

The Yorkville In-House Method for Repairing AP Series Amps

At Yorkville, we have developed a method of rebuilding AP series power boards in the shortest possible time. This method is valid for repairing about 95% of all AP amp failures and is essentially the same process for each of the different models in the AP line.

This process was not designed to correct problems other than blown outputs and collateral losses. We still see an occasional failure in other areas, but about 95% of all amps that you receive in PROTECT mode, will benefit directly from this method.

This uniformity of approach is possible because all AP series amps share the same basic circuit topography and protection circuits. The rail voltages and the number of output devices may change, but overall they remain more alike than they are different. Only the AP800 & AP1020 have enough differences to warrant a comment or two.

The entire program rests on the experience we gained while rebuilding these boards. What became apparent was the fact that we needed to focus on rebuilding the board and not trying to ANALYZE the problem. As you can imagine, this practice goes against just about everything we have practiced as repair technicians. But, by using this method, we were able to reduce turn-around time and expense by more than 50%. In fact, with practice, an average technician can do a full meltdown rebuild in about 90 minutes. The exception to this rule would be the AP 6040, which runs about 3 hours for an average rebuild.

The root of this system is the practice of NEVER measuring TO-92 style transistors. They are always replaced because it takes about 5 minutes to replace them and they cost next to nothing compared to the cost of analysis and the risk of a failed rebuild. I instituted this policy after discovering that these little transistors have a really nasty habit of “half-failing”. By this I mean that we were testing these things in the normal fashion and they were showing “good”, but when powered up to operating voltage, they would do all kinds of inexplicable things. As soon as I mandated the practice of always replacing these little transistors, these strange post-rebuild malfunctions disappeared and departmental efficiency went way up.

Determining which channel is blown

In order to determine which channel(s) requires repair, it is only necessary to open the chassis and flip the upper circuit board out of the chassis without disconnecting any wires (be sure to insulate the board from touching the chassis when in this position). Then all you need to do, is turn on the power and measure the voltage across ZD7 on each power board. (The location of ZD7 is shown on the M1146 Diodes & Semi's PDF) If the voltage here is less than the zener rated voltage of 16volts, the board under test is blown and probably in DC offset.

Locating Defective Parts

Attached to this file are 3 PDF's that locate and identify all the components which require measuring. For the purpose of clarity I have divided the components into 4 groups, each with its own colour. Further to this, I separated the parts into 2 PDF's, one for resistors and one for semiconductors. In order to provide maximum clarity, I have expanded isolated areas of the circuit board, showing only the area of the board, which is home to the suspect components. By doing this I have cropped out half of the output transistors, emitter resistors and tier diodes (MR854) from view. Please be certain to test these none-visible parts along with the rest of the output devices , resistors and diodes.

The PDF Colour Coding

Green These are the large transistors and Fet's.

Simply test these with your diode checker and replace any shorted units. You will almost never need to replace the tier Fet's, they never seem to fail, but we check them anyway. Although it is not shown on the PDF, you will need to check the output crowbar TRIAC for shorts, along with everything else.

Blue These are all the diodes to be measured (remember, we only show 4 of the 8 MR854 tier diodes which must all be measured). The only significant measurement in this group will be a short circuit which signifies a diode to be replaced.

Red NEVER MEASURE THESE, Always replace these 8 transistors

Yellow These are the resistors to be measured. You are only interested in units, which measure open circuit, all other readings are meaningless at this time Please note that we are only measuring resistors of 249 ohms or less, with the exception of the 2 x 3K resistors and the 10K trim pot.

The Process

With the component side up and the heatsinks farthest from you. We use a continuity checker (you may use a diode checker) and begin by checking the 8 emitter resistors for open circuit. I immediately cut out any components that measure defective, We do not unsolder the lead fragments until I have cut away all the various bad parts.

Next. Measure the MR854 tier diodes and cutout any bad ones. Now measure all the transistors outlined in GREEN, cut out or remove any which are shorted. The output devices must obviously be unsoldered to remove them from the board. *Please note that it is not uncommon to find it necessary to unsolder and isolate all of the output bases and emitters in order to find all the shorted output devices.*

Now measure all diodes in BLUE (except theMR854 that you have already done) and cut out any that read short. When that is done you may measure all resistors shown in YELLOW, and cut out any that read open circuit. It is also a good idea to check the bias trim pot (orange colour) just to be safe.

