REVISED MAY 2022

MS22B **MS23B**



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Some History

Many years ago there was a British company called World Audio Design or WAD who manufactured various amplifiers as kits for home construction. Unfortunately they ceased trading leaving a legacy of many happy customers with high performance products using the highest quality components. The pricing was very good considering how much one has to pay for similar high end equipment today, maybe they under-priced themselves but their disappearance has been sadly lamented to this day. Then came the age of relatively cheap Chinese valve amplifiers, not just offering good performance, but they looked good too. Compare the following photographs of a WAD amplifier and a Yaqin MC10L and you will see for yourself.





Because their kits were no longer available, the Author built a copy of the WAD Phono Amplifier into a small die-cast box and this performed really well. Many solid state designs were tried later, some using the latest operational amplifiers but none came anywhere near to the quality of this simple little RIAA box.



The Author was keen to obtain and evaluate the Yaqin MS22B and one came his way as part of an amplifier deal. When he replaced his home made effort with this lovely looking piece of kit, he was very disappointed at the sound it produced. Visitors would plead with him to take it out of circuit and put his amp back into operation, was it that bad? Yes it really was!

So rather than put this amplifier away in a cupboard until its innards dried out, he decided to take a look at the circuit board with the idea of transplanting the WAD circuit into the much nicer looking enclosure. The WAD circuit uses three valves (called Tubes or Lamps in some other countries) yet the Yaqin only used two with a transistor acting as a buffer. Buffer? It is a name given to a stage that is designed to stop the effects of a following stage affecting the performance of the previous stage and also be able to drive external cables with minimum losses. A crude analogy would be using an oven glove as a buffer so you can pick up hot things without affecting your hand. Hope that is a bit clearer ☺ Anyway, Yaqin feed their RIAA circuitry from the same buffer circuit output that also feeds the signal to the output sockets. In theory therefor, different loading conditions could possibly affect the RIAA operation? Ideally the buffer should only feed signals out to the following amplifier and nowhere else and as stated, one of its properties is to be able to drive into the loads presented by the following equipment. Well the WAD circuit did not like the transistor at all, as expected the RIAA

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curves were all over the place so a MOSFET transistor was tried and it worked well but not as good as a third valve. So even though it means more effort in making a hole for a third valve, it is a worthwhile improvement and the only way to go, recommended by the author.

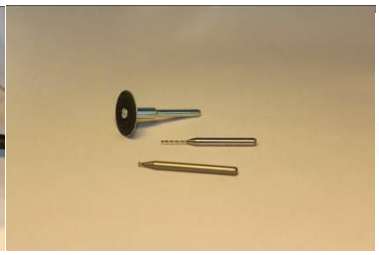
Are you experienced?

You may feel that the following work is too much for you but take heart, there are others who have successfully done the conversion despite little knowledge of electronics or soldering. Soldering is a skill but it can easily be mastered by practicing on old circuit boards and there are plenty of internet sites that show how to solder, cleanliness is the key, make sure your iron tip is clean and well tinned. Avoid using lead free solder, get a small reel of 60/40 leaded flux solder and you will make good joints.

Tools

Apart from the usual screwdrivers, cutters and pliers, a Dremel with some attachments will be found most useful, the drill bit being a 0.8mm PCB drill. The author prefers to use a speed controllable hand drill for drilling the PCB holes and also for cutting the tube holder mounting hole, a stepped cone cutter makes short work of cutting this.






Some solder wick to remove unwanted solder from the circuit board is also required along with some heat shrink tubing to cover component leads and the third valve terminals. If you don't have a heat gun then being nifty with a cigarette lighter can give good results ☺. Also some fine abrasive paper or a fibre glass pen to clean away the Green solder resist from the track ready for soldering. A Multimeter for pre-switch-on and safety checks and above all, be prepared to take your time to produce a good job. The task looks daunting, but not if you take your time and re-check your work as you go. The rewards are most significant!

The Author is indebted to Juha Järvelä and Mark Kerr for their contributions of other tweaks to the design and the supply of excellent photographs to complement and even better his own.

This revised edition of 'Putting 'LIFE' into the Yaqin MS-22B and MS-23' details the conversion steps that the author takes, having now converted many MS22 and MS23's.

Video construction on YouTube.

CHECK OUT THIS FANTASTIC VIDEO PRODUCED BY ZONE1242 ON YouTube!
https://youtu.be/eSt5KbBcDEo

The following Part numbers are a guide only; the suppliers constantly delete from their stocks or change them. Electronic components you will need may also be bought cheaper from other sources like eBay. RS Part Numbers are given so you can find data on them and perhaps order from elsewhere to avoid having to buy more than you actually require.

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Conversion Parts List.

Qty.	Ref.	Description	UK supplier RS COMPONENTS	US supplier ALLIED*	MOUSER (Nearest Equivalent)
2	C2 & C9	100nF 400V Capacitor	755-4472	70188308	647-QXK2G104KTP
2	RAA & RBA	1k 0.25W Resistor (chosen for small size)	135-847	70063029	279-YR1B1KOCC
2	R2 & R13	1k2 1W Resistor	214-1153	70205469	71-CMF201K2000JNR6
4	R5,R16,RAH & RBH	1M 0.25W Resistor	136-058	70239138	279-CFR16J1M0
2	RAB & RBB	316k 1% 0.25W Resistor	683-3528	70289086	603-MFR-25FBF52-316K
2	RAC & RBC	39k2 1% 0.25W Resistor	754-5673	70289087	71-CMF5039K200FHEB
4	R6,R17,RAJ & RBJ	330k 1W Resistor	214-1478	70063546	279-ROX1SJ330K
2	RAE &RBE	180k 1% 0.25W Resistor or 165k**	149-048	70063378	279-LR1F180K
2	R7 & R18	150k 1% 1W Resistor	214-1434	70121819	279-ROX1SJ150K
2	RAD & RBD	2k2 1W Resistor	214-1181	70121809	71-CPF12.2K2%T1
3	R3 & R15	120k 1W Resistor	214-1412	70063514	294-120K-RC
1	R25	100k 1W only needed with single LED	199-5060	70205420	279-RR01J100KTB
2	RAF & RBF	75k 0.25W Resistor	148-944	70183661	279-LR1F75K
2	RAG & RBG	18k 0.25W Resistor	683-2755	70063379	279-H4P18KFCA
1	D1	1N4007 Diode (For heater voltage lift)	628-9546	70015973	512-1N4007
2	R10 & R21	1k 0.25W Resistor (For RCA outputs)	707-8669	70122738	279-YR1B1KOCC
2	C15 & C16	68uF 350V Radial Electrolytic Capacitor. **Height important: 25mm Max.**	144-3974	No Part	647-UCS2V680MHD
2	C5 & C13	8200pF 1% Silver Mica	495-947	70639198	598-CD30FD822FO3F
2	C3 & C10	200pF 1% Silver Mica 250V	744-1546	No Part	598-CD15FD201FO3F
2	C4 & C12	3.3uF Poly Capacitor, audio grade, 450V	CRICKLEWOOD CPW3u3		Alternative Audyn Q4 Film Capacitor MKP 3.30 uF /400 V 5%
1 off – For the extra Valve V3, a B9A skirted Valve Holder with screening can e.g. CRICKLEWOOD B9AS http://www.cricklewoodelectronics.com/product.php?productid=18321&cat=23&page=1					

***Name changed to Allied Electronics & Automation. https://www.alliedelec.com/**
****Alternative value 165k (RS 683-3089) for alleged better accuracy at 50 kHz?**

Author not a Bat so cannot comment. ☺

Suggestions:

The present 8200pF capacitors cannot be reused as their handling voltage is not known, but it is recommended that 1% types are used to help match channels. Needless to say, the Author has actually tried 5% Mica capacitors and the channel matching has been satisfactory, the WAD circuit has proven to be so repeatable that you can be confident in obtaining a good RIAA characteristic even without test equipment to verify. The Author uses 3u3F 450V Audyn Q4 capacitors because they sound good and their small physical size and gauge of connecting leads are easy to work with. Expensive Russian paper in oil capacitors have been tried with no detectable improvement in sound and their size makes them rather difficult to fit so not recommended.

THE AUTHOR TRIALED A NEW METHOD OF FITTING THE V3 VALVE HOLDER TO THE STOCK MS22/23 BOARD. IT IS POSITIONED IN THE SAME PLACE AS THE SWAP BOARDS SO ONLY THE ONE 28mm HOLE WILL BE REQUIRED ON THE CHASSIS TOP.

THIS WILL REQUIRE SKILL SO DON'T ATTEMPT IF YOU ARE NOT SURE.

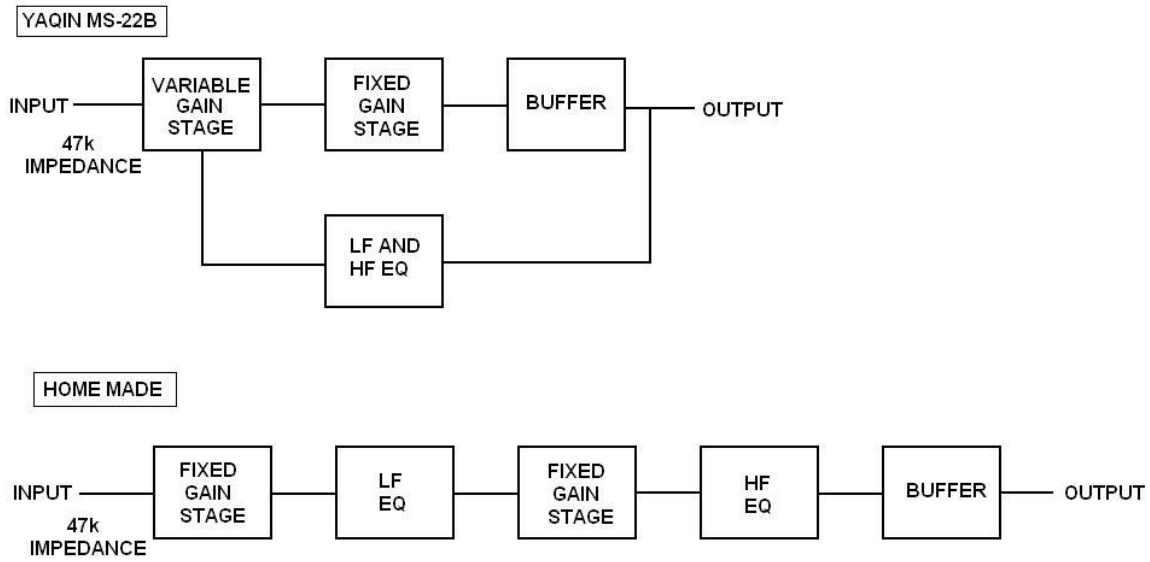
SEE 'POSITIONING V3 SIMILAR TO V1 AND V2' ON PAGES 45 to 47.

DO NOT CHANGE YOUR MIND AFTER CUTTING THE 28mm HOLE AS IT WILL NO LONGER BE POSSIBLE TO MOUNT A VALVE HOLDER ON THE CHASSIS TOP!

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Block Diagrams

Basically, you will be converting the circuitry from the feedback arrangement used by Yaqin (called a Yin Yang circuit) to the straight filter technique as shown in block form below.



Whilst you are doing these changes, you will also add a diode to the heater regulator to give the heater voltage a lift of approximately 0.7V and take it from 11.8V to the more ideal 12.6V.
You will also be doing some changes at the RCA jacks that will remove a potential hum loop that has given some owners a real headache; of course you may have already done this.

It is the Author's opinion that any small residual hum that still remains is either due to the magnetic fields from the mains transformer acting upon the metal parts of the input triodes of each channel. Also power line frequency vibrations from the transformer cannot be ruled out. Real high end RIAA amplifiers use a remote power supply to get over such problems, however the level is so small after converting the MS22/23 that it cannot be heard at normal listening levels on the main amplifier.

IMPORTANT SAFETY NOTE!

PLEASE CHECK THAT THE POWER INPUT IS REMOVED BEFORE STARTING!

AS YOU PROCEED THERE ARE DIFFERENCES BETWEEN THE 22B AND THE 23B WHICH HAVE TO BE OBSERVED.

Nothing too severe, the circuit is the same; just the mechanics have altered slightly.
MS23B changes will be highlighted in Blue as you go through the conversion.

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Taking apart.

You have to completely remove the circuit board to get totally free access to the components that require deletion and/or changing but first you need to get into the Beast.
It is strongly advised to apply some wide sticky tape or kitchen towel across the top and sides of the transformer cover to prevent any scratches that may be accidentally picked up during the conversion work.



Best to remove the Valve guard using a 2mm Metric Hex driver.
In true Yaqin style, some units use what appear to be size 10 Torx fixtures.
Now carefully pull out the two valves and put in a safe place for later.
You need to get into the Beast using a cross head screwdriver for the bottom plate.
You also need the 2mm Hex or size 10 Torx driver as previously mentioned for removing the top screws retaining the front and rear panels.

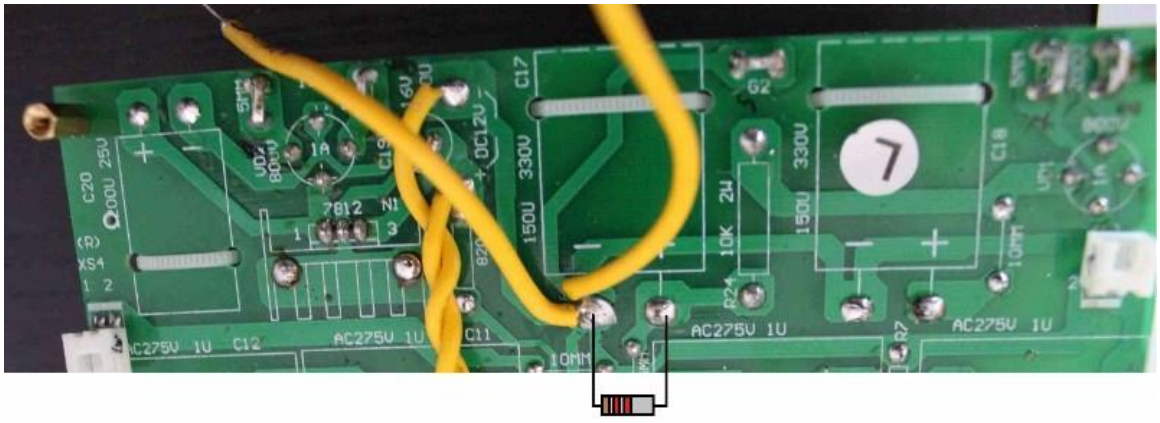


The Yellow indicated screws are 6mm machine thread screws.
The Light Blue are 8mm self-tap and the Purple are 10mm self-tap screws.
On current MS23's all screws are 6mm machine thread screws.
The cover should now slide slightly towards the front to disengage the rear lip after which the cover can be lifted away. The Author found this slightly difficult on a MS22 due to a foot screw fouling on the internal screening frame. In this respect it will be found helpful to also remove the top right hand foot as shown in the above picture.
This is not a problem on MS23's that use a different type of foot.

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HT (B+) discharge check.

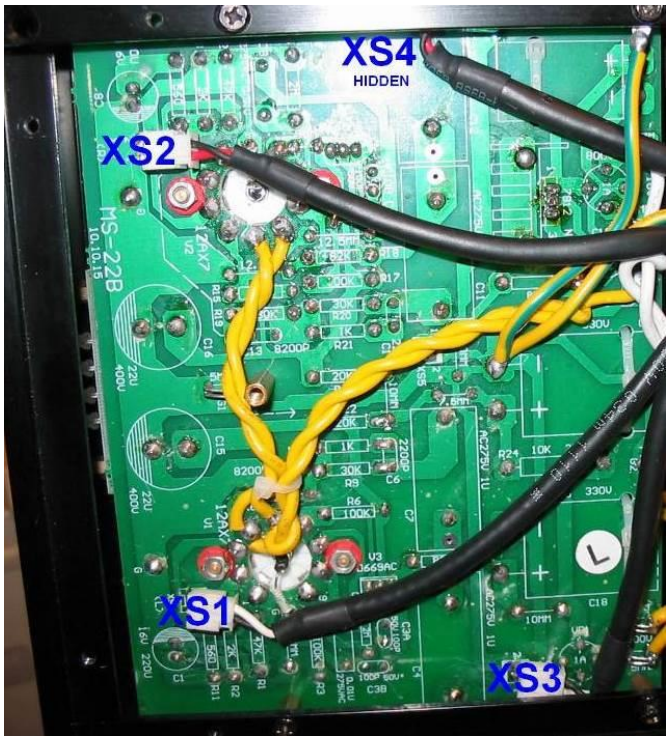
Now before commencing on the board, you must make sure the internal capacitors are fully discharged! These can be discharged by holding a suitable low value resistor (one of your new 1k2 1W should do) across + and – of C17 for 20 seconds. Check with your Multimeter switched to DC Volts that the capacitors are all but discharged.



The front panel is detached by removing two size 10 Torx screws on the amplifier top side.
As you withdraw the front panel you will see a connector providing supply to the front panel LED assembly, disconnect this connector to allow the front panel to be totally removed.

Detaching the four white plugs

Now detach the four white plugs from the circuit board connectors, don't worry, they are easy to identify when it comes to re-assembly.



Just to ease your mind for when it comes to re-assembly, the Author has made a note for you!

Left Channel INPUT (White inner) to XS1

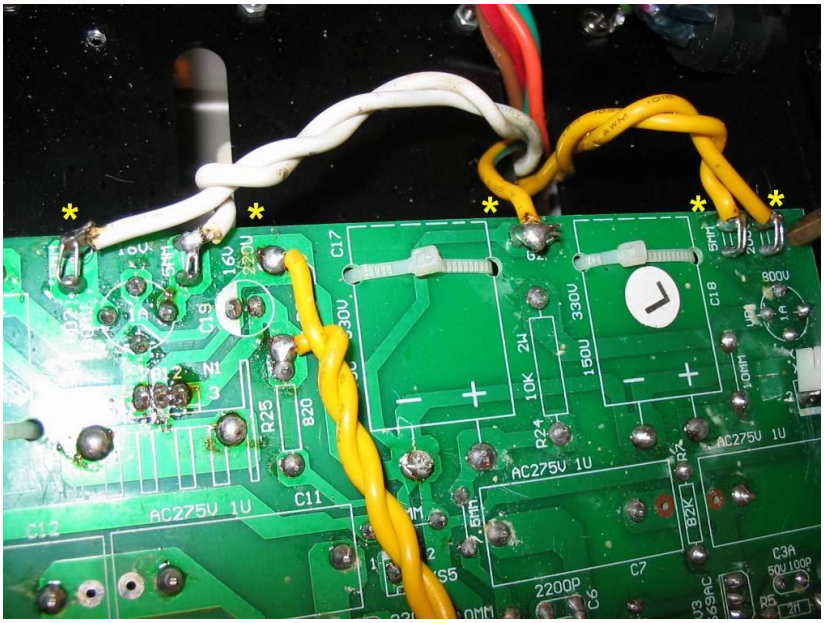
Right Channel INPUT (Red inner) to XS2

Left Channel OUTPUT (White inner) from XS3

Right Channel OUTPUT (Red inner) from XS4.

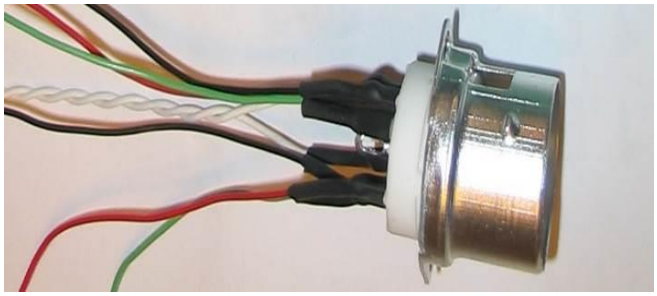
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With reference to the photo below, now unsolder the two White wires (**on later MS23B models this may be a 2 pin plug with Blue or Green wires**), the two Yellow wires and the Earth wire going to the circuit board at the position marked G2. **On the MS23 there are two black wires on G2 and not a Yellow/Green wire as shown. In fact there have been a number of production variations so make a note of where the Ground wires have been attached. Some will go to G2, some to the STAR Point, some use a connection to the left of the STAR (hidden by the Yellow twisted wires) and some units even have a connection on the ground track that connects to the lower electrolytic capacitors C15 and C16. It seems Yaqin have tried many ways to reduce hum in these units whereas a mu-metal shield around the power transformer could have also been tried.**



The author now likes to do all of the mechanical work on the chassis first including the changes to the RCA INPUT jack phono sockets and fitting of the optional pre-wired holder for V3 if mounting onto the chassis is preferred. The board can be put aside for rework later, including the more difficult fitting of the valve holder onto the board.

