

Improving Final RF Transistor Heat Dissipation In the Ameritron ALS-1300 Linear Amplifier

Prepared by Rick Williams, VE7TK

(Note: Those undertaking this modification do so at their own risk. The procedures outline how to disassemble the Ameritron ALS-1300 linear amplifier and, following a procedure outlined by W8JI, improve heatsink contact with the power amplifier MRF-150 final transistors.

This procedure has not been approved by Ameritron/MFJ or any of its staff.)

Under no circumstances will the author be liable for any damage to your amateur radio equipment resulting from this modification.

How it Started

In late 2020 I acquired a lightly used Ameritron ALS-1300 linear amplifier. Shortly after installing the amplifier I joined the **Ameritron Amplifier USERS Group** on Facebook. About the same time Tom, W8JI, posted a video pointing out a “field failure” problem in several Ameritron solid state amplifiers, including the ALS-1300.

<https://www.youtube.com/watch?app=desktop&v=IbUKb9LAoUw&feature=youtu.be>

Tom’s video points out some less than stellar PC board construction techniques on the final amplifier boards and *poor* mating surface where the RF MOSFETS attach to the final heatsinks. This excellent video describes the necessary work required to improve the heatsink contact surface and clean up the final amplifier boards.

Since I occasionally operate high duty cycle digital modes I thought that it might be prudent to undertake this modification. Unfortunately, there was no information readily available on how to dismantle the ALS-1300 and get down to the offending heatsinks. What follows is a description of how I got there. As they say, your mileage may vary!

In the Beginning

Before I started digging into the amp I looked on-line for information on the layout of the unit. I found a very valuable source at the FCC. They had a website with a complete breakdown of the ALS-1300. Many of the photos that follow are from this documentation.

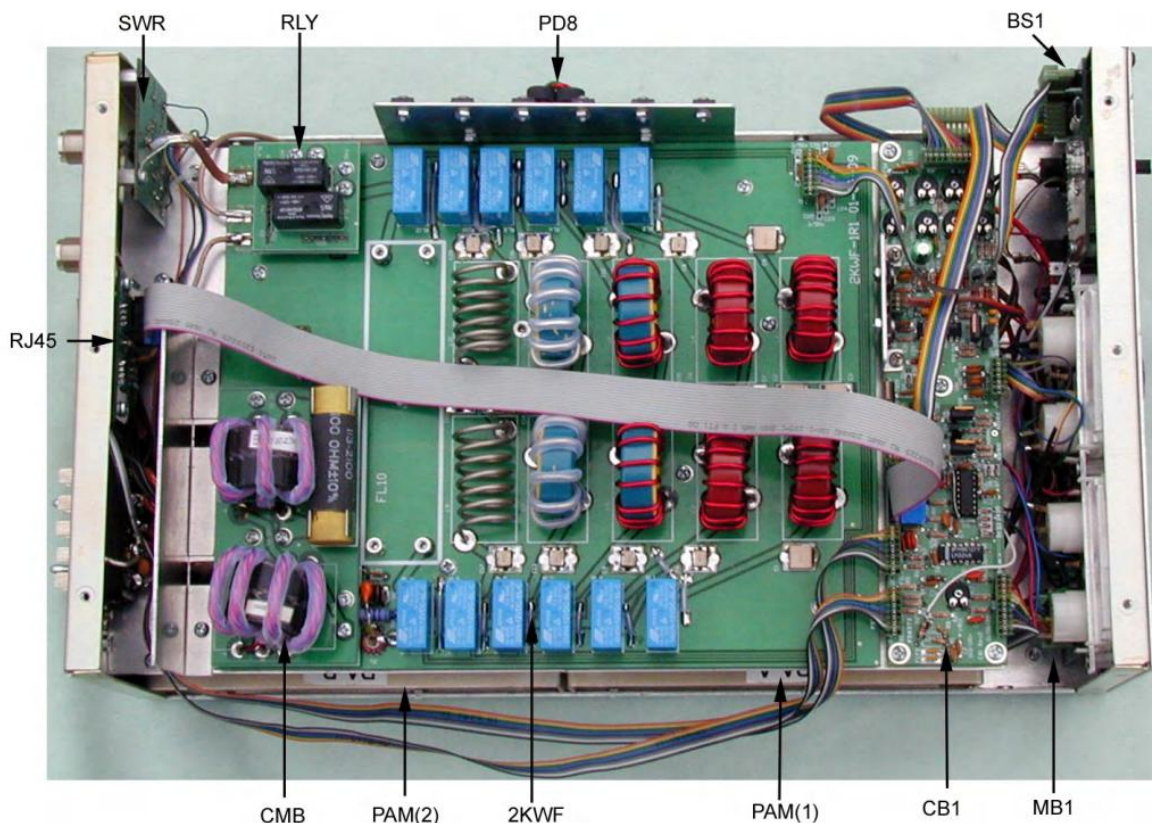
<https://fccid.io/HO82WUALS13/Internal-Photos/internal-photos-1081915.pdf>