Once you have located and cut out all the short and open components, it is time to unsolder and remove all the remaining pieces of the component lead wires from the board. After that, collect all the parts you need and install them to the board.

For the sake of efficiency, I have small parts bins on the bench which have quantities of all the values of resistors I need and all the diodes as well. I only go to the main parts bins to get the big transistors required for the job. (10 different resistors and 6 different diodes will cover 90% of the work). I also keep the mandatory TO-92 devices on my desk because they are always replaced on every job.

After you have replaced all the defective parts, it is time to repeat the measurement process. This is a precaution against installing the wrong value or inverting the polarity of a diode and things like that. This time the values you measure will be quite close to the value of the installed resistors (except for R11 which usually reads about 16ohms).

When you are satisfied that all the right parts are in the right places and measuring the appropriate value, you may proceed to a soft start power up of the board. If all goes well, you need only set the bias and return the board to the chassis.

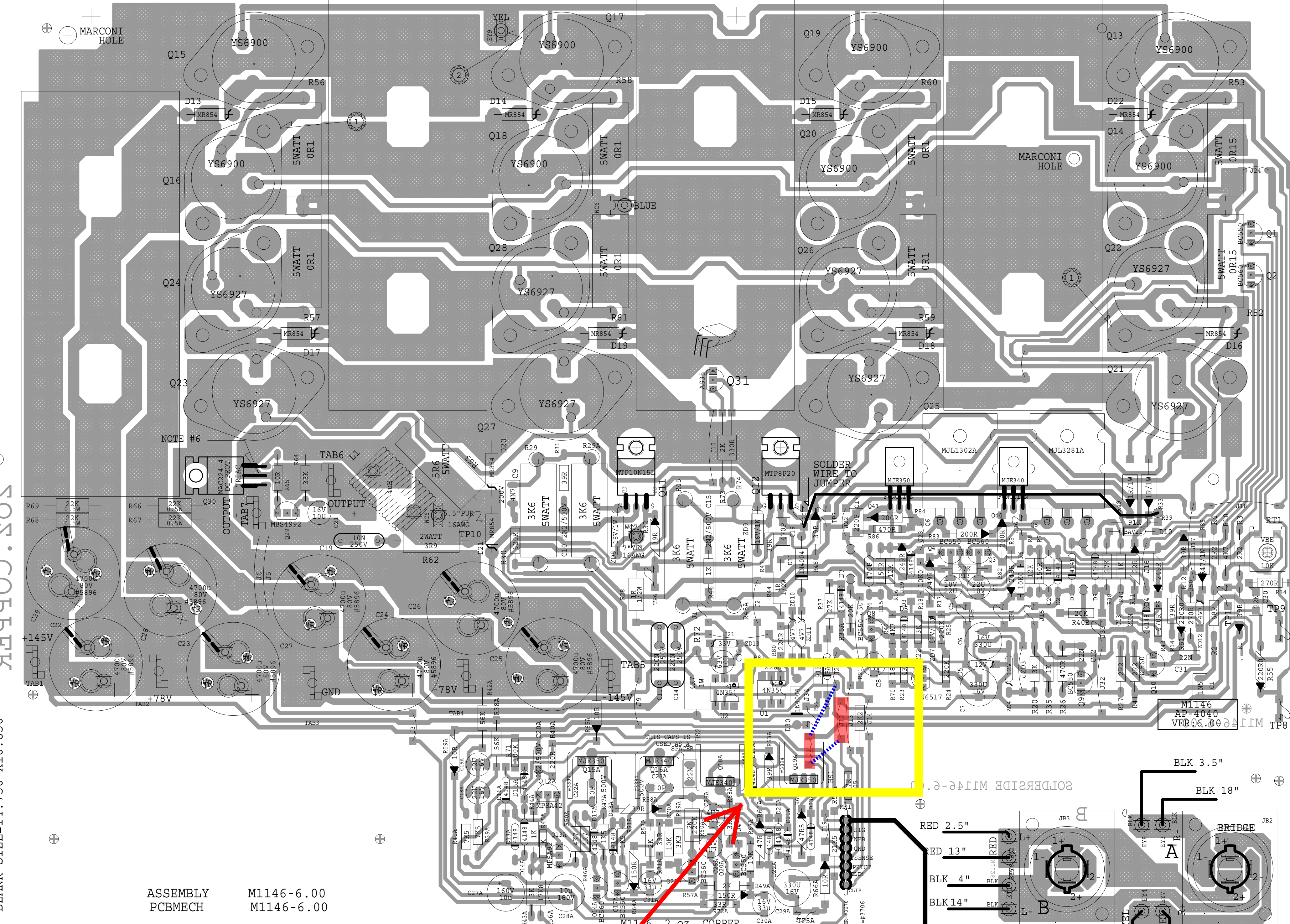
Exceptions to the rules