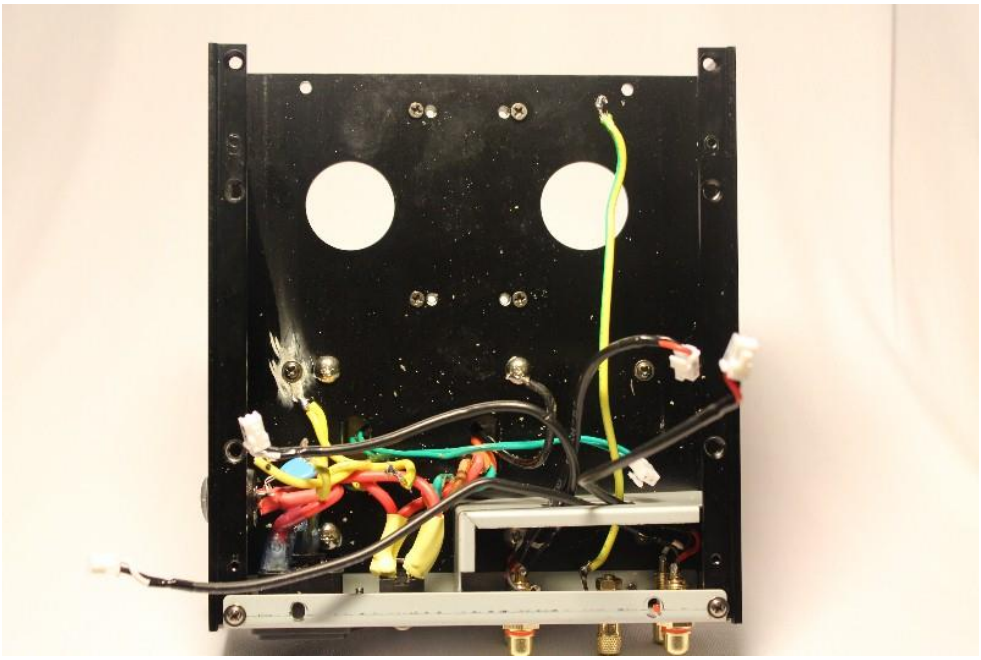
Prewire the valve holder - With 250mm long wires, the Author uses colour codes for easy identification. Red for Anodes (Plates) at Pins 1 and Pin 6, Green for control Grids at Pins 2 and 7, Black for Cathodes at Pins 3 and 8 and a twisted pair of any colour for the heaters at Pins 4 and 5. The solder tags run from Pin 1 to Pin 9 clockwise from the keyway gap, looking at the tag side of course.



The connections (including the unused pin 9) should be covered with suitable heat shrink tubing as shown. **Do not bend the tags at this time as it makes mounting the holder difficult.**
When the holder has been mounted to the top side of the chassis, then the tags should be carefully bent to the horizontal to allow replacement of the board with no danger of short circuiting the tags to components on the board.
Where the holder is mounted onto the circuit board (Pages 45 to 47) then the tags are bent outwards and the centre spigot is cut off. Two M3 x 10mm F-F spacers will be required to mount it onto the circuit board.

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Rear Panel work.



We can now turn our attention to the chassis modifications, first look at the following photo.

Remove the two 6mm screws and the central cross head screw (marked with asterisks), the latter secures an internal screening frame and may be either threaded or of the self-tapping variety.



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First step: Hum reduction and checking RCA Ground connections:

Check that the Ground lugs of the RCA INPUT sockets are not soldered together.



As shown in the photo, if you find the two Ground tags soldered together then separate the tags and Black wires. The newer units appear to have some kind of thread locking varnish applied which makes it difficult to loosen the fixing nut. The author removes both Black wires and excess solder, then reheats the connection whilst turning one of the RCA jacks with a 15mm socket or combination wrench. With luck the two tags will separate and you should continue turning until the tags are well spaced apart. Finally reconnect the respective Black wires to their own independent tags.

Output resistors: On both of the OUTPUT RCA jacks we will be fitting R10/RAH to the LEFT OUTPUT and R21/RBH to the RIGHT OUTPUT.

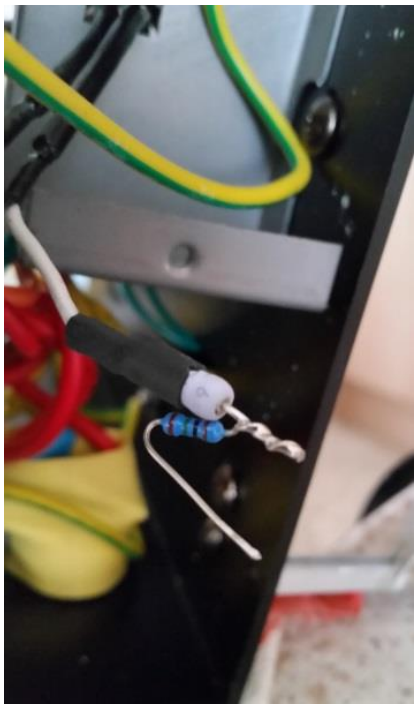
First prepare R10/RAH and R21/RBH as shown, the larger resistor (chosen for illustration) is R10 or R21 (1k) and should be twisted with RAH or RBH (1 Meg) as applicable, tinned and cut to 5mm, the other end of the 1k (R10 or R21) is also cut to 5mm.



Taking the LEFT OUTPUT RCA first, the White wire from the centre connection is removed and soldered to the 5mm free tail of the 1k Ohm resistor R10. Note position of RAH.
Don't get these two resistors mixed up or you will have very low output!
Now slide a short length of suitably sized heat shrink tubing over RAH and R10 to the joint just made with the White wire.

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Afterwards flip back the 1 Meg resistor RAH and form as shown.



Solder the twisted section to the RCA jack centre pin.
Trim as required the remaining wire of the 1 Meg resistor RLH and solder to the Ground lug of the RCA socket together with the Black wire already there.
Repeat procedure to the Red wire on the RIGHT OUTPUT socket with R21/RBH.

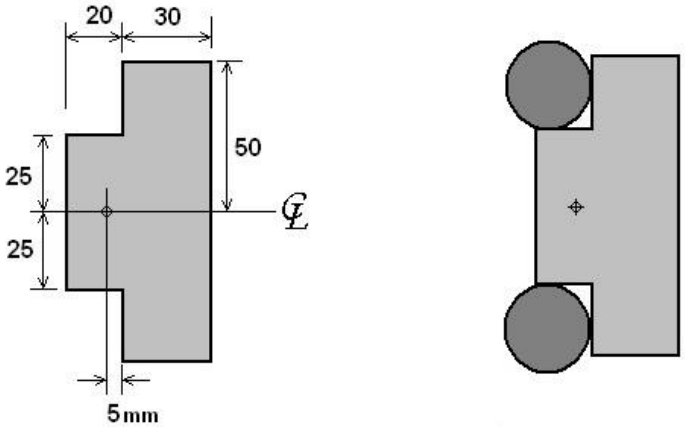
Refit rear panel into the chassis and secure with the two screws on the top surface and two cross head screws on the bottom edge at the chassis corners.

Refit the fixing screw that holds the internal screen to the rear panel.

The Author also checks the tightness of the other lower screw that secures the internal screen to the Chassis.

Template for mounting V3

Below is a simple template (shaded in Grey) for you to make from thin card or stout paper, using this template you can position the mounting hole correctly for the extra valve V3. The template card comes into its own where a large number of chassis need to be drilled. This is how the author fits the extra holder on the MS23 due to his limited metal working facilities, but take a look at Pages 37 to 40 where John (celebabe on the diyAudio Forum) shows how he did it whilst retaining the original tube shield.



Simply lay card on the underside of chassis as shown and drill/mark the centre spot for the new valve holder.

After making to the sketch, place the template onto the underside of the chassis using the present large holes as a guide to placement. Simply centre mark or punch the required position for the pilot hole and then cut the panel for the valve holder. Despite not looking as good, the Author thoroughly recommends only topside mounting of the new holder, which at least on the MS23, can be concealed

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with a modified cover. **However!** Before you do any drilling you have the option to fit V3 onto the circuit board so only the one 28mm hole is needed. See pages 45 to 47.

If you decide to mount on the outside there is caution here!

If you make this hole too large it will reduce the metal available for the actual fixing screws.

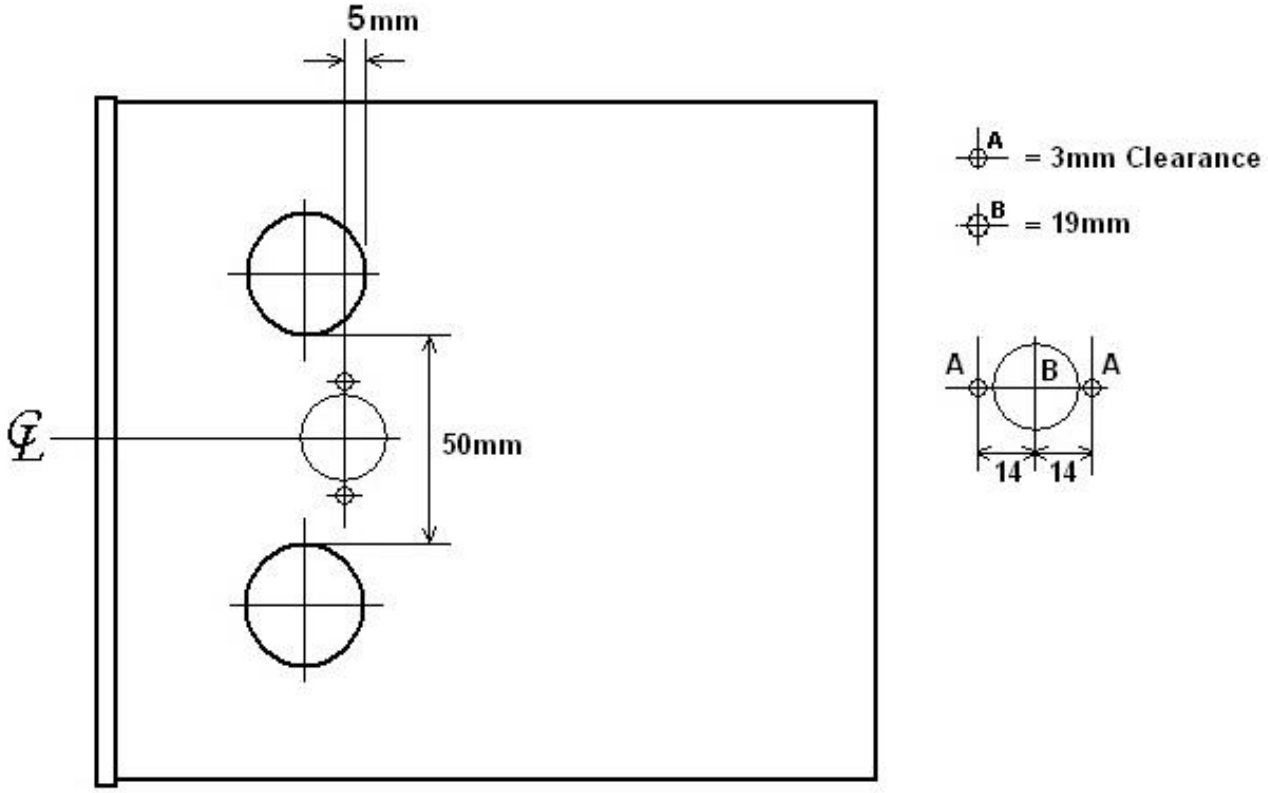
Some valve holders, particularly the skirted type, require a larger hole than depicted on the next page e.g. 22mm. The safe solution here is to carefully cut the hole until the new valve holder fits comfortably into it.

Be careful of machining operation swarf when cutting the large hole for the extra valve. It helps to keep the amplifier body tilted forward slightly during these operations to prevent metal particles finding their way into the power transformer cover.

The holder should be retained with suitable screws, shake proof washers and nuts, but clear away the Black anodising at the underside fixing points so that the shield will be properly grounded.

The author recommends that the keyway gap faces the power transformer but this may not be possible with some valve holders as there appears to be no design standard for pin orientation.

Alternative mounting sketch:

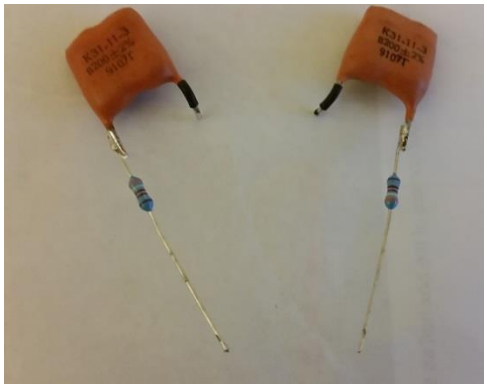


The next things to make are the EQ's which will be fitted to the board later when the wires from V3 have been attached. They are the last components to be fitted before the board plugs from the rear panel RCA Jacks are re-attached.

Once these have been made the work on the printed circuit board can commence.

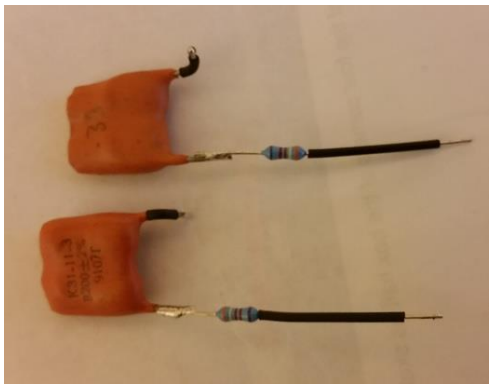
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The 8200pF EQ's



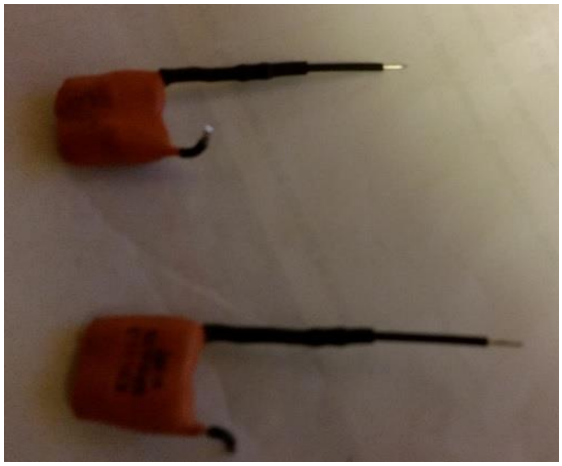
Cut legs of the 8200pF capacitors (C5/C13) to approximately 10mm. Bend down the right hand leg of one and the left hand leg of the other as shown. The author likes to apply a small 5mm length of 1.2mm heat shrink tubing to the leg that is bent down as, when it is installed, it gives some protection to the wire from a nearby fixing nut. Later, the bent leg on the Left capacitor will connect to pin 2 of V2 whilst the Right capacitor bent leg will connect to pin 7 of V1.

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Add the 39k2 resistors (RAC/RBC) and apply some 1.2mm heat shrink tubing to the uncut end of these resistors.

Finally apply some 3.2mm heat shrink tubing to cover the resistors and their connections with the capacitors as shown in the following photograph.

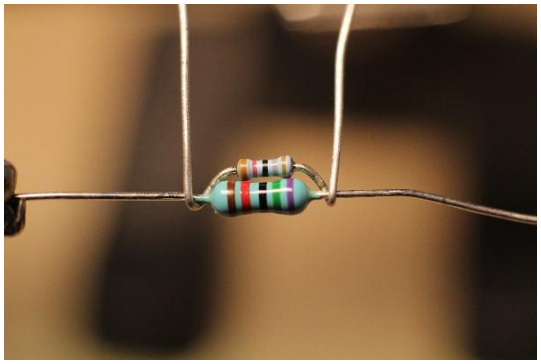


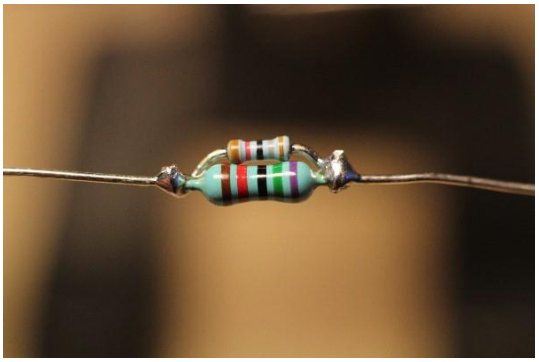
Put these aside for fitting when the board is refitted.

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The 200pF EQ's

Place resistors RAF (75k) and RAG (18k) in parallel, i.e. together side by side and trim as required. Then apply some solder to the joints. **You can if you wish use a single 14k3 resistor.**





Repeat procedure with RBF (75k) and RBG (18k) or the single 14k3 if you used this.
Add these resistor networks in series with the 200pF capacitors C3 and C10.
One leg of these capacitors is kept straight and cut to 10mm length. The other leg is also cut to 10mm but bent down at 90 degrees. This end is soldered to the resistor network and then covered, along with the resistors, with 3.2mm heat shrink tubing.





Now also put these aside for fitting later when the board is refitted.
We now commence work on the printed circuit board which starts with removing all of the components that are no longer required.

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The Circuit board conversion.

On the Left Hand channel, remove components C2 (10nF), R11 (560 Ohms), C3a and C3b (100pF each), R2 (2k), R3 (100k), R8 (680k), C5 (8n2), R9 (30k), C6 (2n2), R10 (1k), R5 (2M), R7 (82k), R6 (100k), C4 (1uF), C7 (1uF) and Transistor V3.

On the Right Hand channel, remove components C9 (10nF), R14 (560 Ohms), C10a and C10b (100pF each), R13 (2k), R15 (100k), R19 (680k), C13 (8n2), R20 (30k), C14 (2n2), R21 (1k), R16 (2M), R18 (82k), R17 (100k), C11 (1uF), C12 (1uF) and Transistor V4.

Remove the Yellow link wire that skirts around V2 (already done in the photo).

Now remove the short wire link marked as 5MM which is presently connected to pin 1 of V2. You DO NOT want this!
On the MS23 this is shown as a 6MM link!

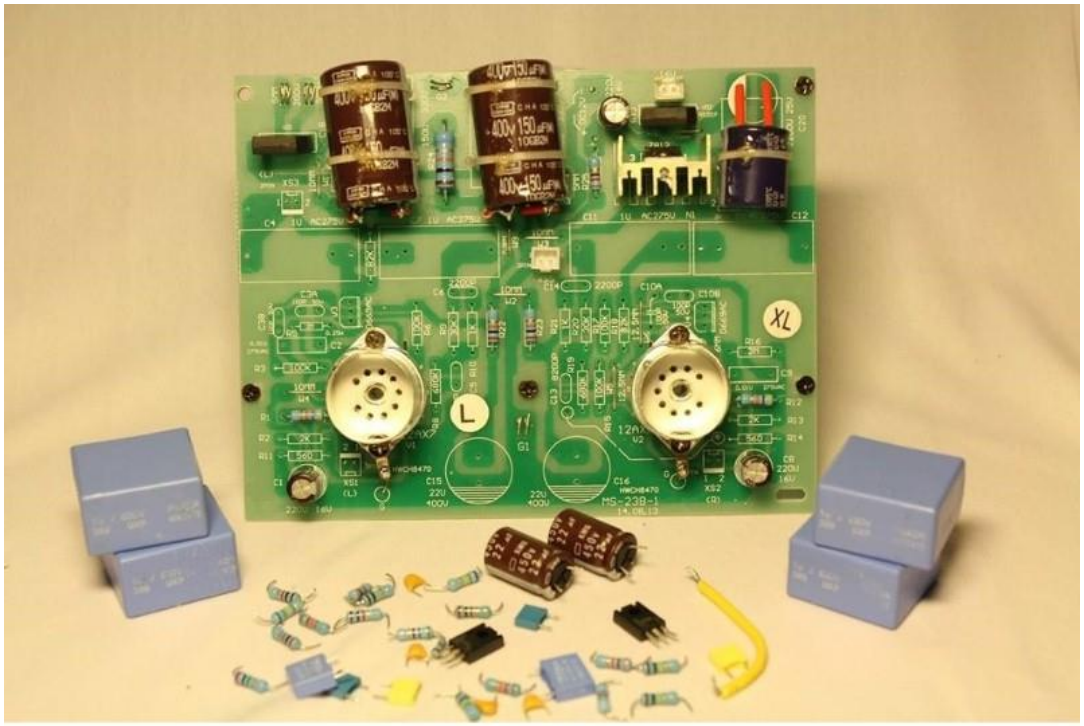
Use some solder wick to clear all solder pads for re-use followed by a wash and scrub with Isopropyl Alcohol (IPA) and a small stubby brush.
All the Yellow starred components are no longer needed.



If you are fed up with being blinded by the single Blue LED, applicable mainly to the MS22 and early MS23, then also remove R25 (820 Ohms). This is shown to the left of the heat sink and can be replaced with a 100k 1W later.
If the front panel however has a row of LED's then you should retain the existing 820 ohms.

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The board should look like this:-



References will still point to the original Yaqin component numbers but where new parts are added, a letter system is used to avoid any confusion. Component references like RAA, RAB, RAC etc. refer to the Left Channel whereas their counterparts on the Right channel will be called RBA, RBB, RBC etc.

One thing to remember! When you are working on the printed circuit side of the board, the Left channel is on the Right Hand side as you look at it! The Author has been caught out a few times by this ☺

Views of the actual circuit boards may differ due to production changes, particularly the change in Valve Holders and the addition of slots between valve pins on later models.

Some of the photos were taken at advanced stages to what is being described so ignore other components that are not applicable to the work in hand.

The procedure for track cutting, drilling and component placement has been changed from previous issues, all the cutting, drilling and component placement is all done in 3 set stages.
1) Cleaning away Green solder resist,
2) Cutting tracks then
3) Drilling. This is how the author now does the board rework as he found it better to complete each stage whilst tooling was to hand.