Additional excellent photos of the ALS-1300 taken by NG7M can be found at:

<http://www.nc7j.com/pa/main.php?cmd=album&var1=NG7M%2FAmeritron%2FALS-1300%2FPreMod+Pictures/>

However, a word of warning, before I go further. This modification to the heatsinks requires an almost complete teardown of the amplifier. It is not for the faint of heart.

When the ALS-1300 cover is removed you can see the layered structure of the unit. The top layer is dominated by the **2KWF6** filter board. Plugging into the filter board is the transmit/receive relay (**RLY**) board and combiner (**CMB**) board.

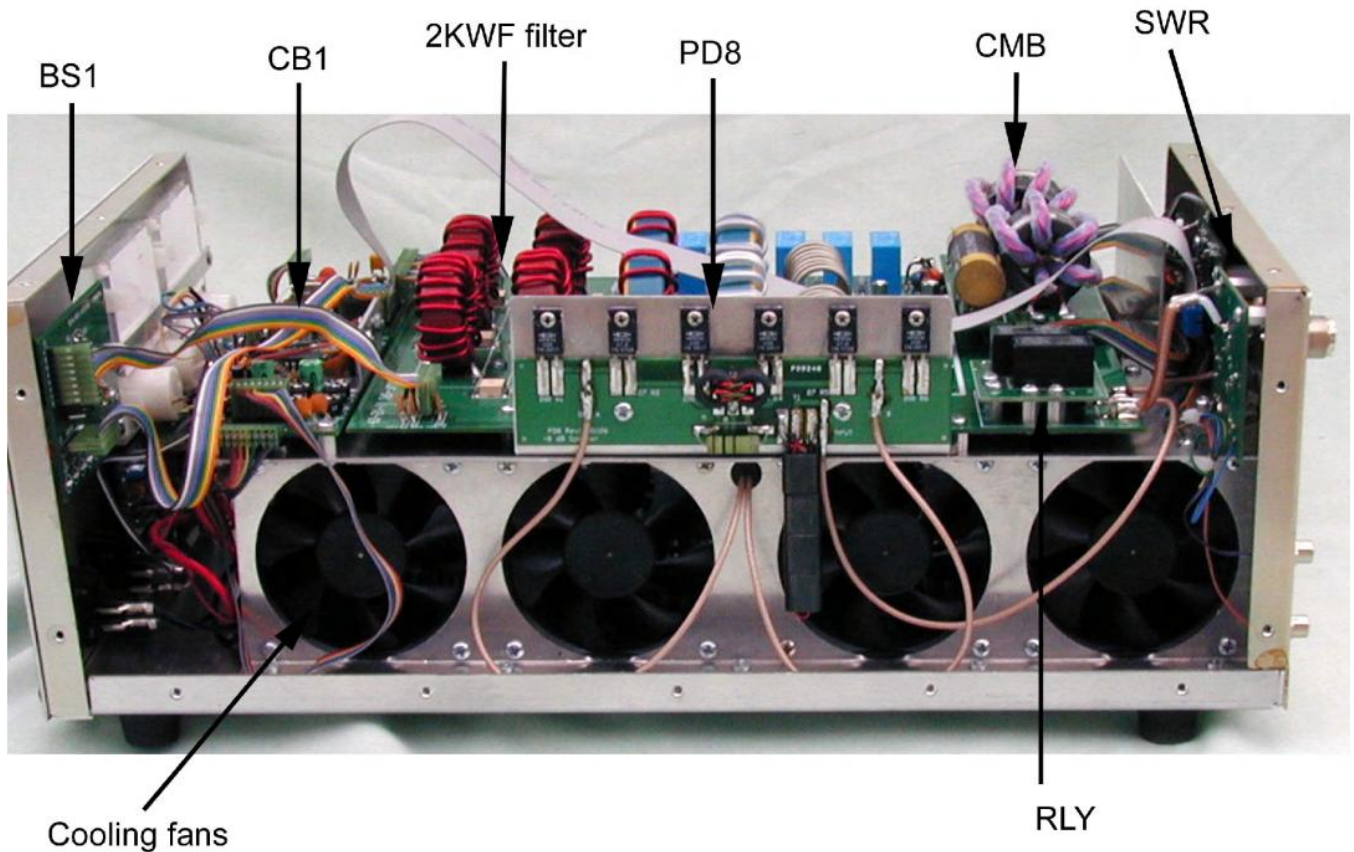


Source: FCC

On the rear panel are the **SWR** and **RJ45** boards along with the RF input and the power connectors. In front to the filter board is the control board (**CB1**). On the front panel are the bandswitch (**BS1**) and metering (**MB1**) boards.

Below this layer the power splitter (**PD8**) board attaches to the shield separating the filter board from the power amplifiers. Finally below this shield are housed the power amplifier (**PA-A** and **PA-B**) boards (labelled **PAM(1)** and **PAM(2)** above).

Here is a view of the construction of the amp from the fan intake side.