There will be rare occasions when the voltage amp will be compromised as well as the current amp. In this case it is only necessary to use the same basic process to repair the voltage stage. And as always, just replace the small signal transistors as we do for the current amp stage. In order to effectively deal with the voltage amp, it will probably be necessary to electrically isolate the voltage amp from the current amp. To do this I have created a PDF called “Separate voltage and current amps AP4040”. When you are finished the repair, just restore the original connections for normal operation.

The AP6040 is a special case as a rebuild. This is due to the fact that a 6040 is really pretty much 2 AP4020’s on each output circuit board. In order to repair these boards, you should treat them as a permanently bridged AP4020. Repair each half of each channel as if they were separate AP4020’s. Due to the high currents generated in the bridged condition, these amps are more susceptible to destroying circuit board traces than their un-bridged counterparts. Please keep a sharp lookout for bad traces on this board. Because this amp is really 4 complete amps an two boards, we found the rebuild times to be twice what they are for our regular two channel amps.

M1146 AP-4040

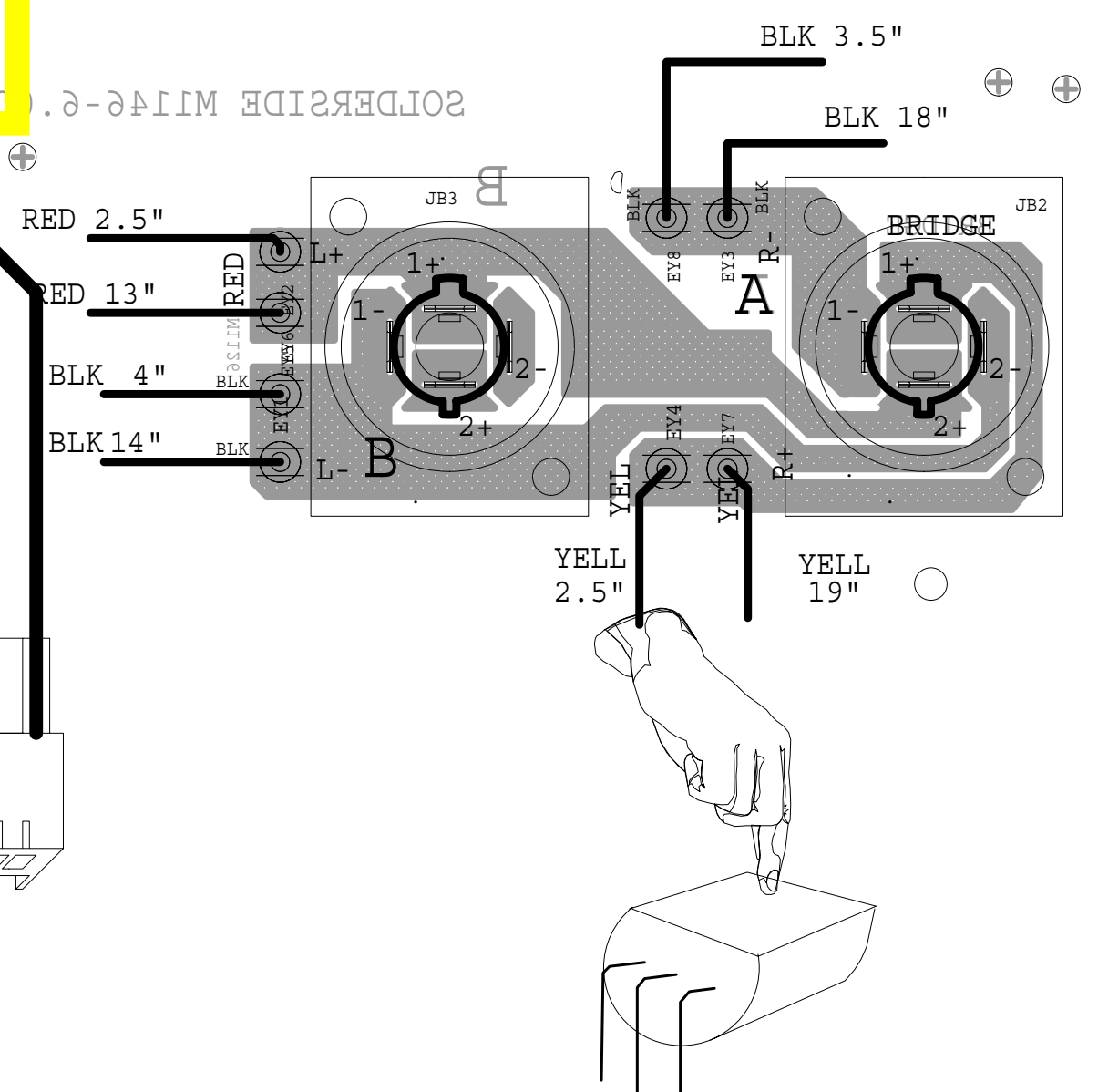
REF: 0905PTKY
"08.01X10.12" B1WK 215-71-120X10.850"
SOS COPPER
BLANK SIZE=14.750"X10.850"