Preparation before reworking the stock circuit board

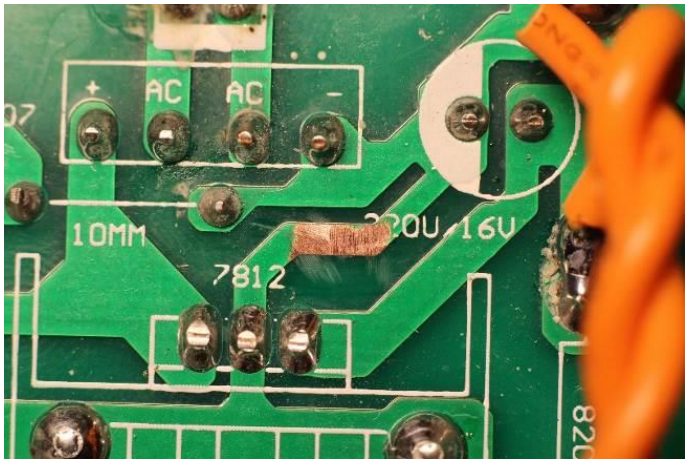
a) **De-solder pin 2 and pin 6 of V1.**
b) **De-solder pin 1 and pin 2 of V2**
c) **Remove all 3mm nuts and fibre washers from the valve holders.**

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1) CLEANING AWAY GREEN SOLDER RESIST.

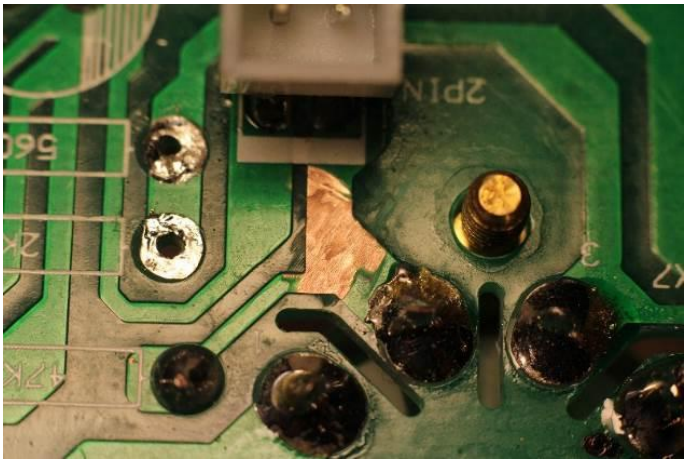
ADDITIONAL HEATER DIODE D1

Centre trace from 7812 to Capacitor.



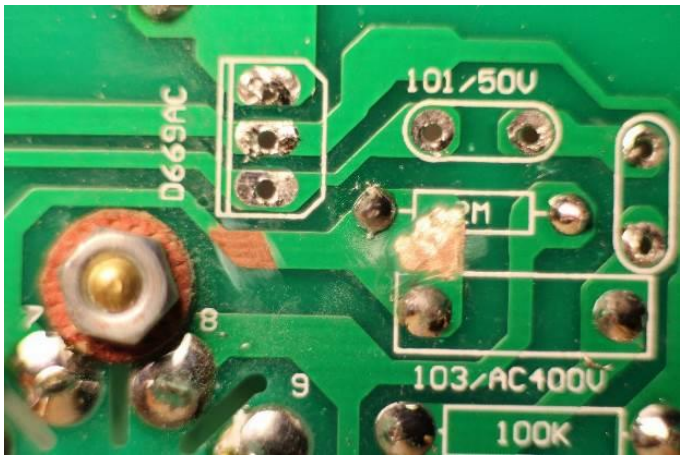
RAA

Note that fixing nut and insulating washer have been removed for better access.
A large area as this will be dissected later.



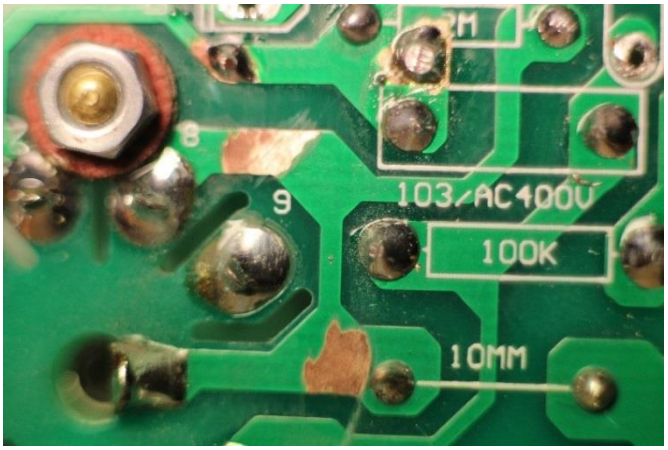
RAB

Located on bend to the right of fixing nut and also at far end of the pad that takes the 2M resistor and Capacitor.



RAD

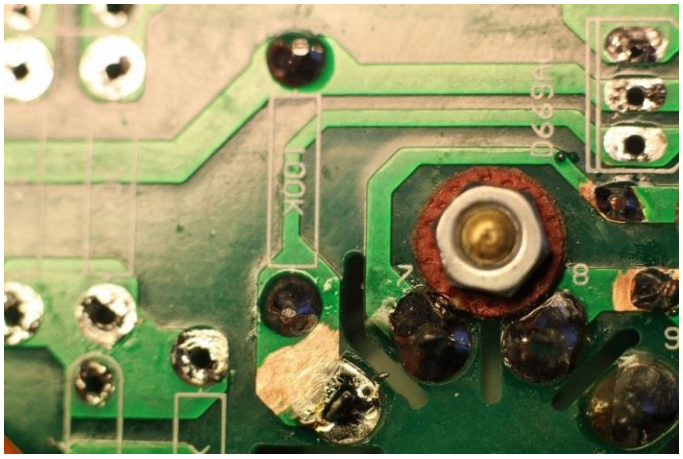
To the right of pin 8 and to the left of the 10mm ground link.



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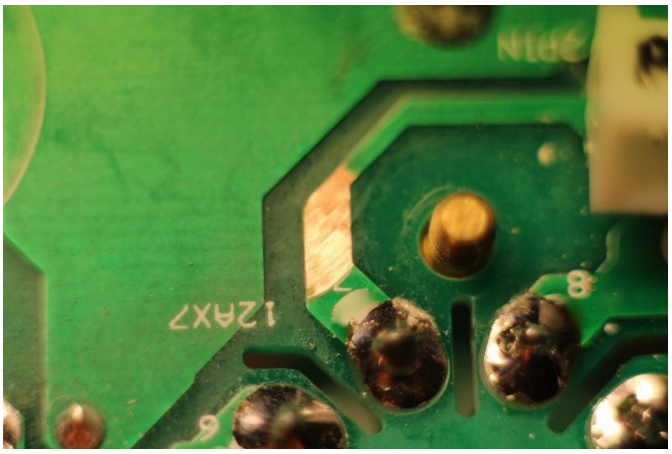
RAE

There is only one area requiring preparation (for RAE) and this is at V1 Pin 6. The other end of RAE will make use of the old transistor V3 Base pad.



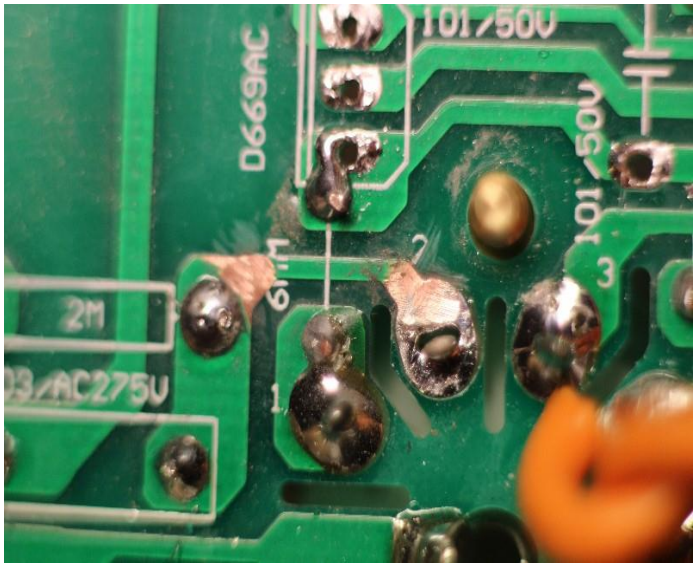
RBA

Just one long area, between input connector and Pin 7 of V2. NOTE: Nut and Washer removed to assist in the work.



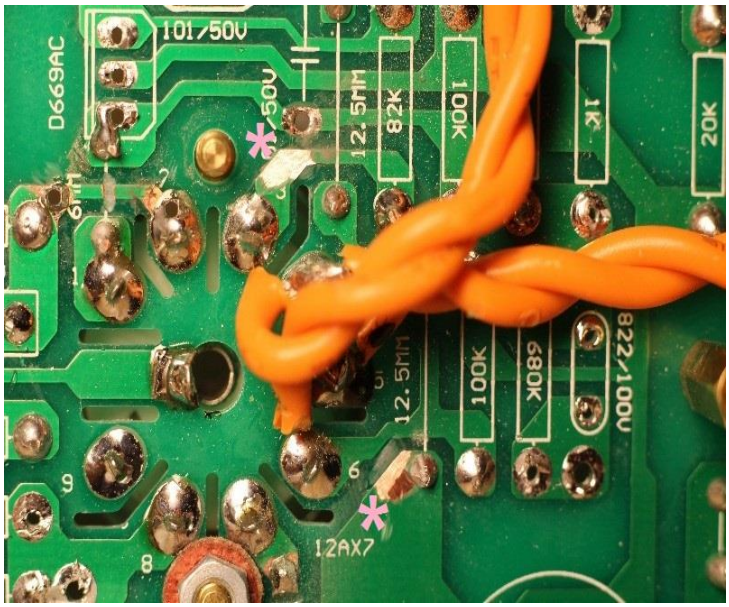
RBB

At pin 2 of V2 and left hand side of the track connecting to the 2M resistor and capacitor. NOTE: Nut and Washer removed to assist in the work.



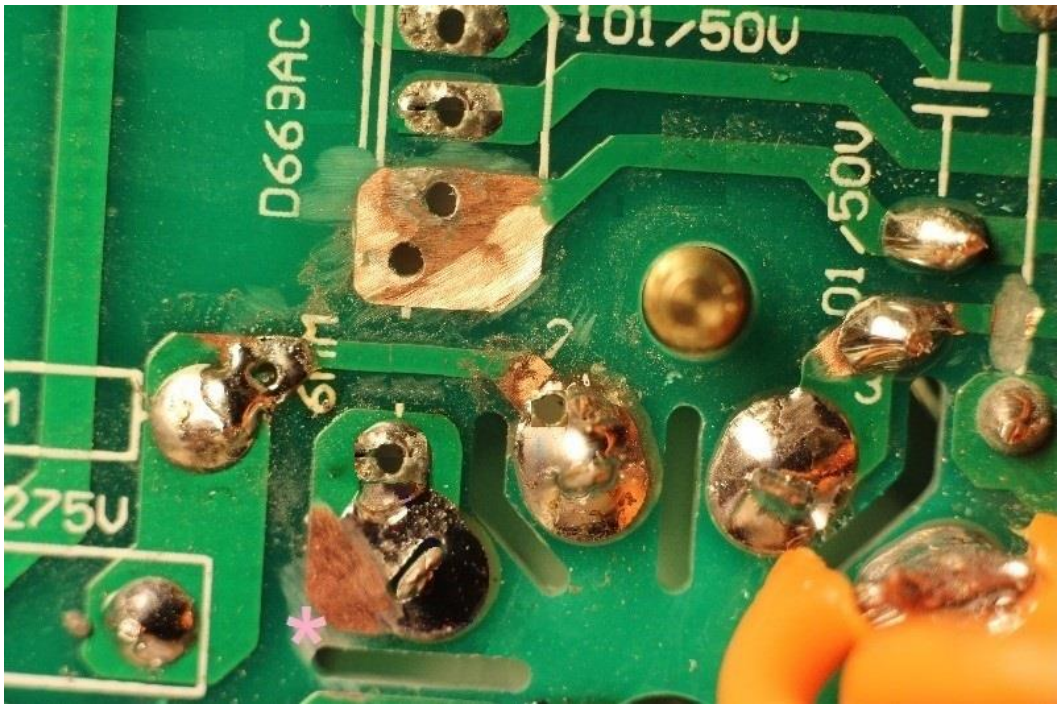
RBD

Pin 3 of V2 and bottom end of 12.5mm link (Highlighted by *)

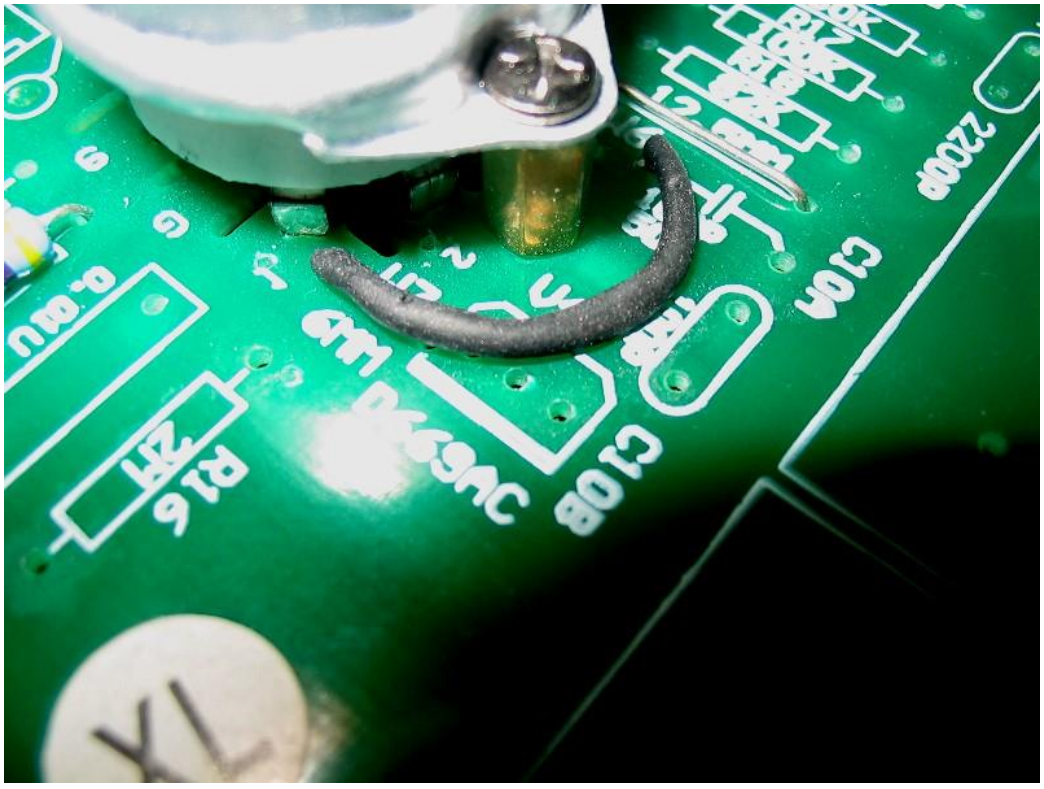


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RBE
Pad of Pin 1 of V2 (Highlighted by *)



At V2 Pin 1 pad, add an insulated link wire to connect to V2 Pin 1 (where the 6mm link was removed) and the other end to C10A (end not connected to C10B). Just use a solder tack at Pin 1 to hold wire as another component (RBE) is destined to be located here in a hole you will drill later for it.



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2) TRACK CUTTING

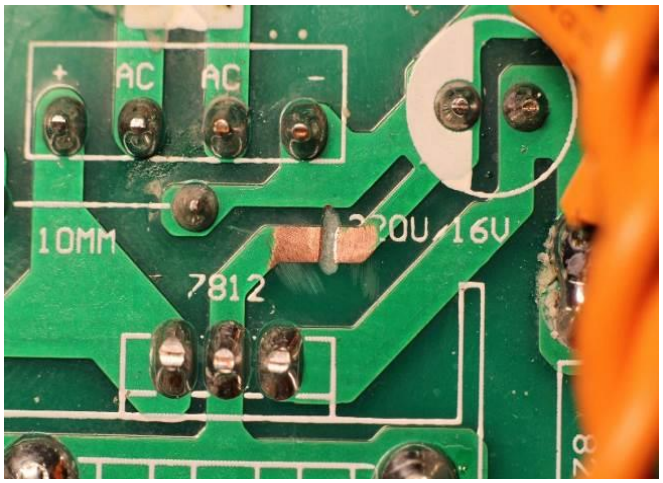
ASSOCIATED WITH THE PREVIOUS AREAS YOU HAVE JUST PREPARED.

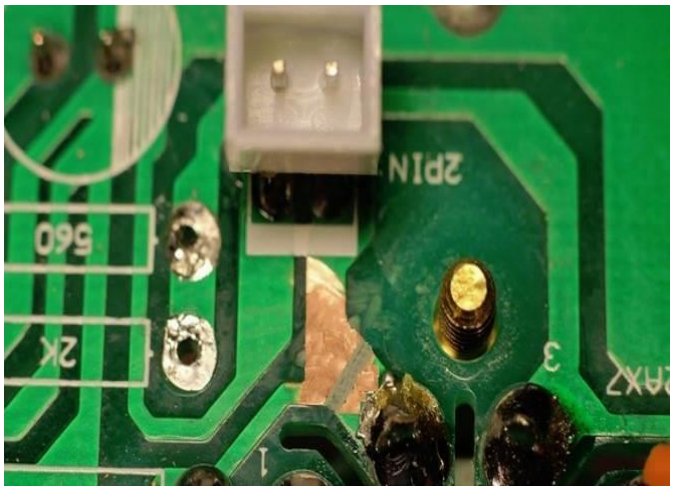
HEATER DIODE D1.

Cut track with Dremel or a craft knife

RAA

Important: Leave track connected to the 47k Resistor. Only isolate the valve pin.





RAB



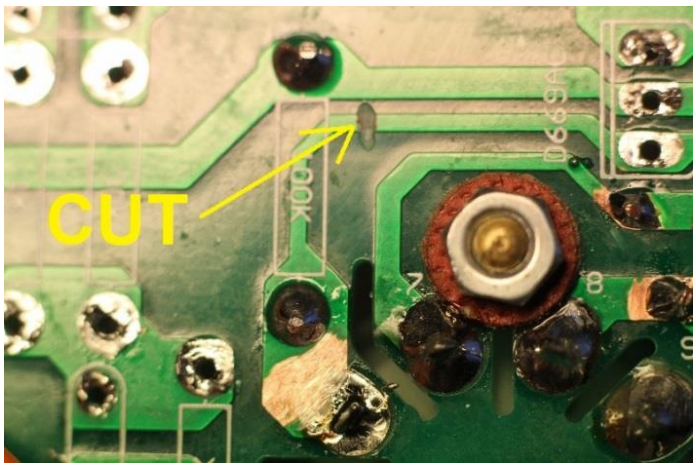
RAD



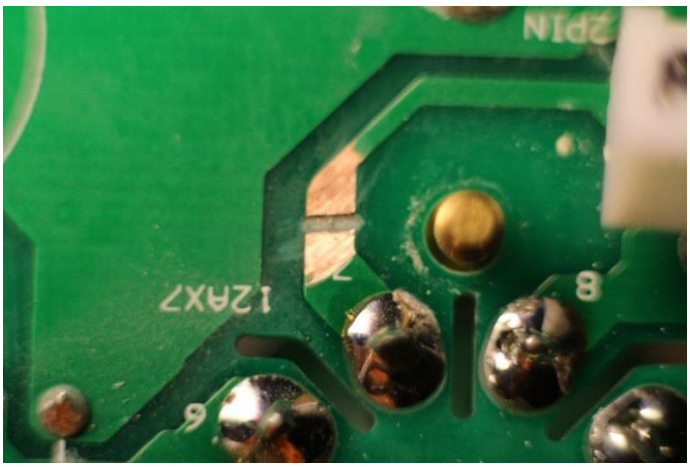
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RAE