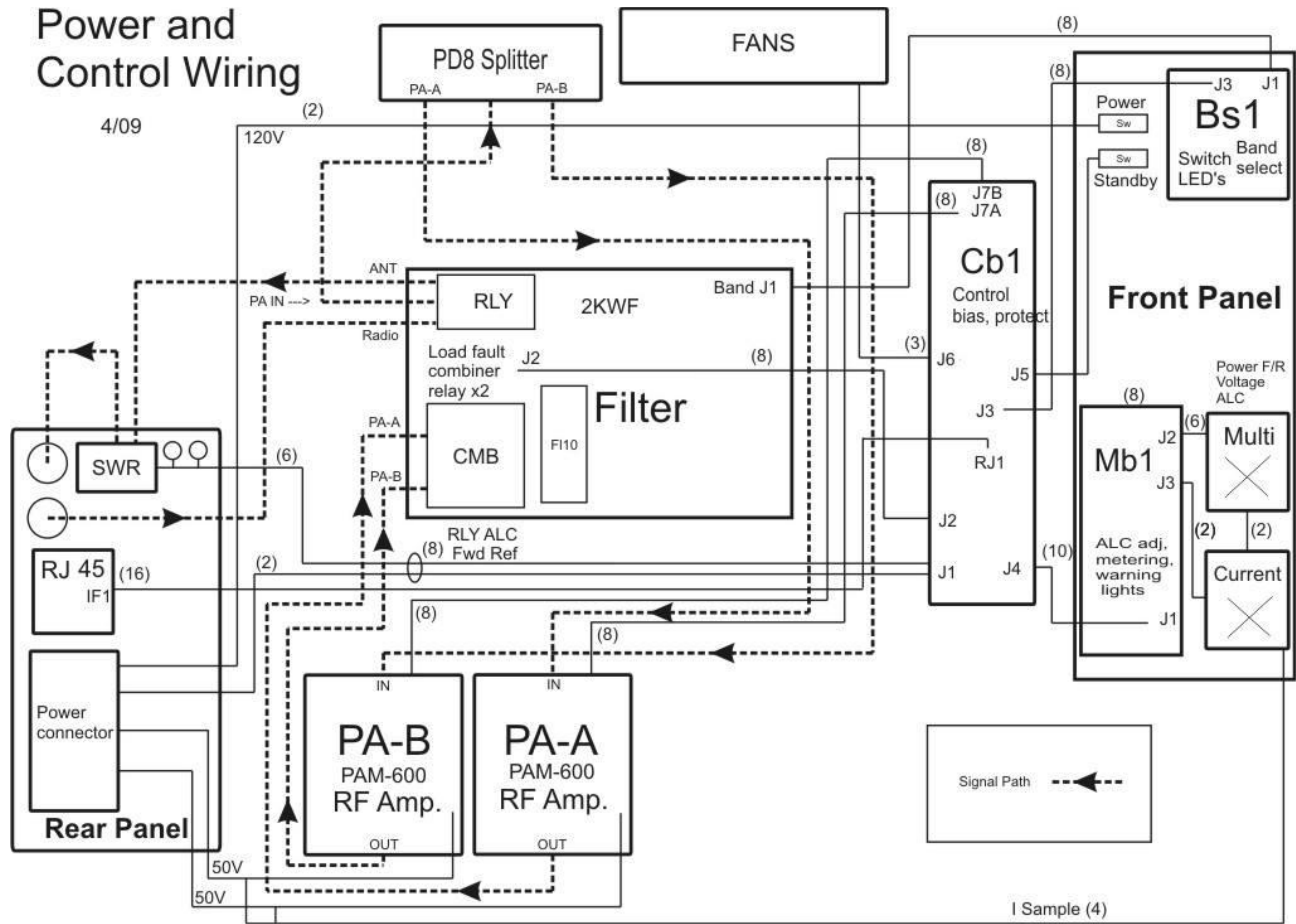


Source: FCC

Connectors

There are LOTS of connectors and virtually all of the cables are **unlabelled!** Take lots of pictures and/or add labels to each cable as you unplug them. My system was to use the board and jack number on that board. For example on the control board there would be cables **CB-J7A** and **CB-J7B**. In most cases I'd use masking tape and/or write on the connector itself.

The **Power and Control Wiring** diagram for the ALS-1300 is shown below.



Source: <https://radioaficion.com/mods/ameritron-als-1300-review/>

The Tear Down

I began with the removal of the **RLY** board. I kept each board and any screws removed in its own anti-static bag. The RLY board is attached with 4 screws and plugs into the filter board.