ASSEMBLY M1146-6.00
PCBMECH M1146-6.00

| M1146 PCB DATABASE HISTORY | | | |
|----------------------------|-----------|------|--|
| MODEL(S) :- AP4040 | | | |
| # | DATE | VER# | DESCRIPTION OF CHANGE |
| 1 | FEB/12/98 | 1.00 | RENAMED M1126A->M1146 |
| 2 | JUN/19/98 | 1.01 | PC#5767 C10/C15/C20A 2N2 TO PT#5427 |
| 3 | JUL/45/98 | 1.02 | PC#5798 R72 4K7 1/2W->4K7 1W |
| 4 | SEP/10/98 | 2.00 | PC#5806 ADD 33R 33u/16V ACROSS R57A R64A C30A/R72A C31A/R71A |
| 5 | JAN/27/99 | 3.00 | PC#5908 U1,U2 4N35->TLP621 |
| 6 | JUL/08/99 | 4.00 | SPKON JACKS RE-CONFIGURED |
| 7 | AUG/12/99 | 5.00 | CORRECT ERROR IN SPKONS |
| 8 | OCT/12/00 | 6.00 | PC#6278 ADD R56-C17 AT Q41 |
| 9 | | | PC#6083_REDO_GND_TRACKS |
| 10 | | | |
| 11 | | | |

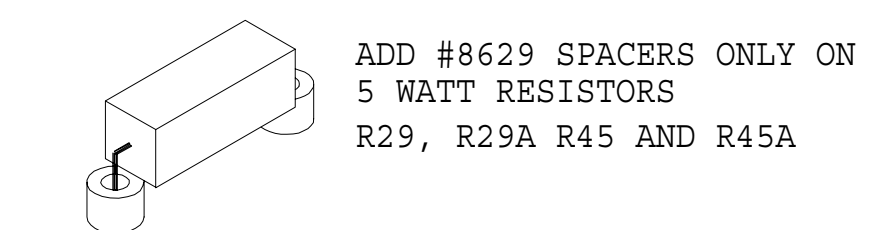
In order to separate the voltage amp from the current amp. It is only necessary to remove jumpers J11 and J12 (highlighted in red) and then make the two new connections as shown by the BLUE dotted lines.