Track cut shown by Yellow arrow



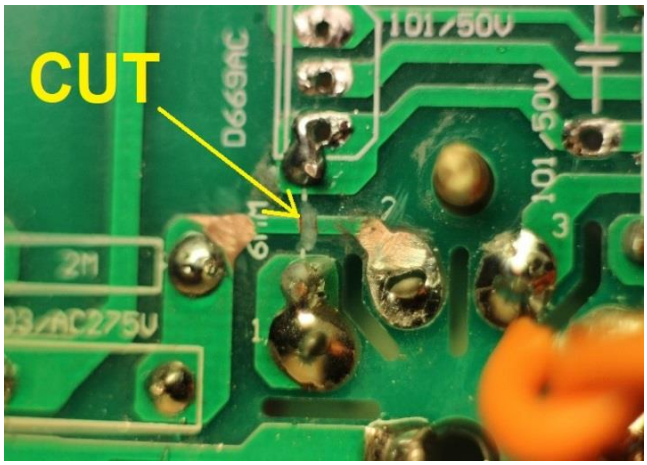
RBA

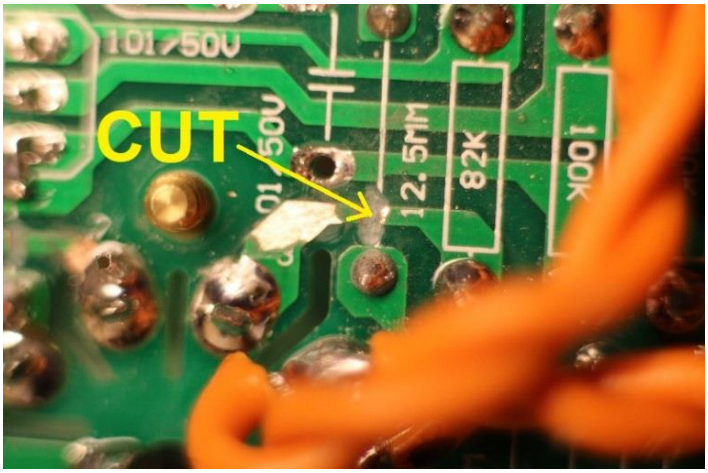


RBB

RBD

Track cuts shown by Yellow arrows

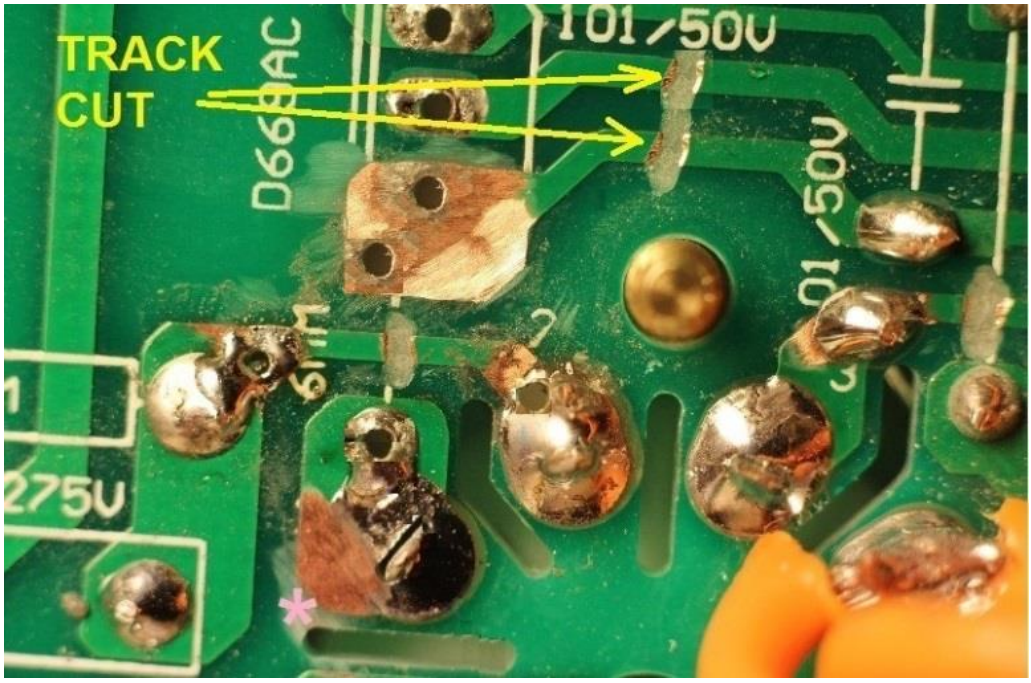




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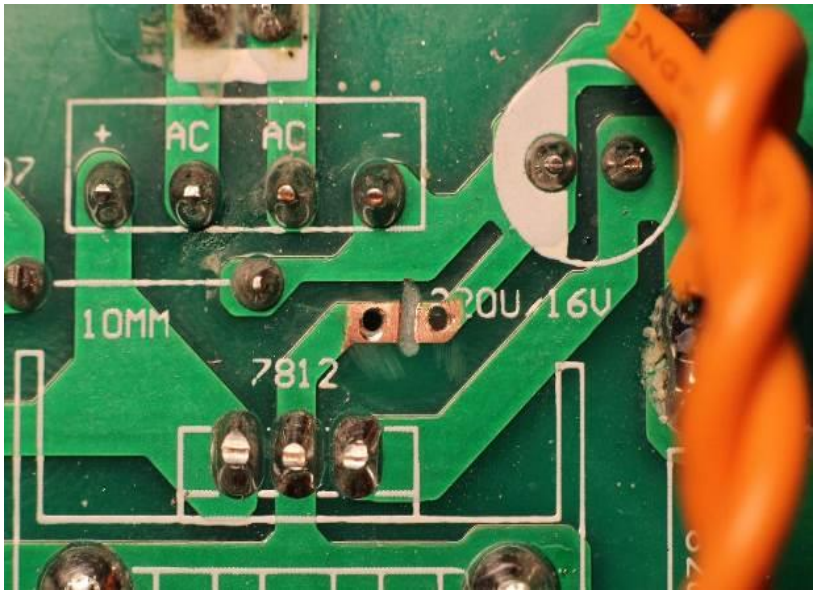
LAST TRACK CUTS

RBE
Two cuts here, top one is a safety isolator.



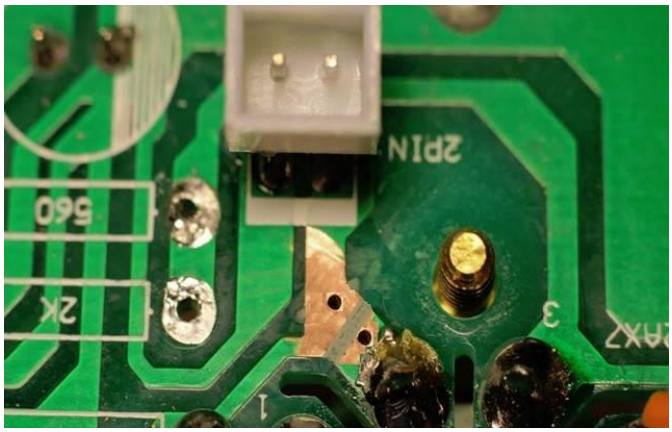
3) TRACK DRILLING

HEATER DIODE D1



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RAA



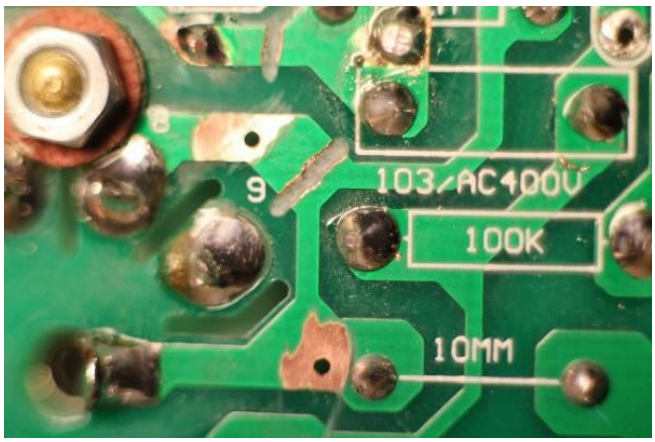
RAB

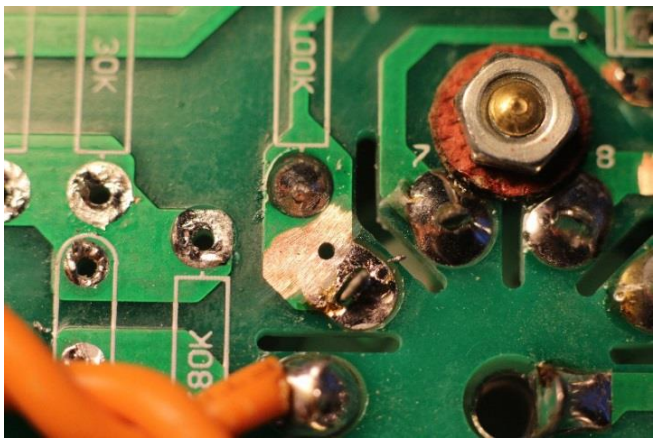


RAE

Only one area requiring drilling and this is at V1 Pin 6.

RAD

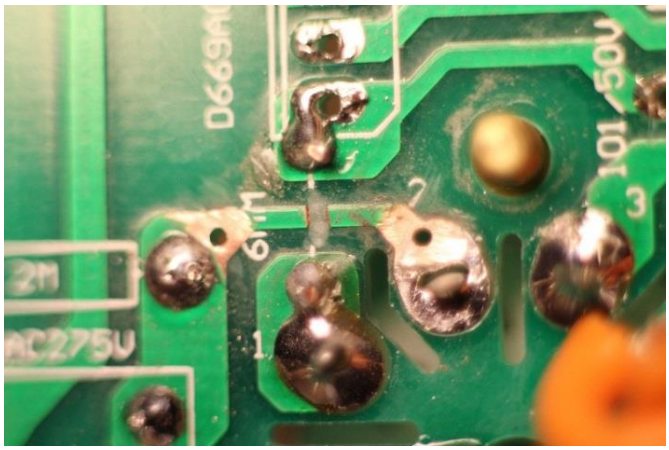




RBA

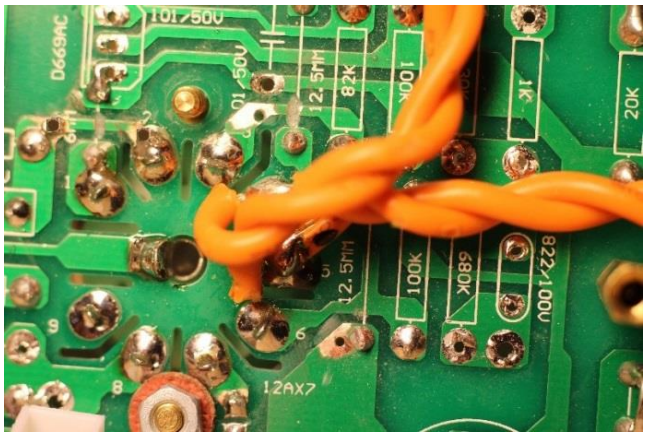


RBB

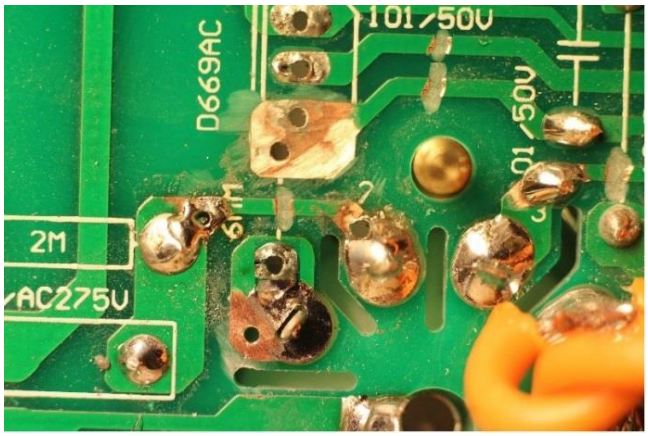


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RBD
Pin 3 of V2 and bottom end of 12.5mm link

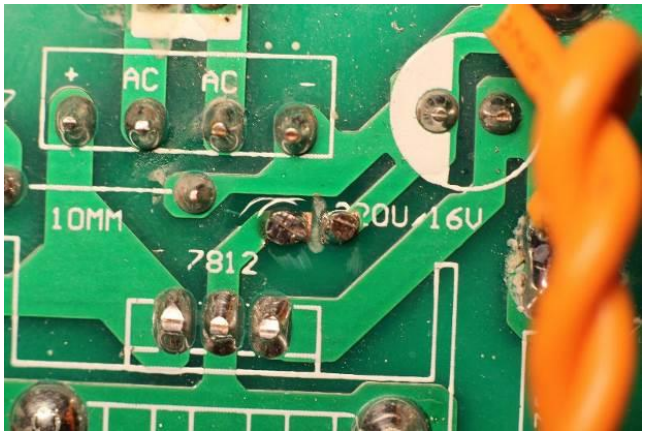


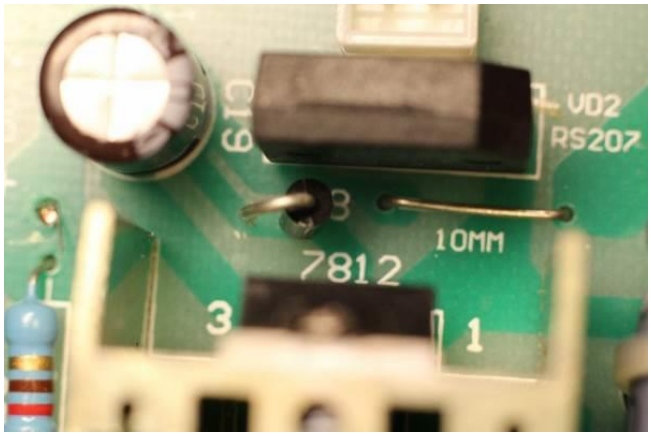
RBE
Pin 1 of V2



4) ADDING COMPONENTS TO THE DRILLED LOCATIONS.

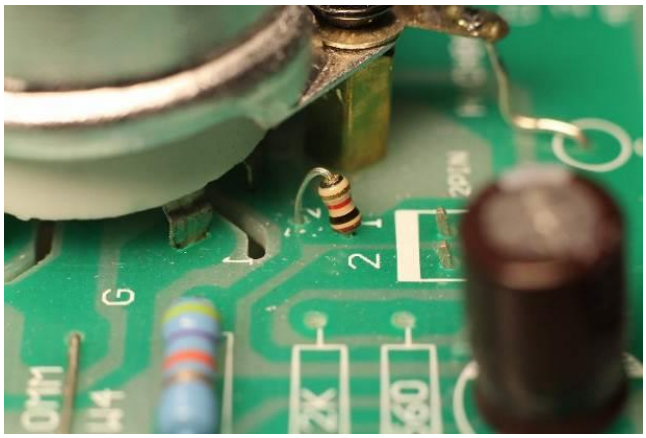
Mount Diode **D1**, it is polarised and must be wired the correct way round.
The right hand photo shows diode positioning, the diodes silver band, is mounted upper-most.

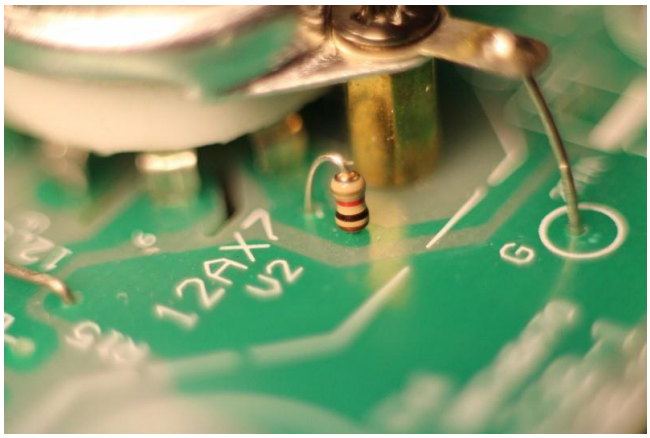




MOUNTING OF **RAA** 1k 0.125W

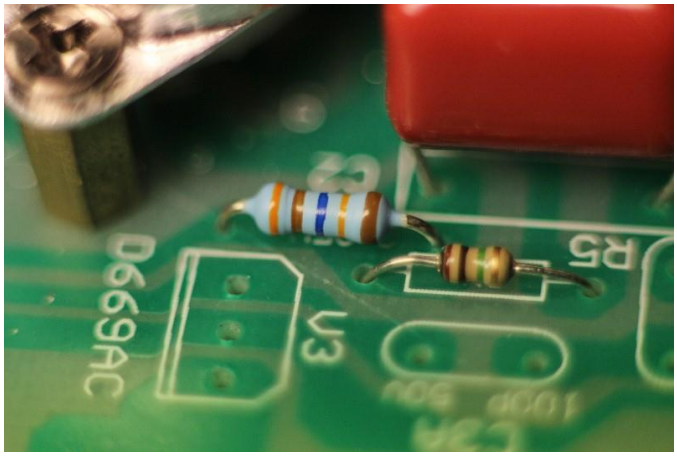
RBA





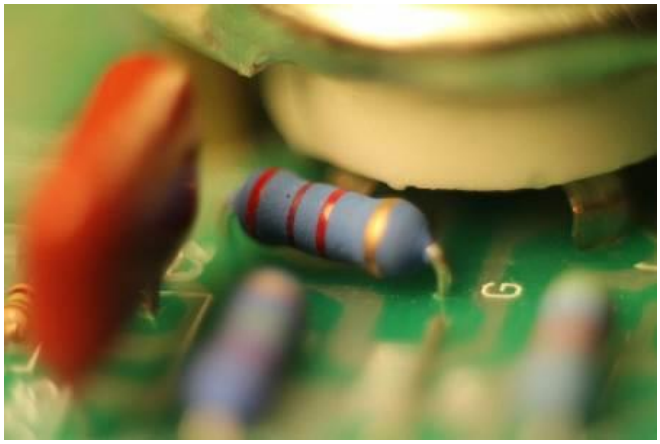
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MOUNTING OF **RAB** 316k 1%

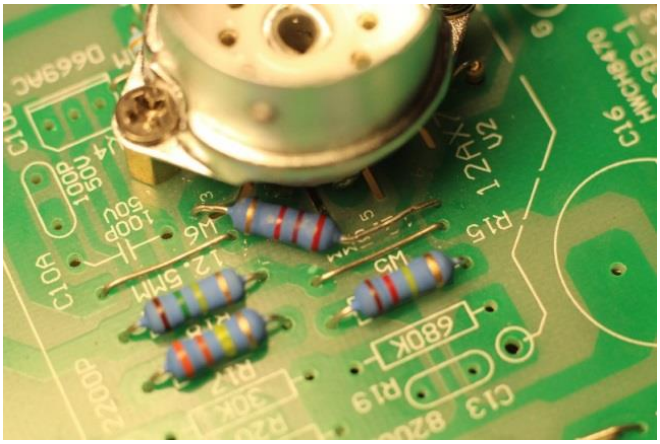


RBB? NOT YET!
This resistor will be piggy backed over RBE as we shall see later!

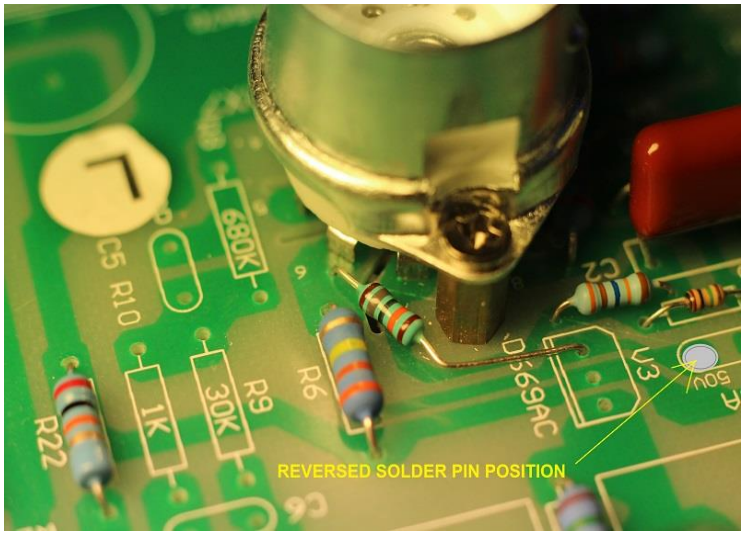
RAD
MOUNTING OF RAD 2k2 1W (Red/Red/Red)



RBD
Note how RBD 2k2 is mounted, the long bare lead may be covered with thin sleeving if desired.



RAE



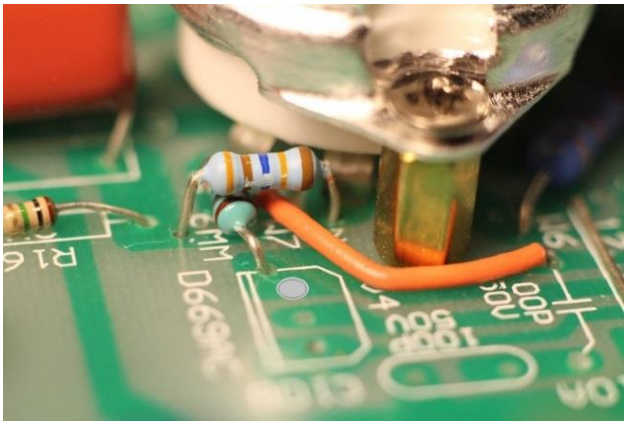
Note how RAE 180k is mounted, the long bare lead (at high voltage) should be covered with thin sleeving.
A suggestion is for you to fit a reversed solder pin at the capacitor hole 101/50V that is linked to the RAE connection at the old transistor V3 Base pad. This will provide a connection to pin 2 of the extra buffer valve and the RAF/RAG/C3 EQ network later.
Also fit a reversed single ended board pin at transistor V4 Base pad. This is the pad closest to the valve fixing nut. This will provide a connection to pin 7 of the extra buffer valve and the RBF/RBG/C10 EQ network later.

