper until restoring the power panel to the cabinet. Then, high level 'barking' on peak bass transients would occur.

The amplifier is very similar to the SWA 1501, except it has bipolar switched HV rails and no MosFET's returning the woofer output current back thru ground to the HV supply. Here, the SWA 1801 switches on the appropriate HV supply when signal dictates voltage swing needs to go above the +/- 18V rails. Its' MosFET's Q6 & Q14 are carrying the higher signal peak voltages of the HV power supply thru 10A Fuses F1 & F4 to feed the output stage Q4, Q5, Q15 & Q16.

I rarely find those fuses blown, BUT I often find the fuse clips broken or too weak to keep a fuse in place. Replacing them is a PITA, as so much heat is needed to suck out all the solder in the plated-thru holes. I live by a well-maintained Pace Desoldering System, and in heavy copper areas, add additional heat with a wide tip on the soldering iron to extract the old solder. Those clips MUST be solid, as all your output current is flowing thru them and the fuses installed. Schruder P/N is 0751-0099

When the power panel has failed, it's not uncommon to find MosFET's Q6 & Q14 shorted, Output Xstrs Q4, Q5, Q15 & Q16 shorted, driver Xstrs Q3 & Q18 shorted, with their emitter resistors R8 & R56 burned to cinders along with R7 & R57 at the ends of the cascode stage. And, often the circuit traces between Q3 & Q18 collectors and the bias path burned open or overheated and dysfunctional. Removal of the failed PCB copper traces and installation of insulated wiring req'd to restore order

The last three I worked on also had bulging HV power supply caps, where more than one of the buss caps had failed. Getting those off the PCB without damaging the board is

challenging, as they have been glued down with just gobs and gobs of glue. And, more fun extracting all the solder out of their PCB pads & plate-thru's in the process.

I've changed to MJL21193 (PNP) and MJL21194 (NPN) from the 2SA1943 & 2SC5200, as they have better SOA and current capacity.

In the HV power supply area, it's not uncommon to find the 1/2 W zeners D3, D30 (1N5245) and 1W zeners D2 & D38 shorted, and resistors R1 (2.2k 5W) & R65 (3.3k 5W) open and having applied enough heat to the PCB over time for the board to be discolored. There's always current flowing thru these 5W resistors, and yes, they're always hot to the touch. Filter caps C3 & C34 (100uF/25V) are sometimes bad. I use 105 deg C rated caps for them, usually higher voltage as well for higher charge current rating & lower Z). You also want to check the gate resistors R3, R64, bias resistors R2 & R63 and the high current clamp diodes D4, D32 and the remainder of the high speed diodes D5, D11, D30 & D37 & steering diodes D10 & D33. I've never seen those large axial lead diodes fail, but always good to check. I have had broken leads on D4 or D32 occur while getting the PCB up off the power plate before.

The opto-isolated gate driver IC HCPL-3100 rarely fails. But, it's a critical part to the HV supply, and there are no direct replacements. I find them on ebay from IC sources in Asia from time to time. It's a discontinued part, so at some point, all the Mackie SWA 1501's, 1801's, SA1232's and SA1532's will be in the bone yard for lack of this part. It's a good system, though a bit thin in the area of having enough silicone in the power path to withstand the current demands of loudspeaker system in use.

The special caps Mackie had made to order C1 & C3 have four leads on them....and all the HV power supply current is flowing thru the leads on the fuse side of the caps. I've found one with a broken lead before, but was able to recover, as there was enough 'stubble' underneath on the cap to wrap in a new lead and re-install them.

The insulator material between the aluminum heat spreaders and the heat sink of the power plate is another headache. Thermoset takes place between the power semiconductors and the material, so when you have gotten all the hardware off the power plate, the power devices are still 'glued' into place from this long-term action, and the insulation usually peels away, still adhered to the heat spreader of the devices. You can't just install new devices and tighten them down now. You no longer have full insulation.

I usually install cut-to-fit Bergquist K10 insulator material or greased mica, after cleaning off the original material. I haven't identified who the mfg is of that green thermal insulator compound. Using greased mica, you have to be sure to align the holes with that of the xstrs.

In this system, the front end signal processing board gets its' supply voltage from the bipolar 18V supplies. I have had failures on the bipolar 12V supply on that board. The MUTE signal comes from it, so I normally power up the LF amp without the HV fuses F1 & F4 in place, the connector J1 unplugged, and a jumper across R2 on the AC Mains PCB so I can bring up the power amp on the variac, watching the AC Power Analyzer for any fault current, monitoring output of the amp at J4-1 (or D11, D30), while watching LED's D9 & D12. Usually both these LED's will come on at the same time. If not, there will be a DC offset at J4-1, but no fault current (unless I missed something). Normally, by the time I'm up to 80VAC or greater, both LED's are lit, the power relay has clicked in, and there's little to no DC level offset at the output.

If I had any failures on the signal processing board, I normally power it up from an external bipolar supply during surgery. Once cured, it goes back onto the power panel, and I can plug it back in. I verify I have a functional amplifier before I ever couple in the HV supplies. Prior to doing that, I've powered down and then discharged the HV supplies before ever installing the fuses F1 & F4.

When powering the complete system back up, still having the in-rush resistor R2 bypassed, I have scope probes on the steering diodes D10 & D33, which allows me to watch the voltages come up to their idle point at around +/- 18V. For AC signal, I use pink noise passing thru a 1/3 oct. filter, usually 80Hz to start. The random pink noise thru the LF 1/3 oct filter produces variable amplitude sine waves, that can vary in magnitude over 10dB from min to max, so it's a very useful test signal for observing the switched behavior of the HV system. My main output is monitored on the scope along with the positive and negative peaks, coming from +/- 95VDC. If all is well, the baseline of the HV system remains at +/- 18V, and ONLY the signal peaks pass on up to the supply limits. Once I have that, I'll connect a known working 4 ohm woofer, and run it. If the woofer in the SWA 1801 has been verified to be functional, I'll then connect it. 40Hz & 50Hz 1/3 oct pink will produce thunderous acoustic level if all is well.

At that point, I'll power down, remove the clip lead around R2 on the AC Mains board, and check the system powers up and down reliably, and then burn in the amp under drive, usually at 50Hz or 63Hz. Shakes the walls in the shop for sure.