Source: Source: NG7M at <http://www.nc7j.com/>

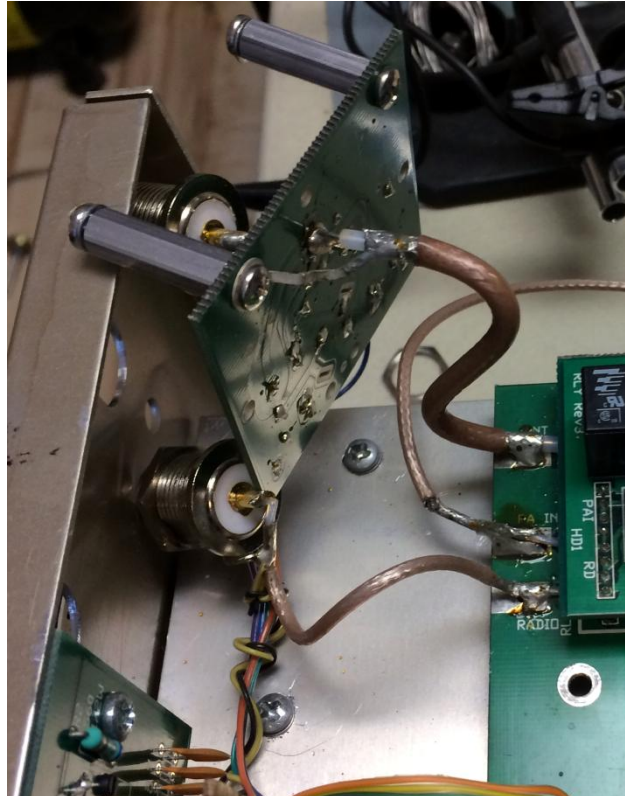
Next I removed the **CMB** board. Again it is screwed in place with no additional connectors.



Source: worldwidedx.com

Continuing at the rear of the amplifier I removed the 2 nuts from the RF input and RF output SO-239 connectors. Remove the 2 screws holding the SWR board to the rear of the cabinet and carefully remove the RF Output Connector/SWR board through the rear chassis while it is still attached the filter board.

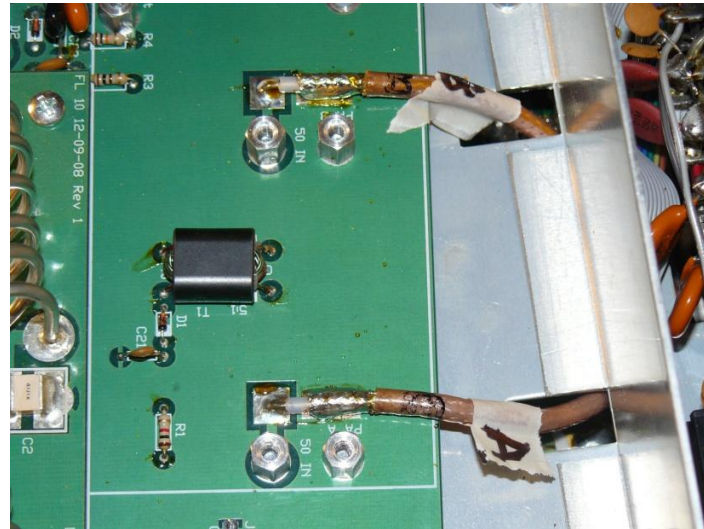
Loosen but do not remove the RJ45 board screws at the rear of the amp. This should give you enough room to remove the RF input connector while it too remains attached to the filter board.