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MOUNTING OF **RBE** 180k

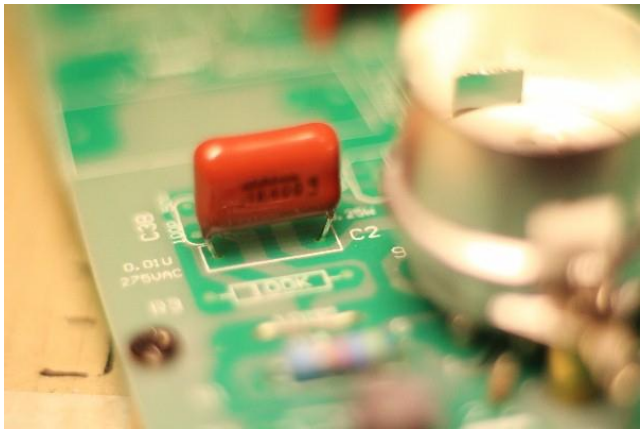
NOW PIGGY BACK **RBB** 316k
KEEP A TINY AIR GAP BETWEEN THE TWO RESISTORS RBE AND RBB

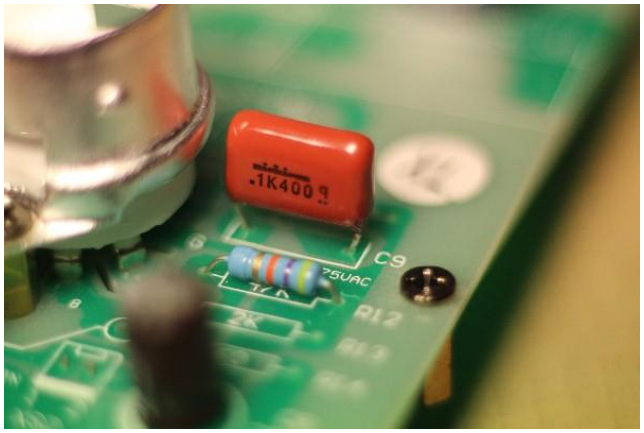




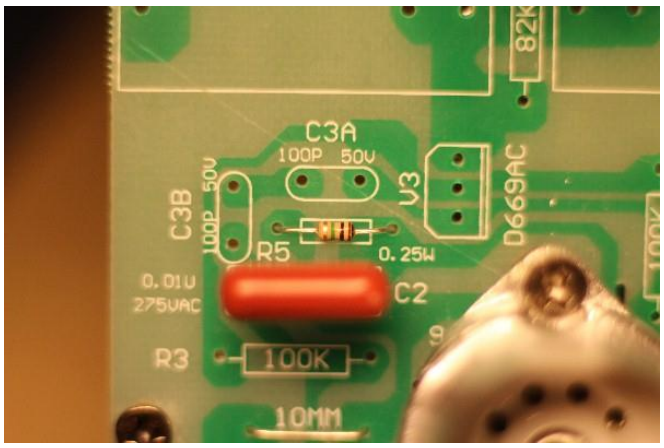
5) Fitting of new components in the holes vacated by the old components.

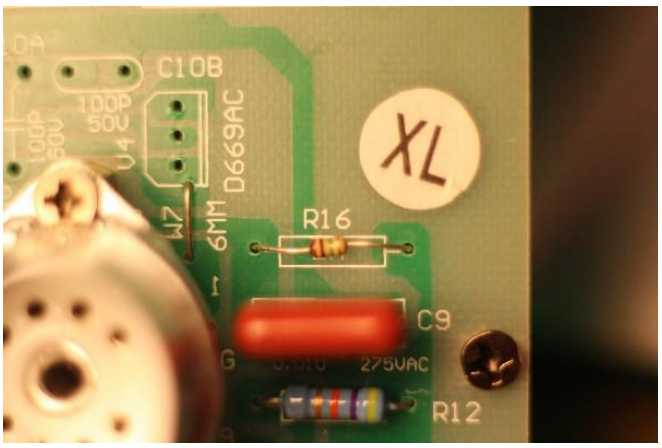
Insert a 100nF capacitor at C2 and C9 positions.





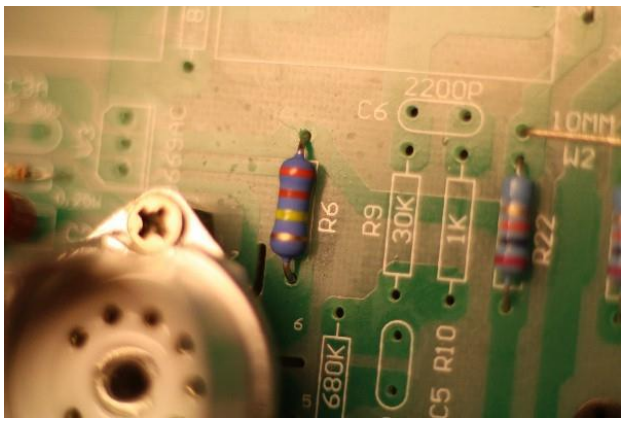
Insert a 1M Resistor at R5 and R16 positions.

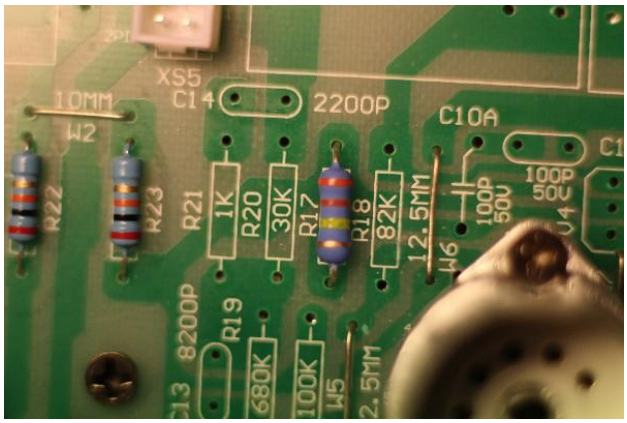




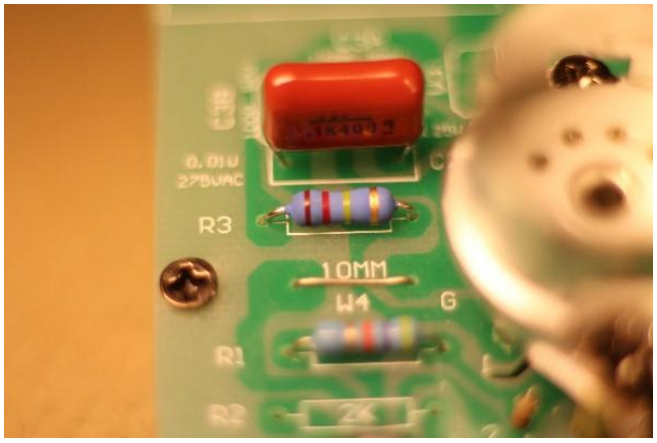
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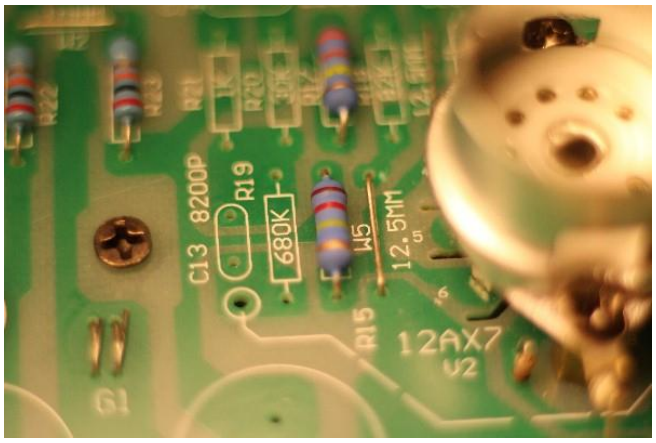
Insert a 330k Ohm 1W resistor at R6 and R17 positions.



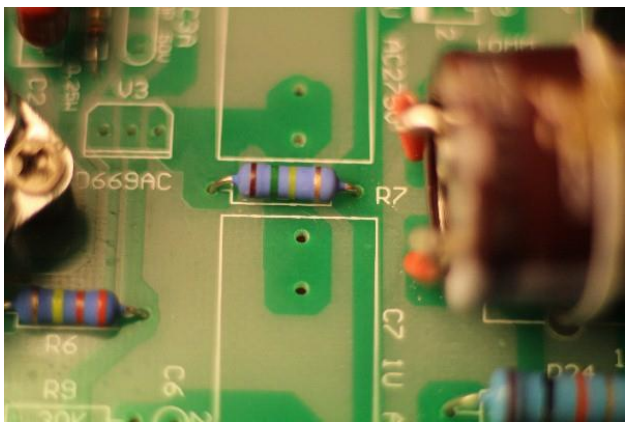


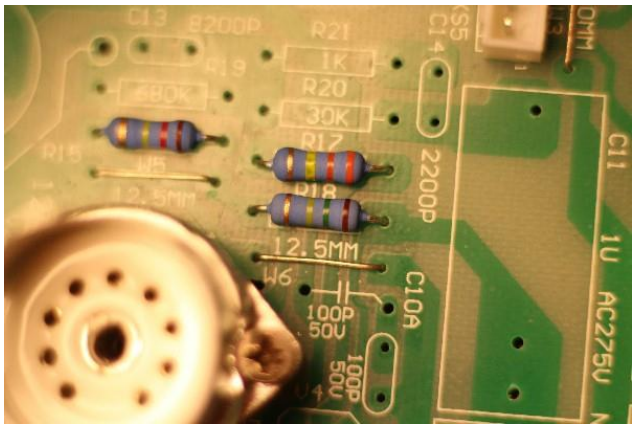
Insert a 120k Ohm 1W resistor at R3 and R15 positions.





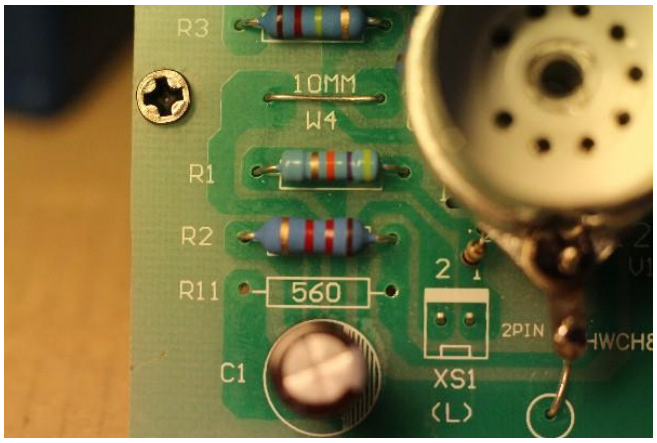
Insert a 150k Ohm 1W resistor at R7 and R18 positions.
Note that if you mount R7 on the reverse print side of the board instead, it will give more room on this side for the new output capacitor C4 when it is fitted later.

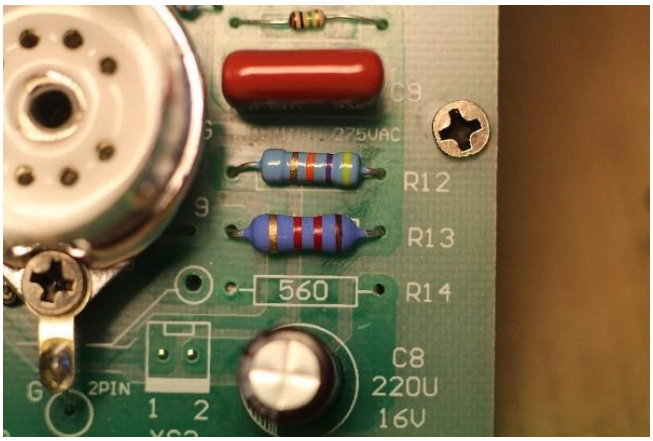




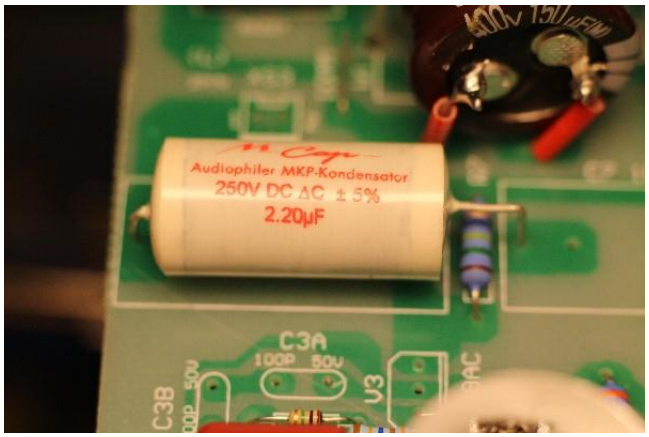
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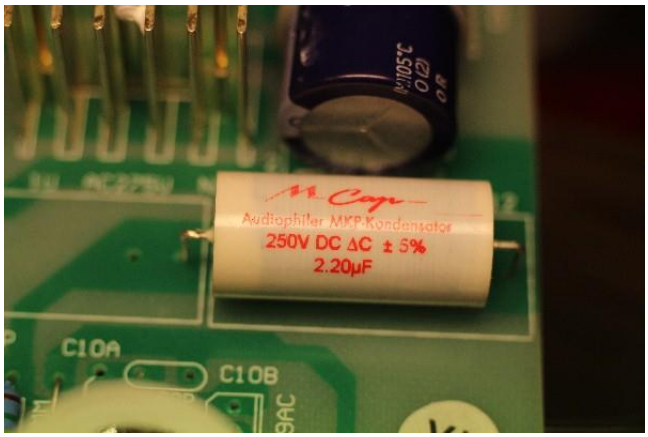
Insert 1k2 1W resistor at R2 and R13 positions.



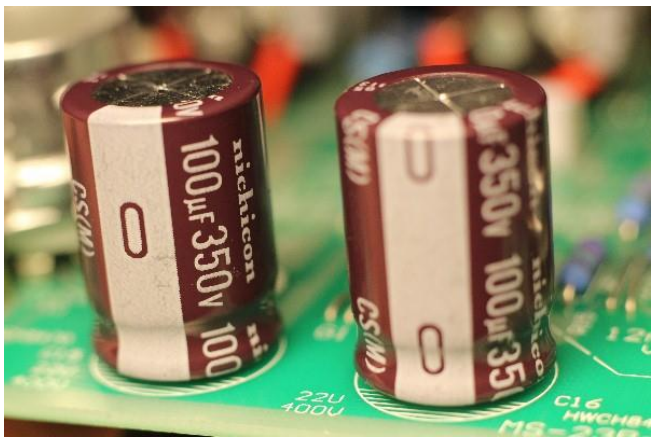


Fit new output capacitors at C4 and C12 positions.
You can see here on the left photograph why it is an advantage to have R7 on the other side; it just looks out of place at this location.



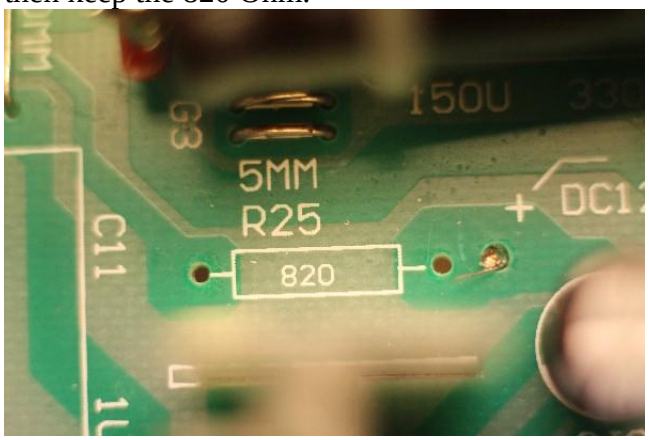


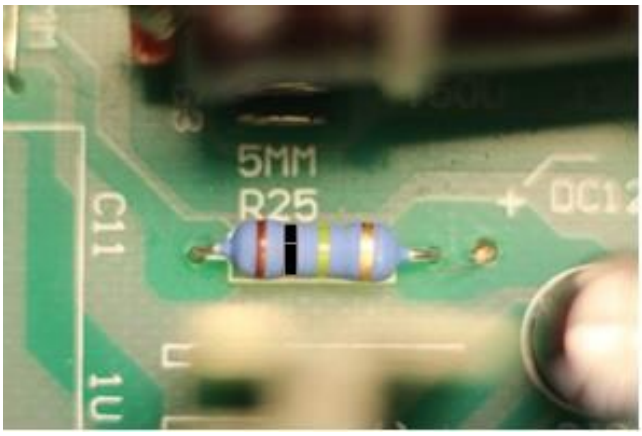
The replacement HT (B+) capacitors C15 and C16 can now be fitted.
Make sure you have the correct 25mm maximum height capacitor types and that these are mounted the right way round with their negative tags towards the front edge of the board.
Note: Due to supply problems, the original 100uF capacitors were later replaced with 68uF 350V types.



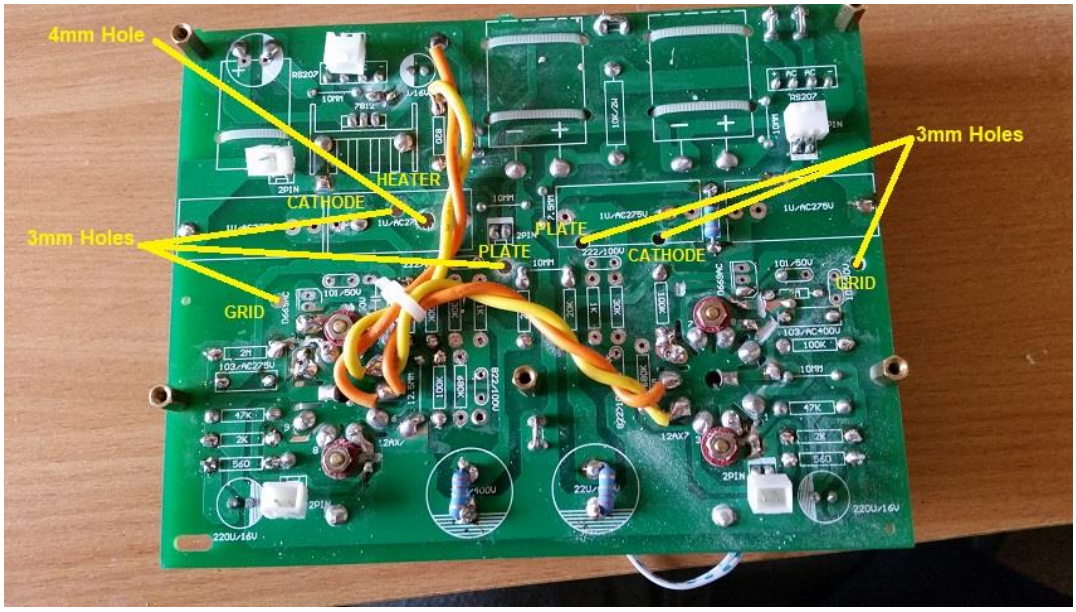
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As a safety precaution, add RAJ and RBJ across the pins of each capacitor or if you are careful, you should be able to drill tracks close by the capacitors and mount here. These 330k resistors will ensure that any residual charge on the capacitors is drained after a few minutes yet there value will not add any appreciable loading to the HT (B+) line.
Now for those wishing to reduce the almost eye damaging glow of the single front panel Blue LED, here is the answer. Replace **R25** with a 100k 1W resistor but if your front panel has a row of LED's then keep the 820 Ohm.



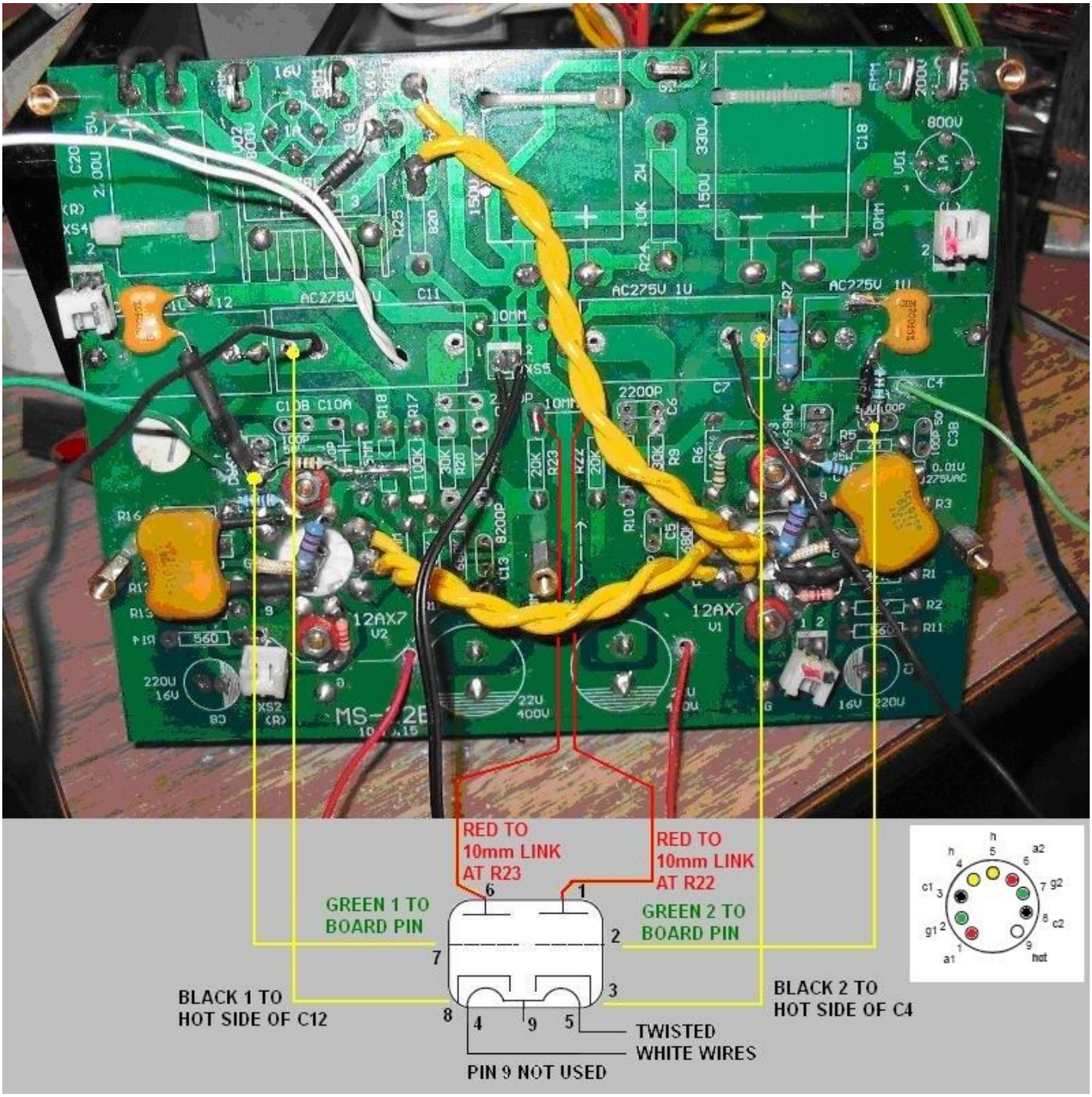


That's it! Make sure that you have replaced the 3mm nuts and washers removed earlier.
You can now drill the board with 3mm holes to take the wires for the extra valve, use a 4mm for its heater wires **BUT FIRST! If you are mounting V3 onto the board then new hole locations have to be used.**
SEE ALTERNATIVE 'POSITIONING V3 SIMILAR TO V1 AND V2' ON PAGES 45 to 47.
The following photographs show the work for **mounting V3 onto the chassis top**. Carefully feed the wires through the holes from the component side and if you colour coded the wires then this should be easy to do. Once the board is in position and the wires pulled through then they can be terminated as required. Remember to push back the tags of the third valve V3, this will allow the board to be slid back into place. It is OK to flex the board slightly to get the large capacitors on the front of the board to pass by the valve. Slowly take up the slack in the wires from V3 as the board goes in, the most frequent obstruction is the heat sink so check that the wires are not snagged on it.