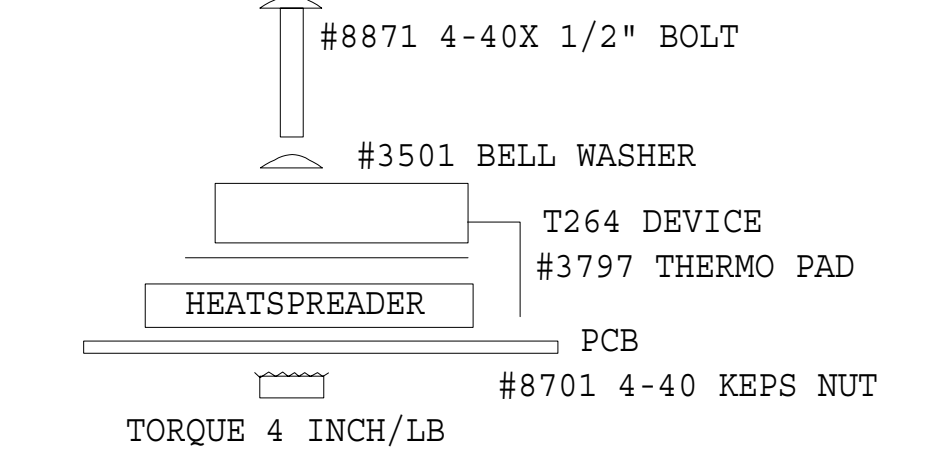
9 Q31 IS HAND INSERTED AND BENT OVER WITH FLAT SIDE UP AS SHOWN.

10

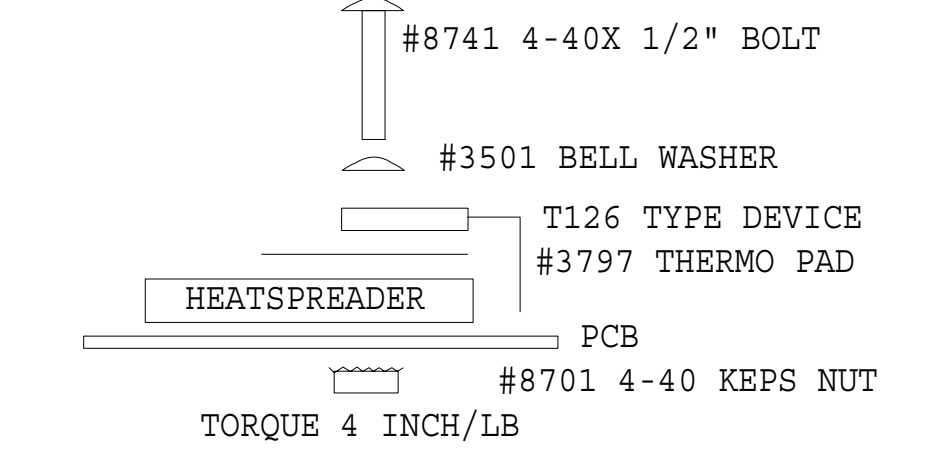
1 PRODUCTION NOTES MOUNTING DETAILS FOR 5W