Source: NG7M at <http://www.nc7j.com/>

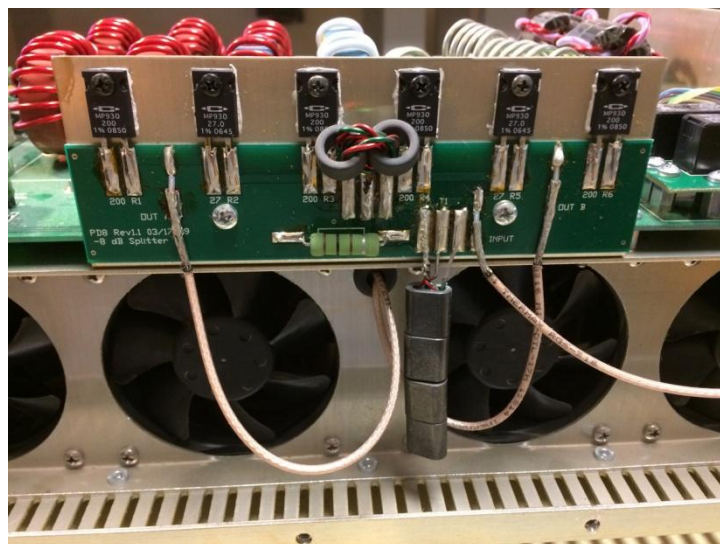
Next I removed all the **very well labelled** cables from the connectors on the control (**CB**) board. Be particularly careful with the ribbon cable connected to **RJ1**. This connector is similar to an IC socket connection and the pins are quite fragile. Remove the board and place it with all the appropriate screws in an anti-static bag.

Returning to the rear of the amp label and then unsolder the pair of RG-142 coaxes connecting the Power Amps (**PA-A** and **PA-B**) to the filter board. Use a little solder wick or a solder sucker to clean the hole in the filter board where the centre conductor was connected. This will make reassembly easier. (Note: This was the **ONLY** desoldering I found necessary.)



Source: VE7TK

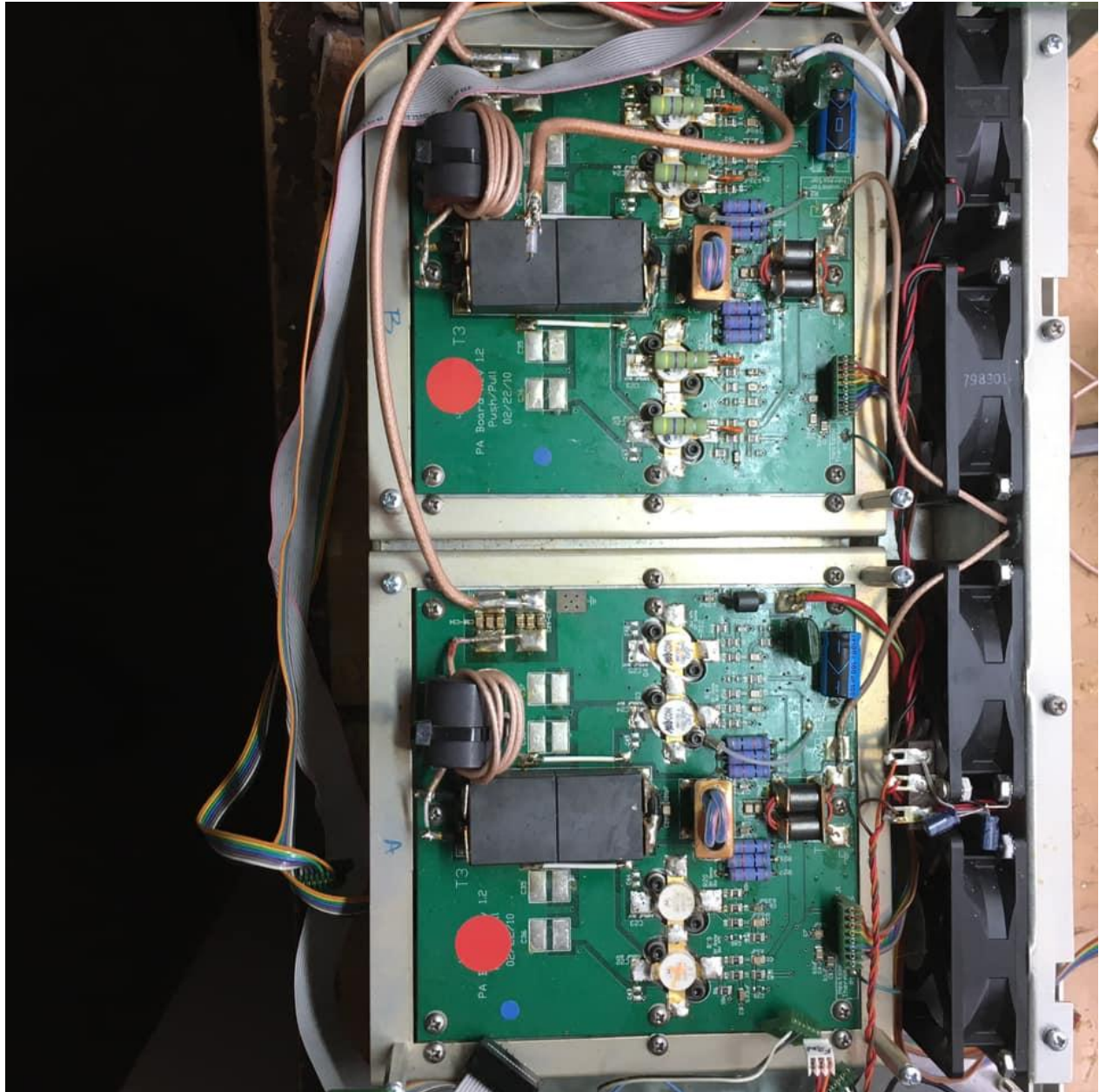
Remove **ALL** the screws holding the filter board in place. At this point (I think) the filter board can be removed. (Bag the screws and keep them with the filter board.) Next remove the screws attaching the power divider board (**PD8**) to the large aluminum shield. With the screws removed let the PD8 board fall to the side of the amp suspended by the 3 coax leads.