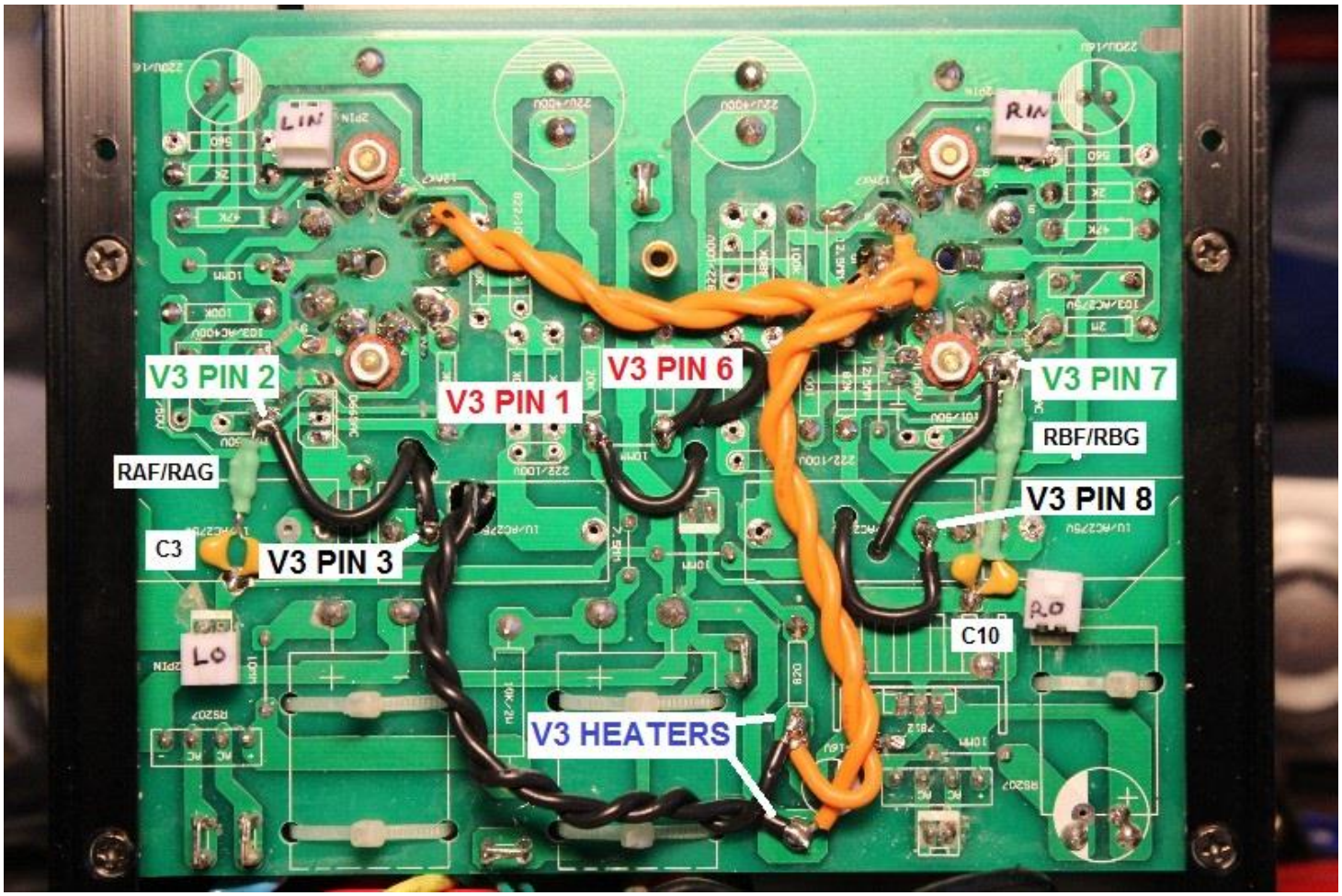
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Below is an early photograph; the Red Anode wires should now be fed through holes further up the board, as shown in previous photograph labelled Plate, to connect with the 10mm link solder pads feeding R22 and R23 (see also next page). Note also that in both photographs the 330k bleed resistors are not shown across the 22uF capacitors which are now of course 68uF. Their fitting is highly recommended and as mentioned it is possible to find space and solder onto newly made and drilled pads close to the capacitors.



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Here is a view of a wired board.



With the board now fixed in place and V3 wires connected, reconnect the Yellow supply wires to the board edge connectors and connect the grounding wires as required.

Reconnect the White heater wires or with later units, replace the two pin connector that provides the supply.

Now for the last part – fitting the EQ's

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Fitting the EQ's (See also lower picture **"**Positions of EQ connections favoured by the Author".



Right hand channel (V2) showing the 8200pF EQ connected to pin 2 of V2. The other end is connected to 0V Ground, there are a number of suitable places for this.

The 200pF EQ is shown connected to the Ground rail that runs across virtually the whole width of the board, easily located here as the wide track going underneath the heat sink outline painted on the board. The other end is connected to what was the Base pin of the old Transistor V4, just to the left of the top fixing nut. A solder pin inserted here helps to carry both the EQ connection and the Grid wire to new valve V3.

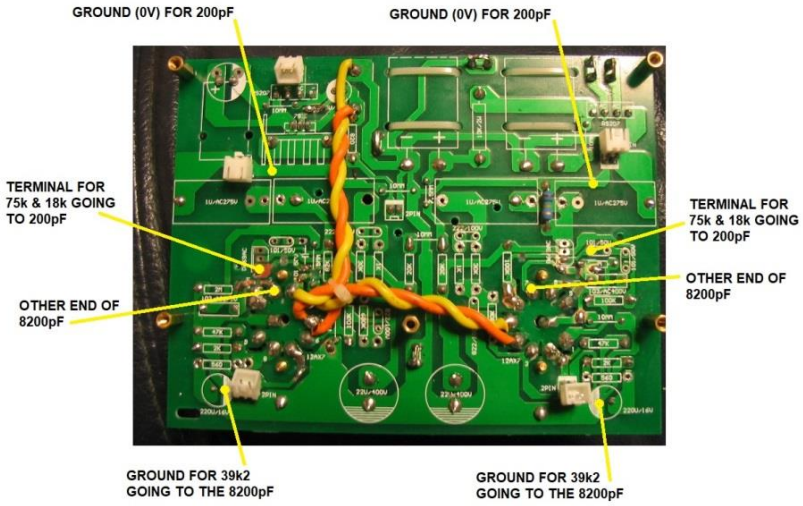


This is the Left Channel (V1) where the 8200pF is connected to pin 7 of V1. the other end is connected to a convenient 0V ground, like the other channel, there are a few locations for this.

Also to be seen is the 200pF EQ connected to the Ground Rail running across almost the whole width of the board, though this is partially hidden by the 8200pF capacitor. This is also connected to what was the Base pin of the old Transistor V3. The author now uses the vacant capacitor pad that is linked to the V3 pad.

IMPORTANT! Despite being covered in heat shrinkable sleeving, leave a tiny gap between the resistors RAF/RAG and RBF/RBG as the tracks that lie beneath them carry full HT (B+) voltage.

Positions of EQ connections favoured by the Author.



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You can now connect the four plugs to the board and temporarily replace the bottom cover with just two holding screws. If you have a digital Multimeter to hand, then it is a good idea to do some 'cold' checks on the circuitry before powering up. Temporarily fitting the bottom cover will save you undoing all of those screws should you find anything wrong?

Just a reminder - valve pins are numbered 1 to 9 clockwise looking from UNDERNEATH. If you are looking INTO the socket where the valve actually goes, then you have to count the pins in an anti-clockwise direction, pin 1 in this case being the first pin after the gap.

It helps to do the measurements if you make up some special leads for locating into the small holes of the valve sockets.



If the unit has been powered up at all then verify that the HT rail is fully discharged before carrying out the following tests. This can be verified using pin 1 and/or pin 6 of the new valve V3 and the GROUND Terminal.

If RAJ and RBJ have been fitted then the HT (B+) will be discharged to a safe level after 5 minutes.
If these resistors have not been fitted then refer to the safety instruction at the top of page 7 where a 1k2 1W resistor can be used to discharge the smoothing circuit.
Check with your Multimeter switched to DC Volts that the capacitors are all but discharged.

CHECK LIST

Test point	Min Value	Max Value	Actual Value	Parts Checked
a) V3 Pin 1 to V1 Pin 1	133k	147k		R22 and R3
b) V3 Pin 1 to V1 Pin 6	332.5k	367.5k		R22 and R6
c) V3 Pin 6 to V2 Pin 6	133k	147k		R23 and R15
d) V3 Pin 6 to V2 Pin 1	332.5k	367.5k		R23 and R17
e) LEFT Phono Input to V1 Pin 2	950	1050		RAA
f) RIGHT Phono Input to V2 Pin 7	950	1050		RBA
g) LEFT Phono Input to Ground	44.65k	49.35k		R1
h) RIGHT Phono Input to Ground	44.65k	49.35k		R12
i) V1 Pin 3 to Ground	1.140k	1.260k		R2
j) V1 Pin 7 to Ground	1250.2k	1381.8k		R5 and RAB
k) V1 Pin 8 to Ground	2.090k	2.310k		RAD
l) V3 Pin 3 to Ground	142.5k	157.5k		R7
m) V3 Pin 8 to Ground	142.5k	157.5k		R18
n) V2 Pin 8 to Ground	1.140k	1.260k		R13
o) V2 Pin 2 to Ground	1250.2k	1381.8k		R16 and RBB
p) V2 Pin 3 to Ground	2.090k	2.310k		RBD

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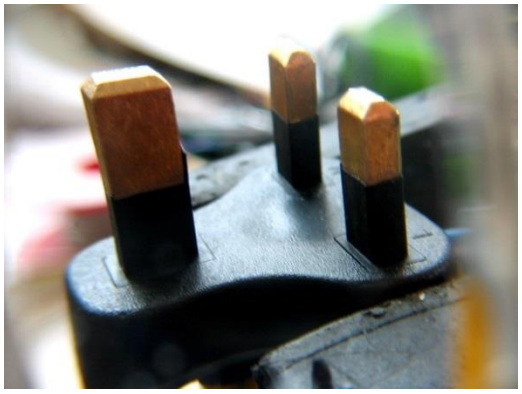
Test point	Min Value	Max Value	Actual Value	Parts Checked
q) LEFT Phono Output to Ground	950k	1050k		RAH
r) RIGHT Phono Output to Ground	950k	1050k		RBH
s) V1 Pin 6 to V3 Pin 2	171k	189k		RAE
t) V2 Pin 1 to V3 Pin 7	171k	189k		RBE
u) V3 Pin 1 and V3 Pin 6	n/a	n/a	**Short Circuit**	
The resistance test between V3 Pins 1 and 6 should show a short circuit and proves that both halves of the valve are connected to the B+ (HT) line. It might be prudent at this point to do a quick check between these two valve pins and Ground to check that no short circuit exists.				

AS WITH ALL WORK CARRIED OUT ON CLASS 1 EQUIPMENT, AN INSTRUMENT PAT TEST OR EQUIVALENT SHOULD BE CARRIED OUT ON THE POWER CONNECTOR. CHECK FOR GOOD EARTH BOND NOT GREATER THAN 100mΩ AND INSULATION NOT LESS THAN 100MΩ AT 500V.

If all tests are OK then you can fully fit the bottom cover into place.

VERY IMPORTANT! YAQIN UK PLUG WARNING!

If the supplied Yaqin power cable has a plug with a sleeved Earth Pin, or a fuse that is not clearly seen, it is unsafe and illegal, cut it up and dispose of it. This really is a fire starter when plugged into the standard UK 30 Amp ring main system, as it contains no fuse at all, the wire is only good for 2 Amps and the core colours do not comply with EU/UK legislation. Worse still, the Live and Neutral connections have been found reversed inside some of the Plugs!





Fit a new IEC cable and Plug, fused at 3 or 5 Amps.



The Author likes to fit one of the above labels to the underside but if you cannot buy one without having to buy a sheet of 20 or more, he suggests that you make one in MS Paint. Apply double sided tape, cut out and stick to the bottom cover.

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Optional re-work of valve top cover.

So is there anything we can do with the original MSS23B valve cover that is now ready for the scrap bin? Yes there is! Read on.

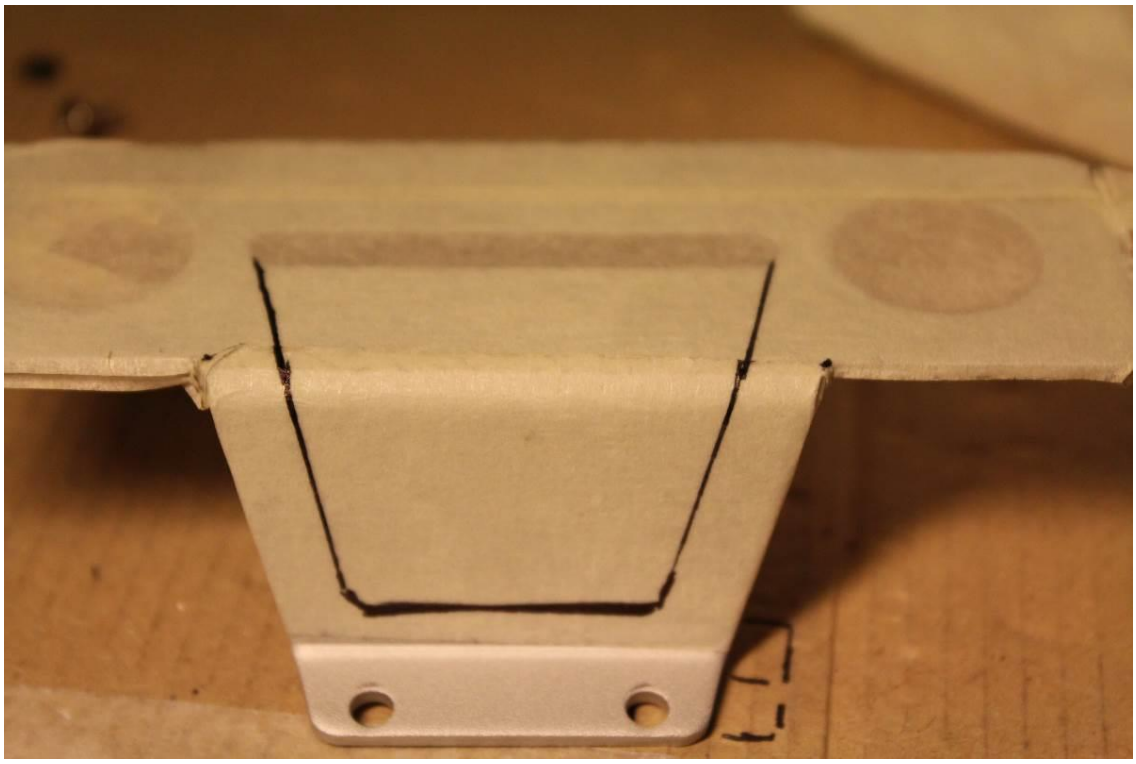
Fellow Yaqin enthusiast Mark Kerr had his MS23B converted but decided to modify the original tube cover for further use. Here is his write up on the work he did, thanks for sharing Mark.



This mod is to allow the shield to be replaced after carrying out the 'Les Box' mod on the Yaqin MS-23B.

Note: If you decide to mount V3 directly to the circuit board you may find that the cover fits without any modification. This is because V3 sits a little lower, similar to when using a Swap Board.

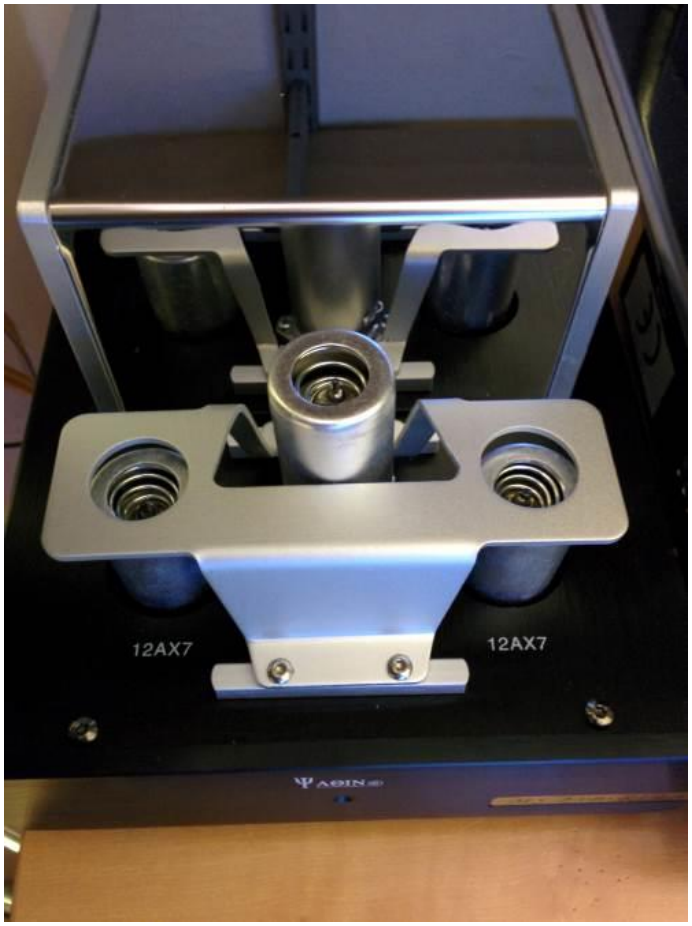
With the rear of the shield facing towards you using a pencil and a steel ruler mark two lines 7mm in from the edge of the upright section so they are parallel to the outside edge and extend from the fold to the curve to the top surface.
Extend the lines from the curved edge so they meet the outer edges of the oblong cut-out in the centre.
Hopefully the image should explain the outline required.



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Using a junior hacksaw with a sharp blade, cut down this line from the centre cut-out to the crease being careful to not go over the outer edge of the line nor past the crease at the base (yes my example in the next photo shows what happens if you do, thankfully as it faces the rear it is slightly forgiving).
Cover the flat portion at the rear with the two screw holes in tape and secure in a vice or similar
Gently flex/wiggle the cut portion to and fro above the crease and it should break off with metal fatigue.
Dress the edges with a file and sandpaper (fine grit), then clean and remove all particles before re attaching.