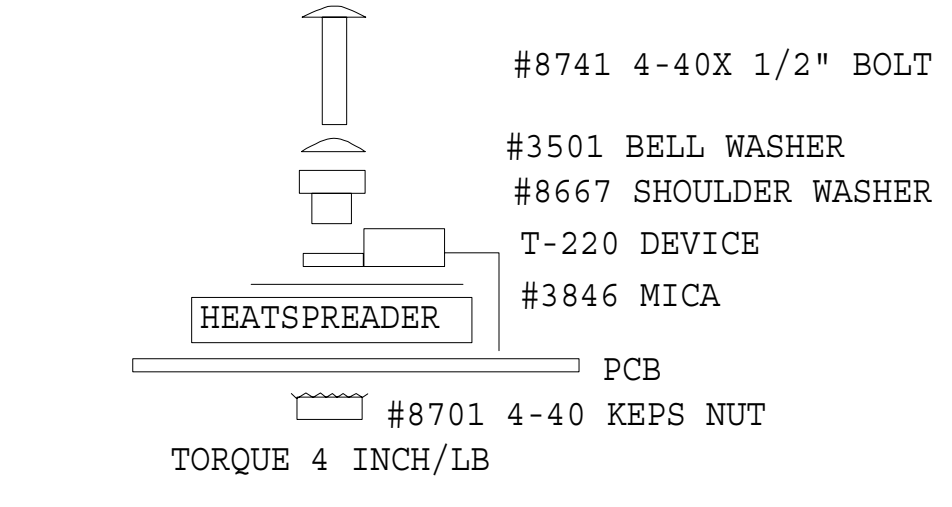
2 MOUNTING HARDWARE FOR Q5,Q6



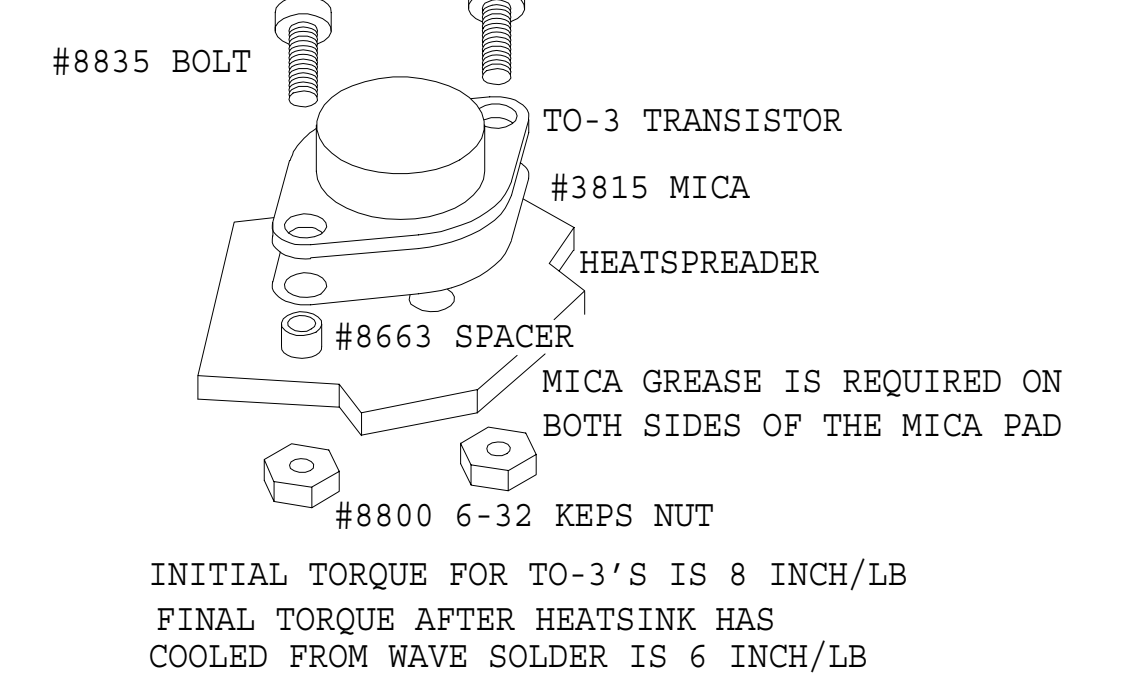
3 MOUNTING HARDWARE FOR Q40,Q41



4 MOUNTING HARDWARE FOR Q11,Q12