Source: NG7M at <http://www.nc7j.com/>

The large aluminum shield can now be removed. In addition to the screws holding it to the various stand-offs above the PA boards and fan support rail, there are 3 screws on the rear of the amp near the power plug that must be removed. Remove the shield being careful not to pull too harshly on the coax feeds to the amplifiers below. At this point it would be prudent to note the orientation of the RG-142 coax feeds from each amplifier where they pass through the shield. Paying attention to how they are folded and stored near the back panel of the amplifier.

The Cleanup

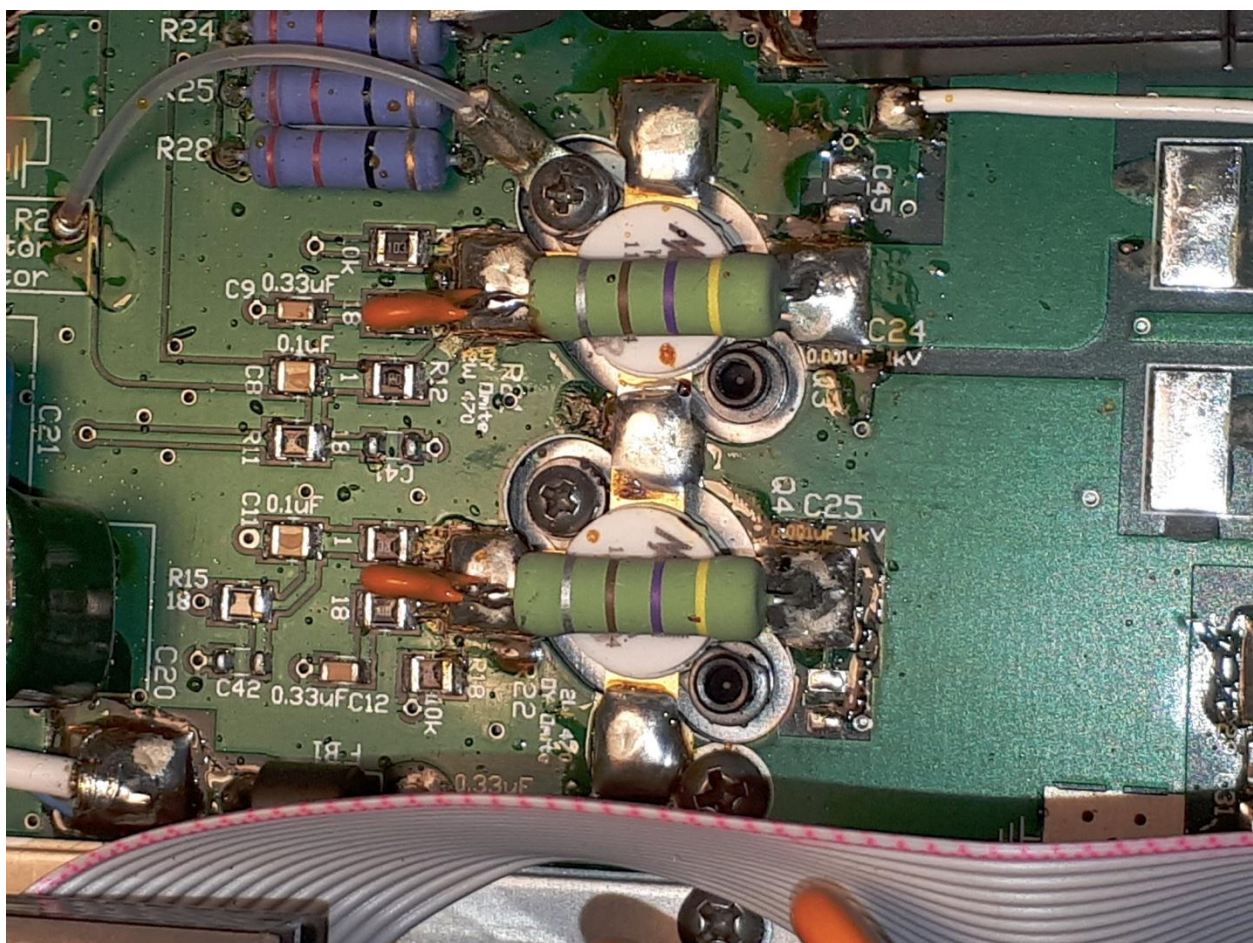


(Source: Ameritron Facebook Group, shows PA-A final transistors under repair -- Jason Harvey.)

Removal of the aluminium shield exposes the two identical 600 watt final amplifier boards. Each board is attached to its respective heatsink with 8 screws around the perimeter AND 8 screws, 2 per MRF150 TMOS-FET.

In addition, each board has pair of PT103-J2 thermistors. One is visible on the top side of the board and is connected to the tab of one of the innermost FETs. The 2nd thermistor is soldered to the PA board near **J1** and labelled at the lower right (near the fans) in the photo above is attached to the heatsink itself.

Up until this point my visual inspection of all the PC boards had been very positive. The boards had been neatly soldered and clean. At this point however I was greeted with a pair of very dirty PA boards. Each board was covered in flux and flux splashes!



Source: VE7TK