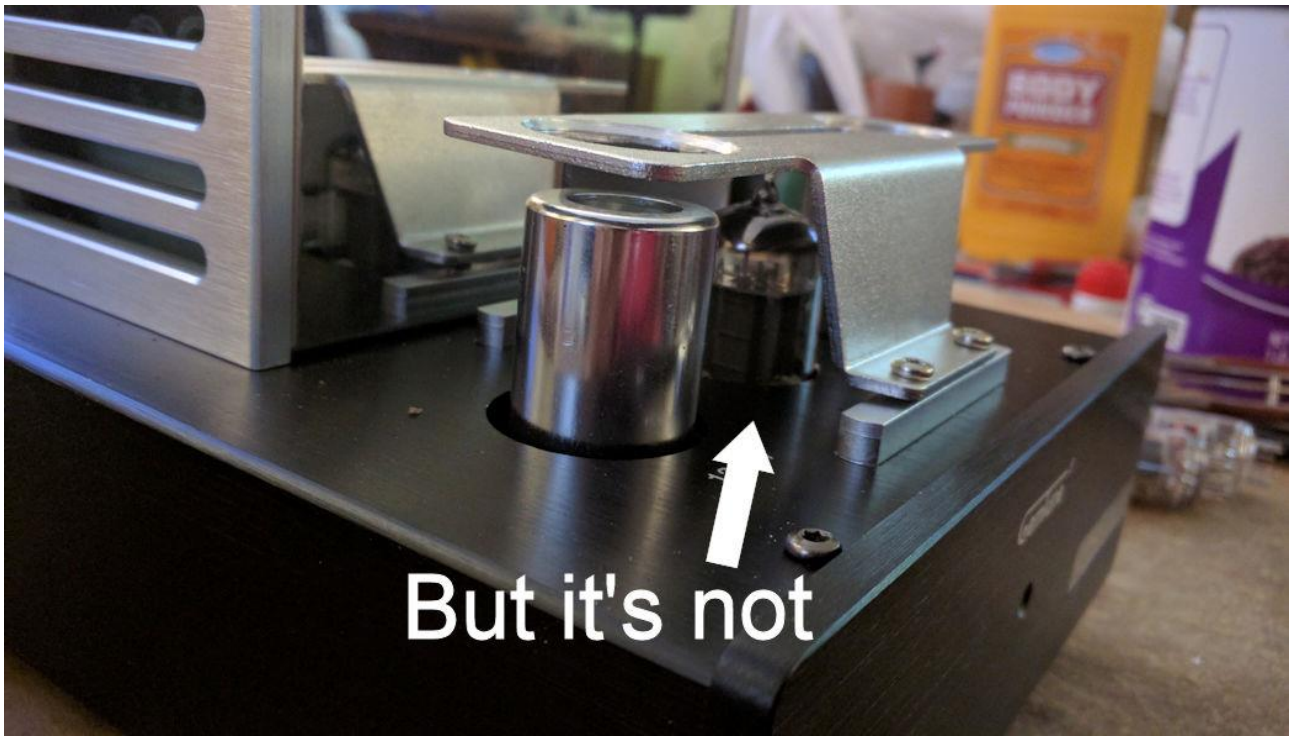




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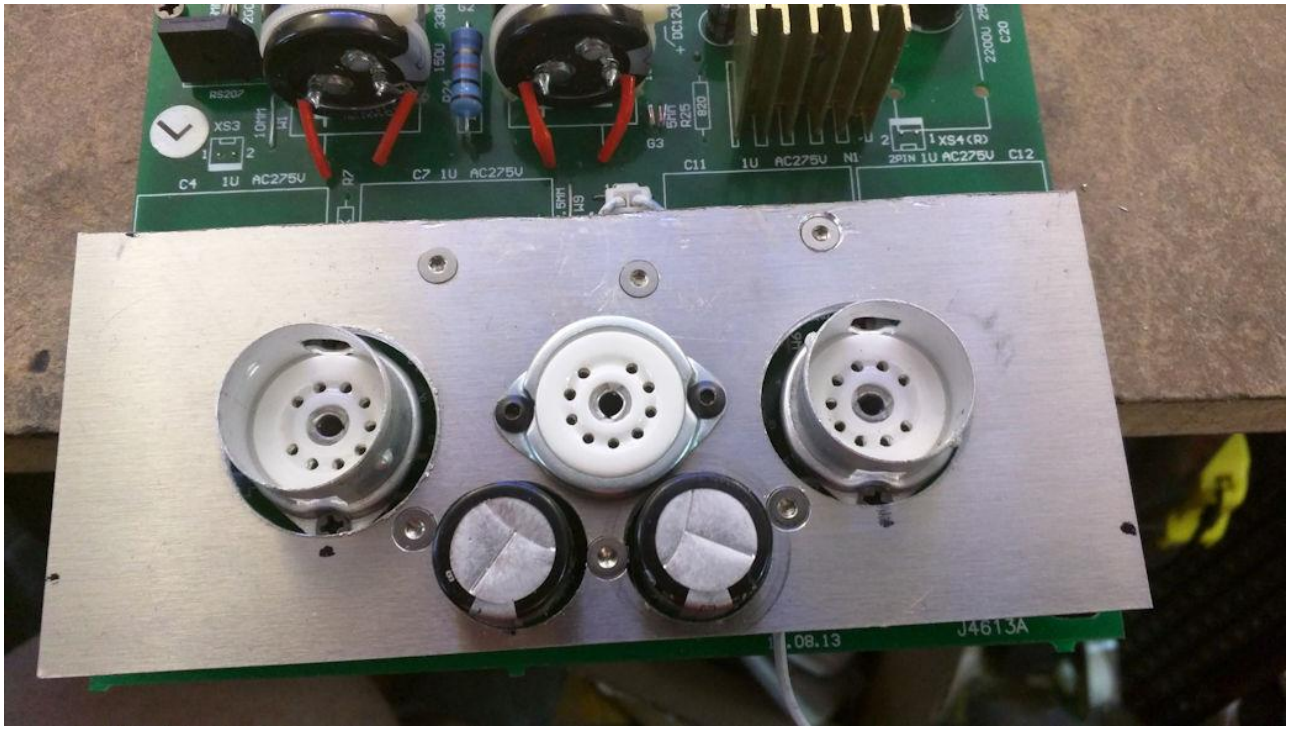
John (celebabe on the diyAudio Forum) shows how he mounted V3 whilst retaining the original tube shield. There are no measurements available but hopefully the pictures tell enough of the story.



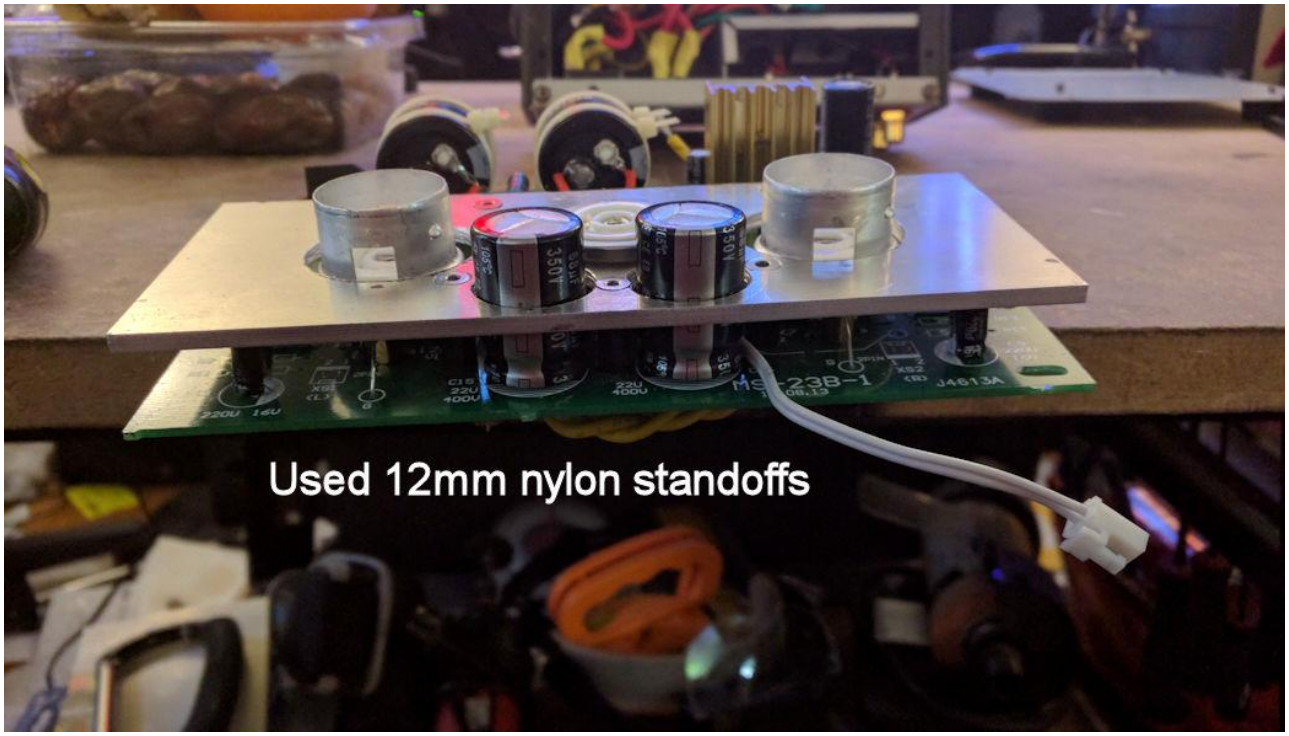


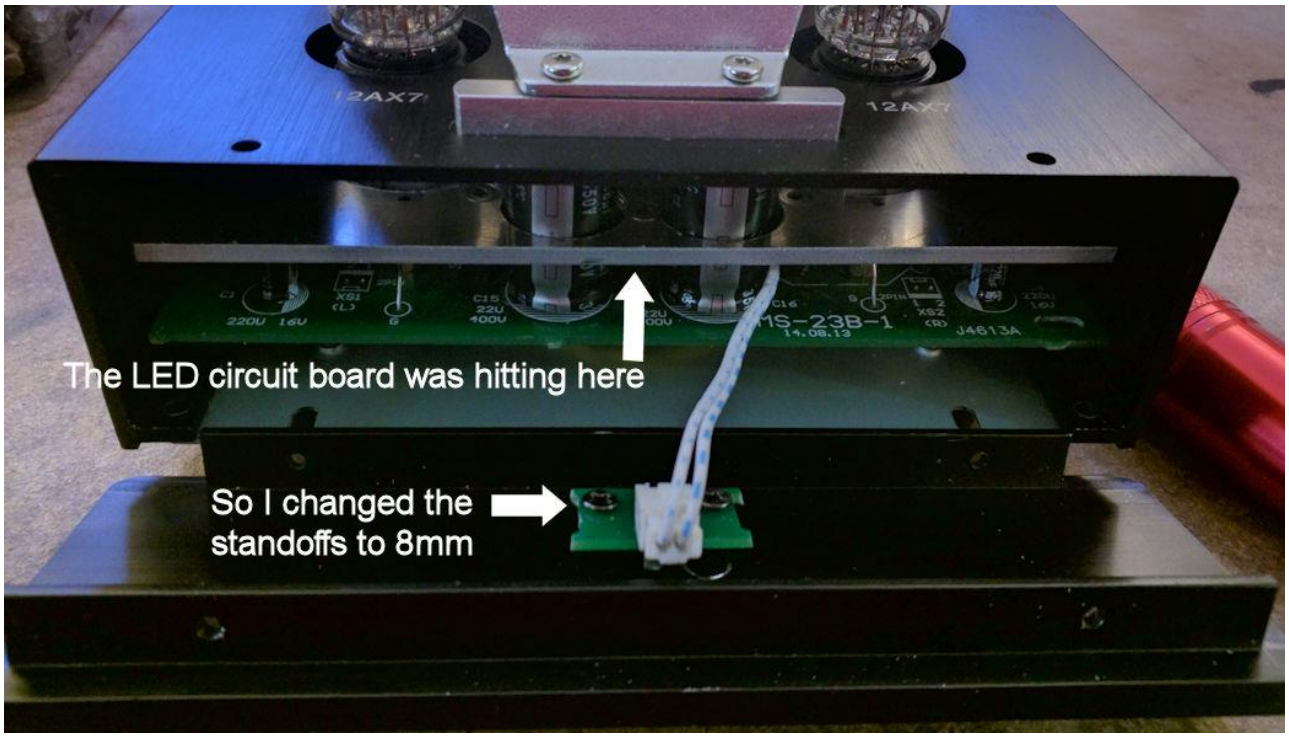
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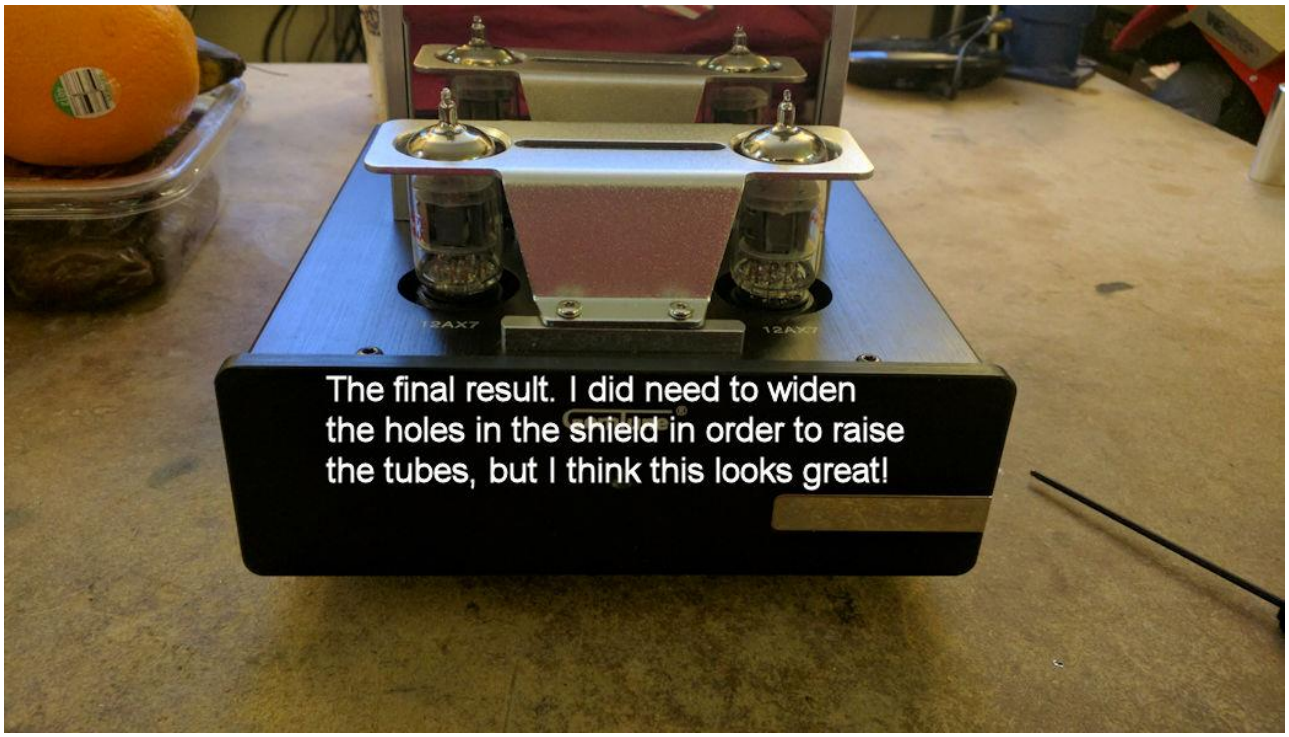




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Notice in the above picture John has raised the tubes using saver sockets so as to show off the tubes. Without screening cans being fitted however, it may allow RF fields to inject noise into the amplifier. Here are two photos of the saver socket version.





Thanks John for sharing your idea.

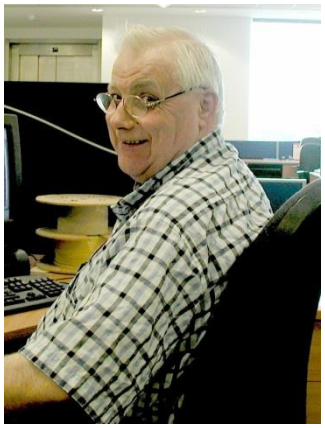
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Here is a fully converted MS23B photo from Juha Järvelä



And that's it apart from a good session with your favourite vinyl to discover the magic that is now there!

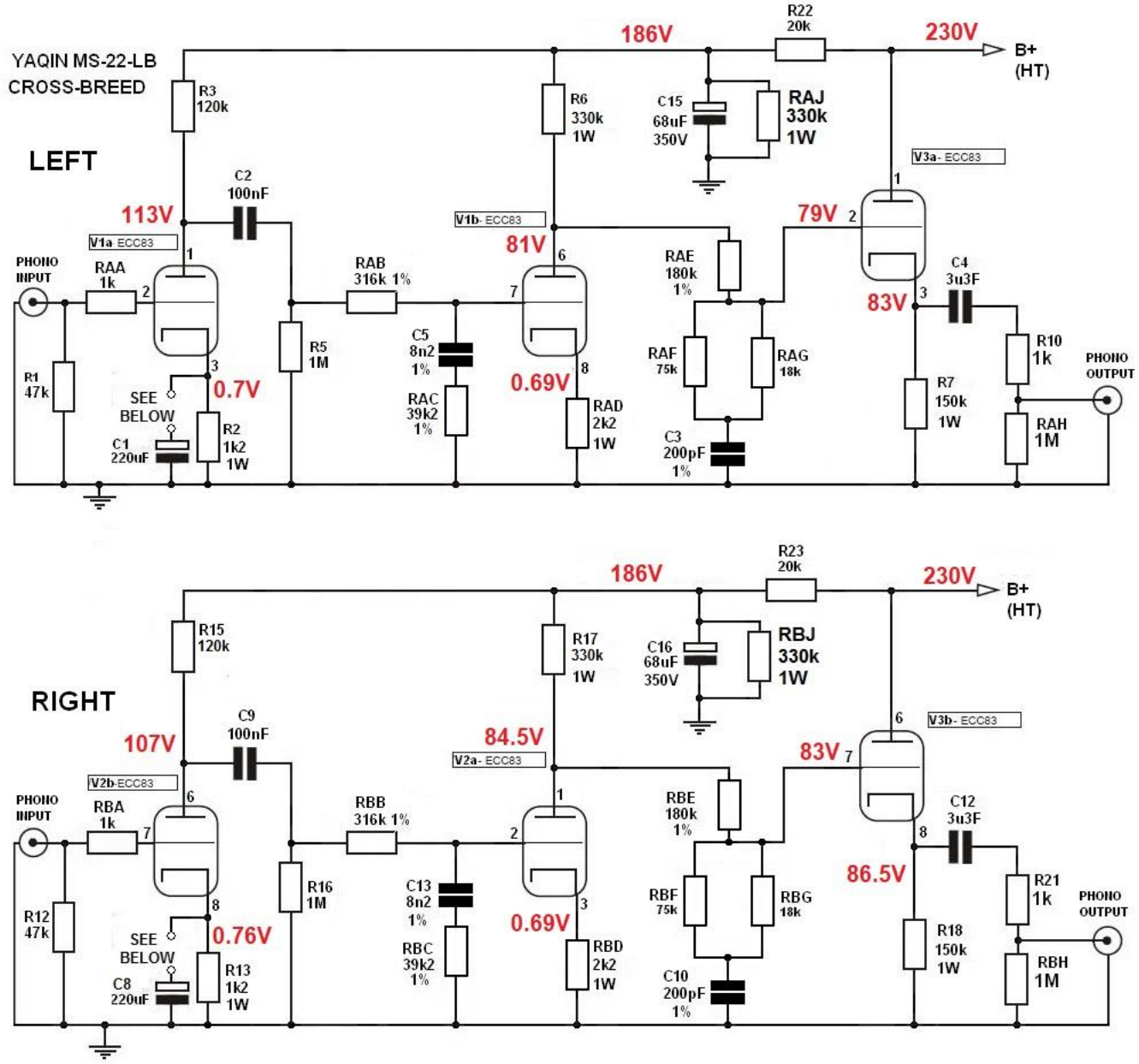
Happy Listening…. Lez at ntlworld dot com





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The circuit after conversion.

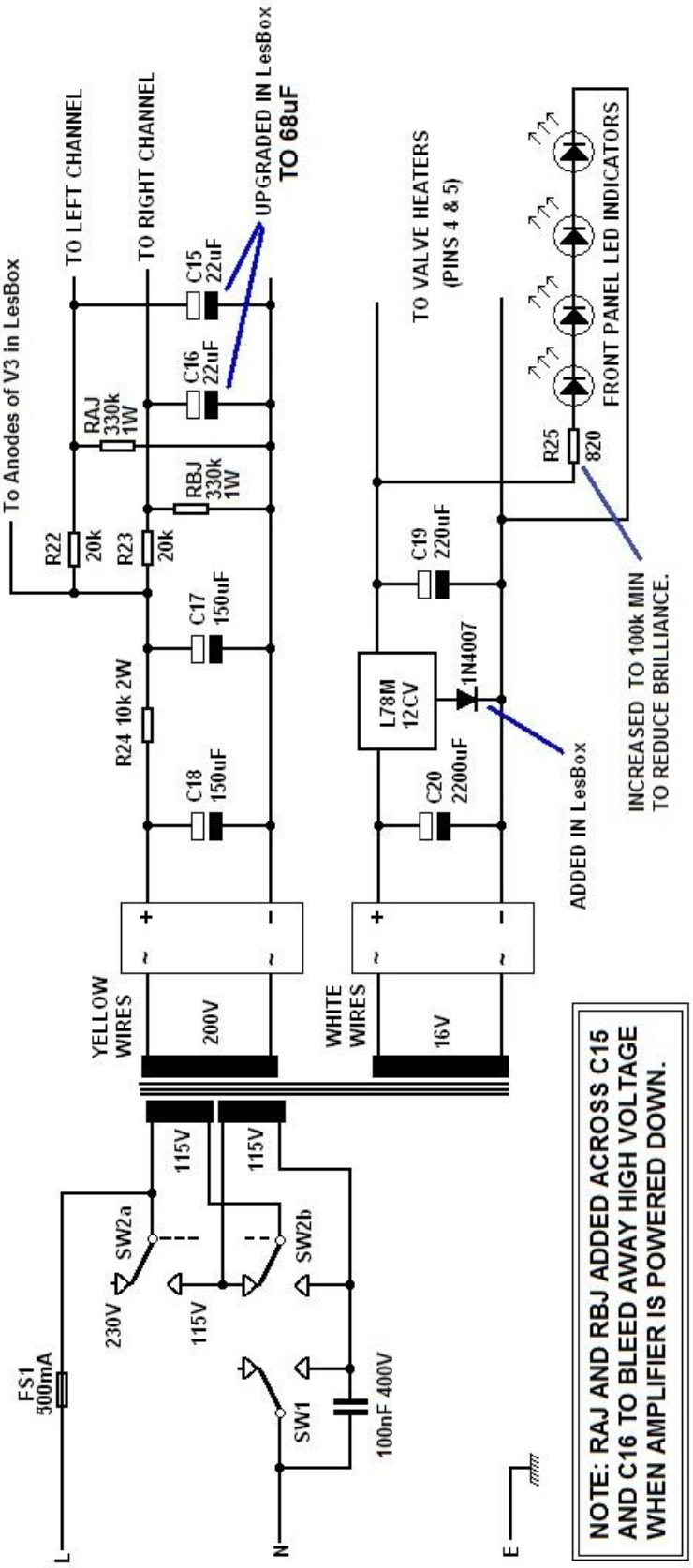


EXTRA 6dB GAIN CAN BE ACHIEVED BY APPLYING LINKS AT C1 AND C8 POSITIONS BY LINKING ACROSS THE VACANT PADS OF THE UN-USED 560 OHM RESISTORS R11 and R14. THIS IS NOT RECOMMENDED FOR NORMAL USE AS IT INCREASES THE CHANCE OF DISTORTION BY NEGATING THE LOCAL FEED-BACK.