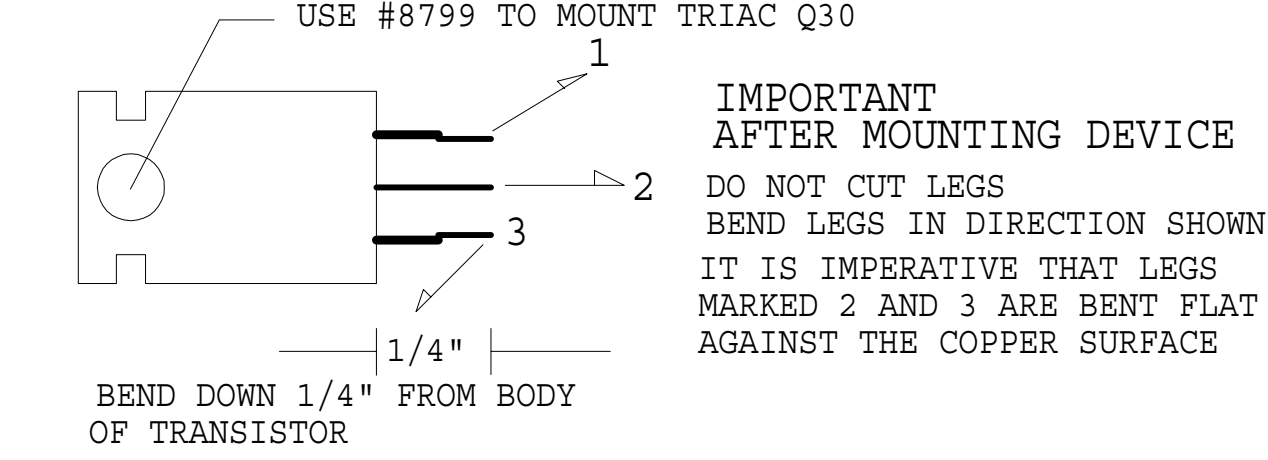


5 MOUNTING HARDWARE FOR TO3 OUTPUTS



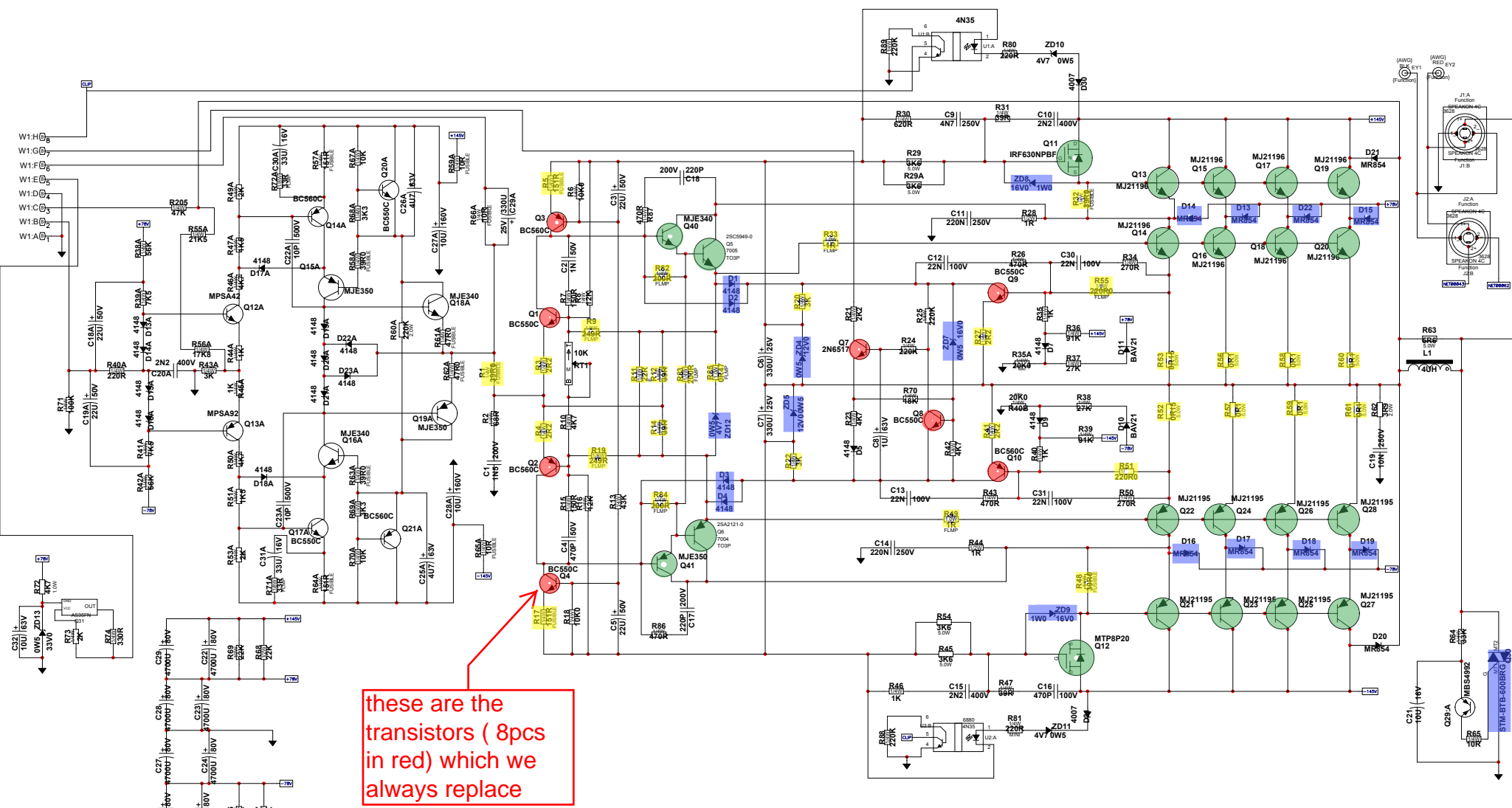
6 USE #XXXX SMALL BODY 1R 1W FOR R33,R49