Before removing the boards from the heatsinks I gave them a thorough cleaning. The first pass was with a commercial flux remover and a tooth brush. This softened the coating. In some places it required a 2nd spray and brushing. Next I removed the remaining residue with 70% rubbing alcohol and cotton swabs from the XYLs makeup drawer. The final inspection removed any traces of cotton attached to components. (Luckily for me the underside of the boards was clean!)

PA Board Removal from Heat Sinks

I suggest that you remove the power amps one at a time. That is, clean and prepare the bottom side of the TMOS FETs and heatsink one at a time. This way if you are unsure on how to reassemble the PA and/or FETs you will have an example to work from.

To remove the PA undo the 8 screws that are located around the edge of the board. Next remove the eight 3/32 inch hex screws holding the FETs. (Alternatively, these screws may have been replaced with Phillips head 4-40 stainless steel screws.)

CAREFULLY note that each screw has a **pair of Bellville washers** and a thicker washer with a flat side (as seen below). On my ALS-1300 each of the thermistors attached to a FET had a second thick washer above the lug containing the thermistor.



Source: VE7TK

At this point the PA board should be free from the heatsink. When you raise the PC board you will see an approximately ½ inch diameter spacer sitting on the heatsink where each of the 8 screws located around the edge of the board attached to the heatsink.

There are two ways to proceed.

1. If you plan to prepare the heatsink in situ you can gently “roll” the PA board over the fan rail and continue.
2. If you prefer to completely remove the heatsink and work on it separately **you MUST unsolder the heatsink thermistor** from the PC board. This connection is labelled at the upper right of the PA board near the fans.