VOLTAGES TAKEN WITH A SUPPLY INPUT OF 244V 50Hz.

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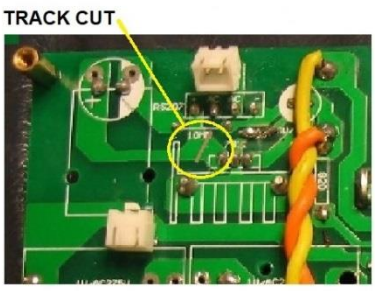
The power supply.



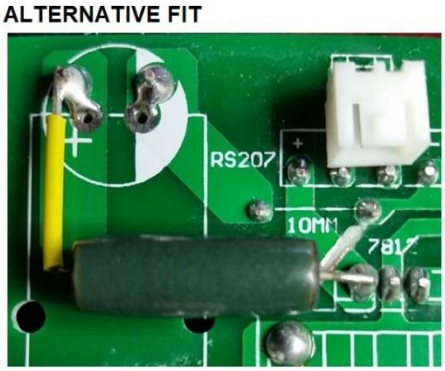
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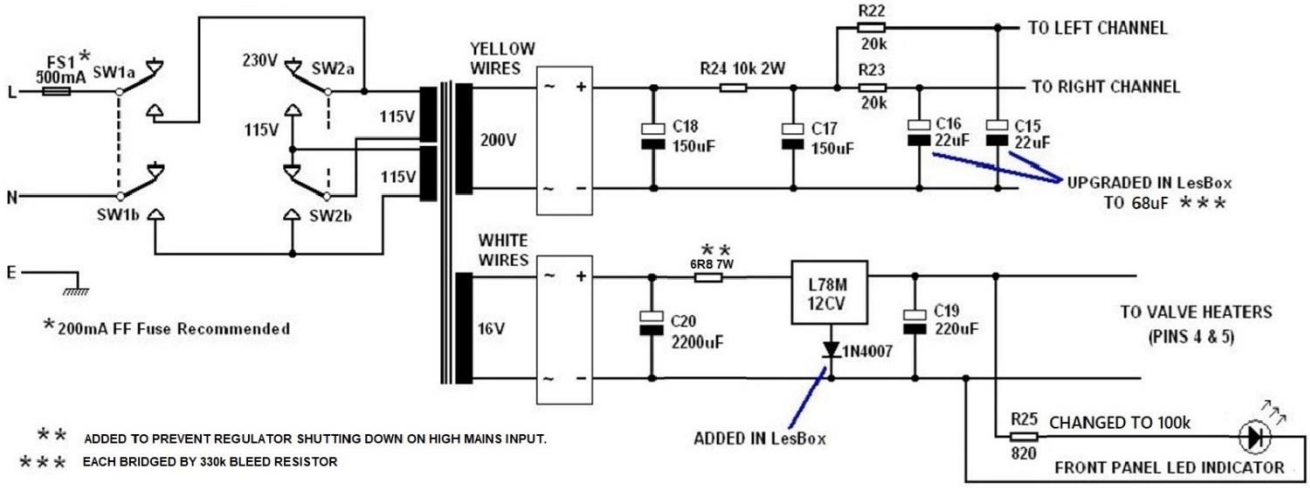
Heater shut down problem.

As of the cover date, the author has converted many MS23's but recently had a problem with two newly manufactured units. One decided to slowly fade out after 20 mins, the other after 2 hours, indicated by the front panel LED being dimmed or extinguished. The 12V regulator was over heating and going into thermal shut down, the filament winding of the power transformer after rectification was giving 18 Volts instead of the usually expected 16V. The regulator is thus now dropping just under 6V and dissipating around 3 Watts. The heat sink should be adequate but bear in mind that there is limited air flow for it to do its job properly. The answer to the problem, should you experience the same, is to fit a 7W 6.8 Ohm resistor inserted between the reservoir capacitor C20 and the input of the regulator. You have to make a track cut, as shown in the photographs, but at least the regulator input will now be more correctly connected directly onto C20, via the new resistor. The resistor takes 3V away from the regulator which now only has to dissipate 1.35 Watts, allowing the heatsink to ensure the regulator does not reach its internal thermal limit. The circuit operation has been checked, using a Variac, to ensure that the regulator still does its job with low supply voltages. The best place to sit the resistor is in the gap between the board and the outer case, lengthening the wires as required, covered in small bore heat shrink sleeving. Thankfully, this change can be done without having to remove the board and only required on units that exhibit the 'shutdown' problem.





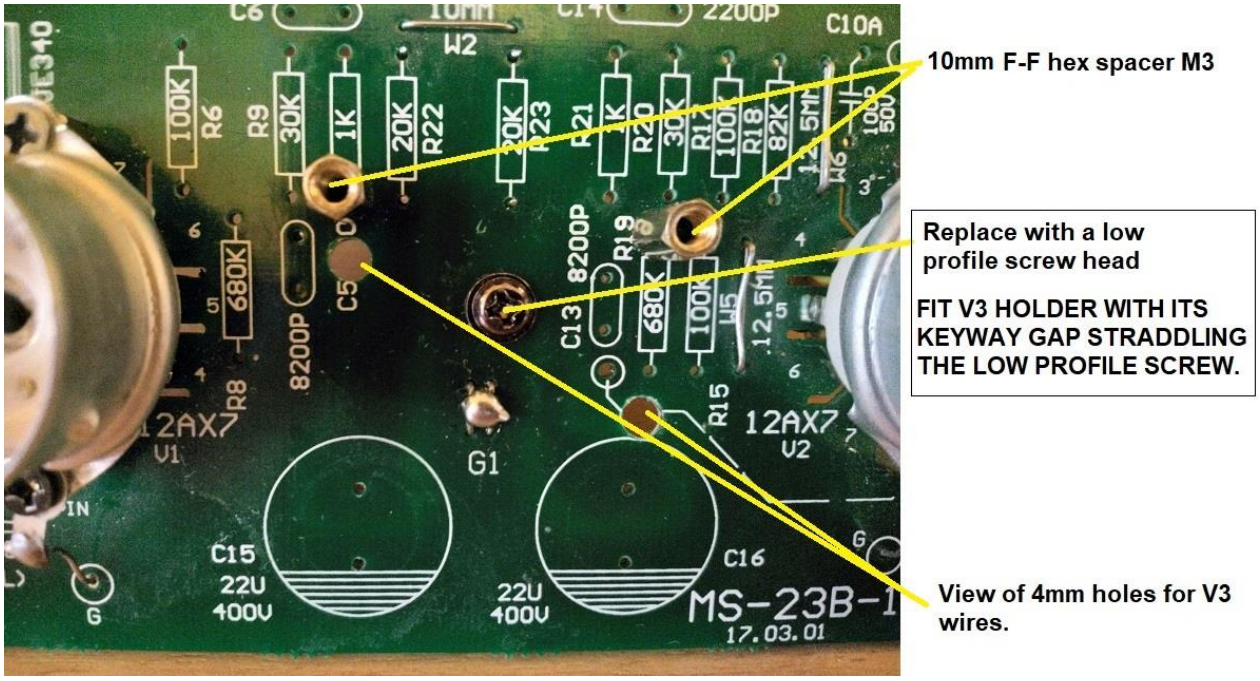




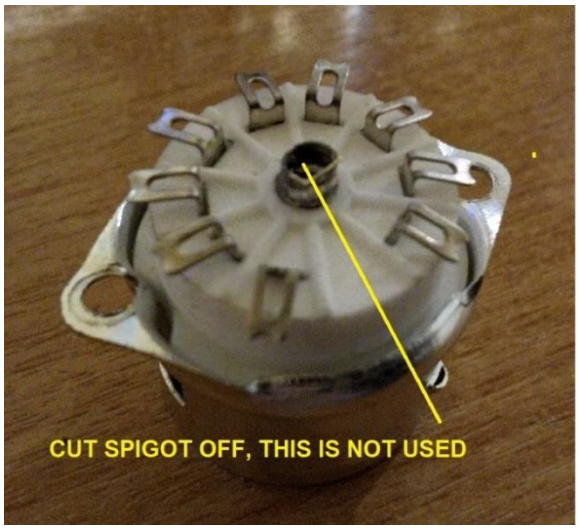
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POSITIONING V3 SIMILAR TO V1 AND V2

The Author had been toying with the idea of placing the holder for V3 onto the board and just drilling a 28mm hole on the top for V3 to poke through. He had a spare stock board so decided to try, particularly with the view of keeping the same spacing as if fitting a Swap Board. The only downside is that the holder is only supported by its fixing lugs so care has to be taken when installing or removing V3.



The nine solder tags of the holder are bent outward (see photo) which was not a problem; the wires were soldered on and sleeved with heat shrink tubing. The Author used M3 screws and two M3 threaded hexagonal spacers of 10mm length, these should be 7mm to match the other valve holders but the extra 3mm gives some welcome extra room for the wiring. Not shown but recommended if fitting a shielded socket, is to fit a M3 solder tag under one of the screws and connect it by a short wire link to the Ground point G1 which is shown prepared with solder for the link wire.

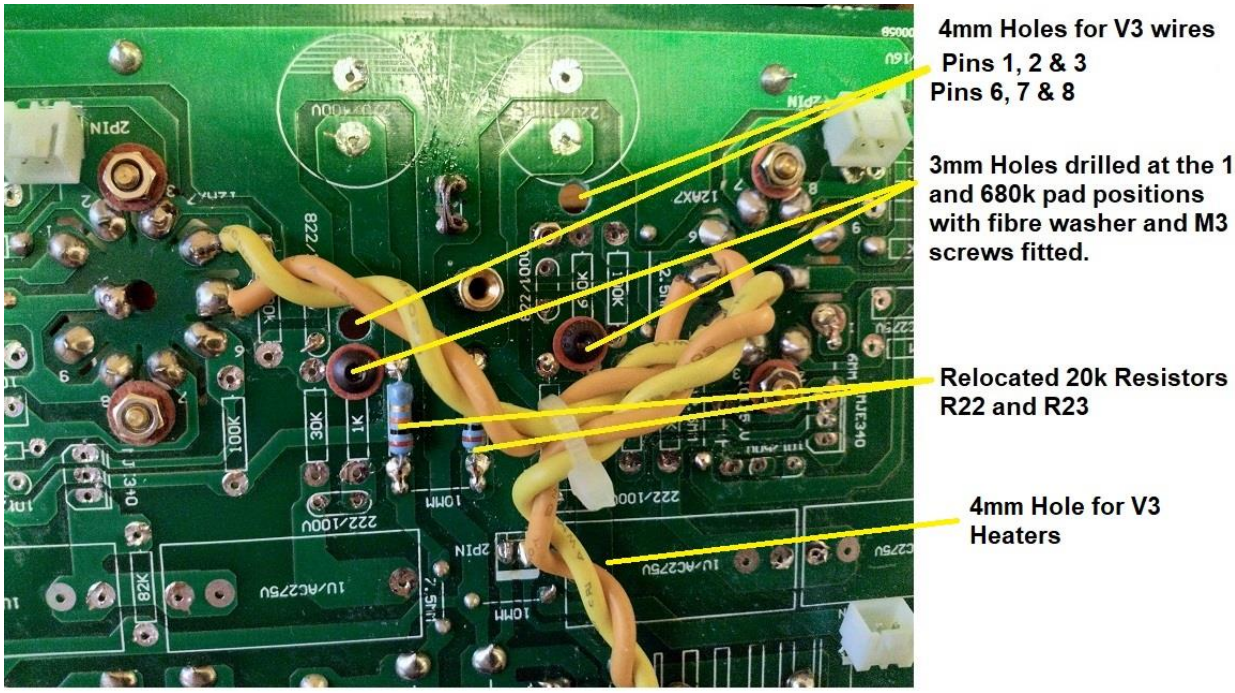


IMPORTANT

To give more clearance for the holder, it is recommended that R22 and R23 (20k) are relocated onto the underside of the board. Ensure that any wire ends are cropped close to the board so they cannot penetrate the wiring from the V3 holder.

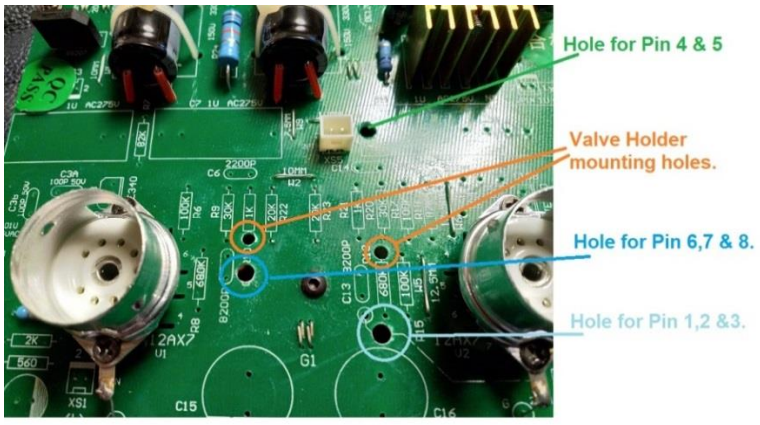
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To accommodate the mounting holes for the stand offs, the Author used (located on the Left channel), the pad areas associated with the resistors 680k (R8), 30k (R9) and 1k (R10).
For the Right channel locations, he used the pad areas associated with the resistors 680k (R19), 30k (R20) and 1k (R21). These areas become unused and spare when the original components are removed.



Fibre washers were placed under the screw heads on this side due to the fact that they are close to the HT (B+) tracks feeding the smoothing capacitors. If you can find one, a NOS UK made McMurdo holder is best to use as its flange is much thicker than current production from the far east and gives a firmer fixing.
The Author had a MS23 arrive later for LesBoxing and it was good to see it all go together OK, the main worry was the position of the 28mm hole and if it matched the proposed V3 board position but all went well.

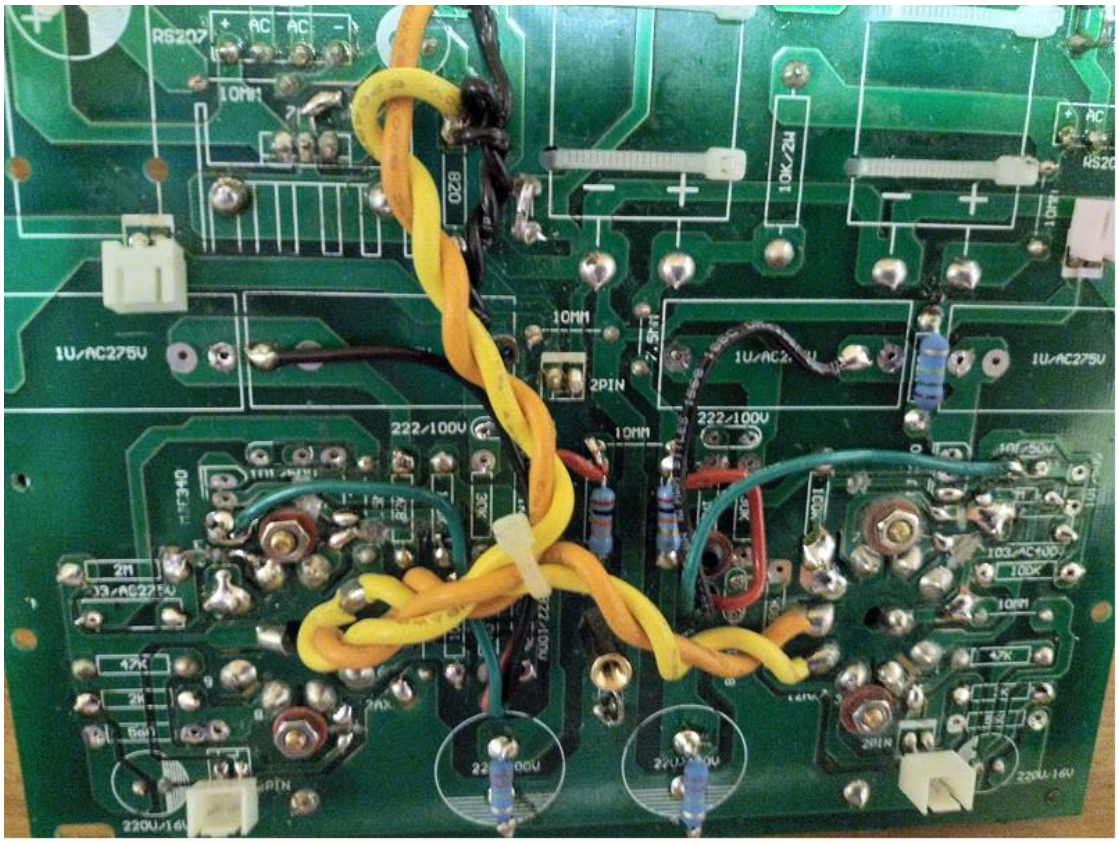
Another view of holes drilled.

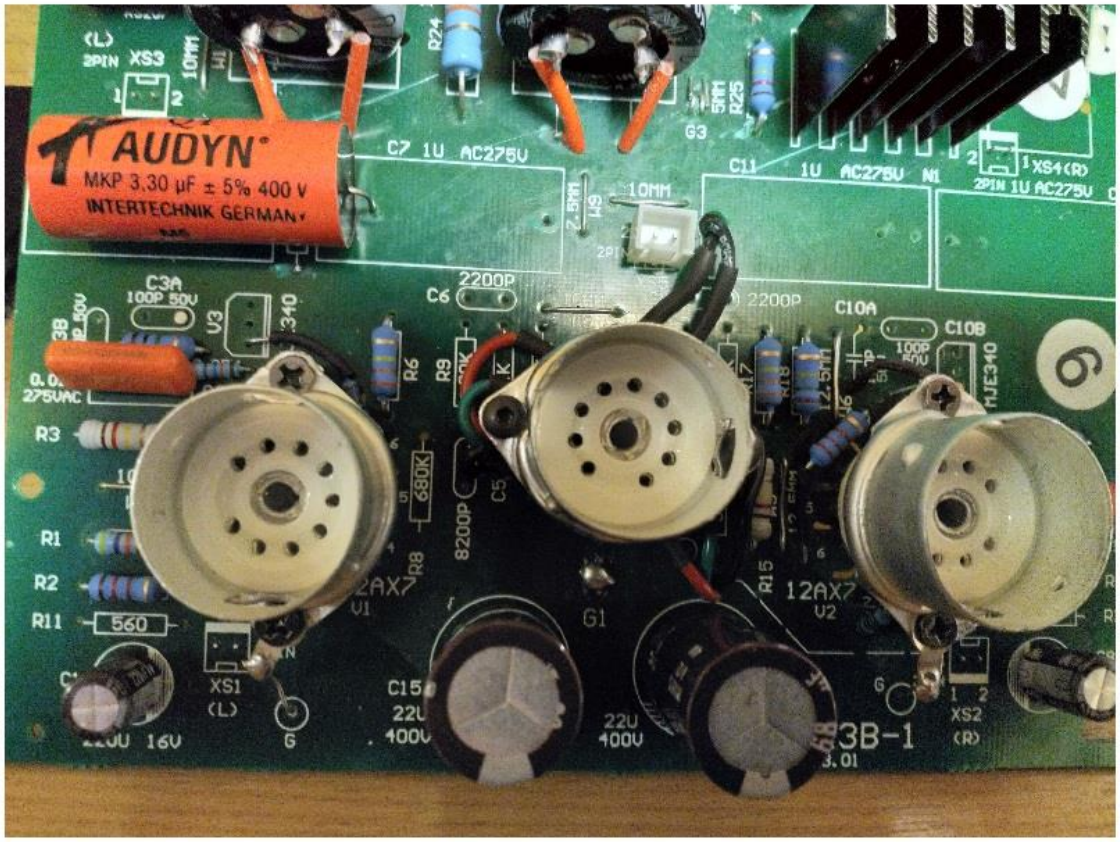




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All you have to do now is fit the holder, wire up and continue with EQ fitting detailed on Page 32.





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For those wishing to build a Rev.2 Swap Board:-
http://www.g4cnh.com/public/PART_1_Making_a_Rev_2_swap_board.pdf

For those wishing to install a ready-made and tested Rev.2 Swap Board:-
http://www.g4cnh.com/public/PART_2_Fitting_a_Rev_2_swap_board.pdf

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