7 MOUNTING DETAILS FOR Q30 TRIAC

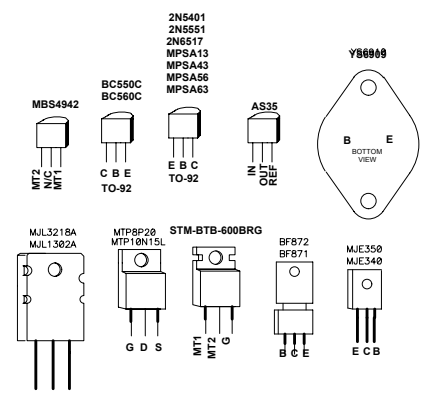


8 TAB WIRE COLOURS

- TAB 1 RED 16AWG
- TAB 2 YEL 16AWG
- TAB 3 BLK 16AWG
- TAB 4 WHT 16AWG
- TAB 5 BLU 16AWG
- TAB 6 OUTPUT +
- TAB 7 OUTPUT -



these are the transistors (8pcs in red) which we always replace



M1146 Database History

| MODEL(S) | AP4040 | | |
|----------|-----------|------|---|
| # | DATE | VER# | DESCRIPTION OF CHANGE |
| 1 | FEB/12/98 | 1.00 | DERIVED FROM M1126 |
| 2 | JUN/19/98 | 1.10 | PC#5767 C10 C15 C20A 2N2 TO PT#5427 |
| 3 | JUL/4/98 | 1.20 | PC#5788 R7 4K7 1/2W TO 4K7 1W |
| 4 | SEP/10/98 | 2.00 | PC#5806 ADD 33R 33u/16V ACROSS R57A,R64A,C30A, R72A,C31A,R71A |
| 5 | AUG/12/99 | 3.00 | PC#5908 U1,U2 4N35 TO TLP621 |
| 6 | JAN/27/99 | 4.00 | SPKON JACKS RE-CONFIGURED |
| 7 | AUG/12/99 | 5.00 | CORRECT ERROR IN SPKONS |
| 8 | OCT/12/00 | 6.00 | PC#6278 ADD R86,C17 AT Q41. PC#6083 REDO GND TRA |
| 9 | AUG/28/01 | 7.00 | PC#6423 ADD RES C17 AT Q40 |
| 10 | SEP/18/01 | 8.00 | PC#6438 ADD R88,R89 AT U1, U2 |
| 11 | MAY/03/02 | 8.10 | PC#6517 Q13->#6900, Q21-Q28 #6927->#6910 |
| 12 | | | R13 27K->43K,C16 1N->220P,R57 100R->470R |
| 13 | | | |
| 1 | MAY/16/03 | 8.20 | PC#6607 C10,C15, C20A #5427->#5208 |
| 2 | FEB/09/04 | 8.30 | PC#6558 CHANGE BREAKAWAY AND ROUTE |
| 3 | SEP/20/04 | 9.00 | CONVERT TO PCA23092 |
| 4 | APR/25/06 | 9.10 | PC#7007 MAC-224-4 TO STM-BTB-600BRG |
| 5 | MAY/02/06 | 9.20 | PC#7083 MTP10N15L TO IRF630NPBF |
| 6 | JUL/04/06 | 9.30 | HA, PC#7075, REPLACE Q5 #6888 WITH #7004 |
| 7 | | | Q6 #6990 WITH #7005 |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |