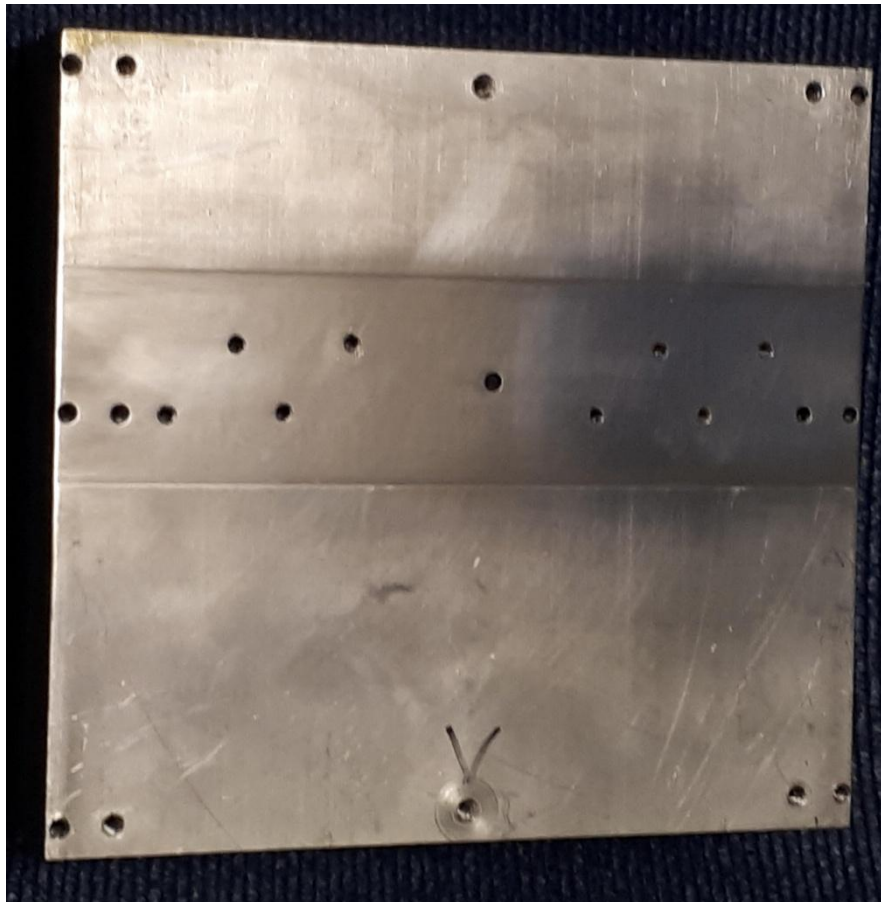
I tried both options and inadvertently destroyed a thermistor in the process. (I feel that with adequate precautions the cleaning and polishing can be done without removing the heatsink from the amplifier.)

As was demonstrated in the video prepared by Tom, W8JI, I found the thermal compound on the transistors to be runny and unevenly applied. Below is a photo from Tom's video.



Source: Ameritron Facebook Group, W8JI

Following the instructions given in the video I lightly buffed the channel of the heatsink where the MFR-150 FETs mount with 2000 grit wet/dry paper. I followed that with final touch-up polishing with some rubbing compound and countersunk the FET screw holes. I cleaned up the surface of the heatsink with water followed by a good scub with rubbing alcohol. In addition I blew zero-residue cleaner into the transistor mounting holes to ensure they were clear of any foreign material. Here's the final result.



Source: VE7TK

The underside of the final transistors were cleaned with rubbing alcohol and a thin coat of fresh thermal compound was applied.

Reassembly, as they say, was in the reverse order. Here are a few hints:

- When positioning the spacers on the heatsink a dab of thermal compound keeps them from sliding around.
- When applying thermal compound to the MRF-150 FETs, remember, a thin uniform coat is all that's needed.
- DO NOT over tighten the FET mounting screws. (Steel screws can easily strip the threads in the aluminium heatsink.) Tom, W8JI, has suggested that "the Belleville washers compress when you snug to about 3-4 inch-lbs."
- At each stage of the reassembly be sure to have ALL plugs attached and correctly oriented.
- Don't forget to solder the RG-142 cables to the correct pads on the filter board.

Finally, an almost complete parts list for the ALS-1300 can be found on-line at the link below.

http://radioaficion.com/mods/wp-content/uploads/2011/04/ALS-1300_Parts-and-tune-up.pdf

Good luck.

73, Rick
VE7TK

Website: <http://www.ve7tk.ca>

Acknowledgements:

Many thanks to Tom Rauch, W8JI, for his great video and for his assistance on a couple of occasions when I backed myself into a corner while undertaking this mod.