SOME NOTES ABOUT THE AM-17 AMPLIFIER

by Ian Cowan VK1BG

The AM-17 is a solid, heavy, fully self contained amplifier originally developed to meet the needs of the then Department of Civil Aviation for VHF air–ground-air communication in the 108 to 136 MHz band.. It is rated for 100 watts continuous output AM as a linear amplifier, which means that a 400 watt PEP SSB signal is comfortably inside its capabilities. The AM-17 was designed in the 1960's. It uses a pair 4CX250 tubes in push – pull as the active devices. These are powered from a massive 2 kilovolt supply. The amplifier operates from a single phase 240 volt mains source, and is complete with all necessary control and protection equipment for safe and reliable operation. The AM-17 is very easy to get going in the 144 MHz amateur band.

A little over 100 of these devices were originally purchased by DCA; most of these now seem to be in amateur hands

There has been a bit of stuff on the Reflector about the AM-17 amplifier. Below is a collection of this which might be useful to anyone acquiring one of these units. The items have been cut and pasted a bit into broad subject headings, and each item carries the identity of its author.

GRID LINE RETUNING (ex VK1BG)

Many AM-17's were set up by DCA for operation at the lower end of the 118 - 136 MHz air band, and as a result are fitted with the 100 to 140 MHz grid bar assembly, together with the 118 - 175 MHz anode line assembly. No problem with the latter, as a minor shift of the anode tune capacitor is all that is necessary to bring it to 144 MHz. The grid line will not go up to 144 MHz, though. I understand that the usual approach by amateurs is to manufacture a grid line similar to that depicted in the AM17 handbook, but I found that this represents too much work. I cut the moulded plastic block (which houses a 3300 pF capacitor) from the end of the existing grid lines and bridged the gap so created with a 47 pF disk ceramic capacitor. This was all that was necessary to get the lines to resonate at 144 MHz (by tweaking the grid tune capacitor of course). I then reformed the existing grid coupling loop to fit more snugly between the grid lines, and so increase the input coupling a bit. With these two simple changes the unit operates satisfactorily on two metres.

In the interests of obtaining low input SWR and better power gain, I disconnected the 68 ohm input load resistor (4R12) at the input coax connector.
The resistor is outside and at the back of the RF enclosure proper. The physical layout is pretty much as shown in the circuit diagram in the manual, and would not get high marks for RF wiring with long component lead lengths and all. I don't have buckets of drive for my unit, only a few watts from a 2N5590, so I took the above resistor out with a pair of side cutters. While this achieved the degree of drive sensitivity I required, it also let me set up the grid circuit for a 50 ohm 1:1 SWR. I had not been able to achieve this with the resistor in place.

OUPUT COUPLING LOOP (ex VK3BRZ)

I replaced the output coupling loop with one made from 12 gauge copper wire, and made it larger (about 140mm long) than the dodgy bit of wire mine had (it didn't look original, I have to say).

PLATE CIRCUIT DC CHOKE (ex VK3BRZ)

Make sure the RF choke that feeds the plate HT is well outside the plate lines. The RF field in this area is very intense, and can couple enough energy into the choke to fry it.

FILAMENT WIRING (ex VK1BG)

The filament wiring was poorly executed in my machine, with the "cold" side of the valve filaments being soldered to a bundle of shielded cables which ran across the grid compartment from one side to the other. There was no give in this arrangement to allow for thermal expansion and contraction, and so one of the joints eventually developed an intermittent connection. The end result was the loss of one of my precious 4CX250's. I suggest that AM-17 owners should redo the filament soldering in their units as a precaution against the sort of problem I had.

FAN MOTOR (ex VK1BG)

At initial switch on of one machine, the fan motor failed, as evidenced by the rupture of the 1 amp fan motor fuse. Naturally I replaced the fuse with a bigger one (doesn't everyone?) and this caused the motor to operate nice and quiet, most unlike the usual AM 17. Unfortunately the quiet operation was due to the motor running at about half speed, and it soon got quite hot. The cause was the short circuit failure of the motor capacitor, which caused the 2 pole 2 phase motor to think it was a 4 pole single phase unit. It would not have lasted long in that mode. There are no markings on the capacitor to show its ratings, but its size and construction suggest that it is about 2 uF. I did not have an exact replacement. but I had a 1.74 uF 1400 VWAC unit from an old microwave oven in my junk box so I tried that and it seems to be OK. I found that the voltage across the capacitor can be quite high due to the series connection of motor winding inductance with the capacitor, so I am happy to have a high voltage rated capacitor in this position.

VK4TZL Comment

Had the same problem with the blower motor on my second AM17. Took same to local motor rewinder, and he replaced the start/run cap with a modern non-toxic device, and it works fine. Can provide details of that caps ratings etc if you require it. I've also found that the local " Bearing Service Center" has exact replacement bearings for the blower, which is a real worthwhile investment, as it restores them to " low noise" almost new operation.

BLOWER BEARINGS (ex VK4TZL)

I've got two of them (AM-17's).

Both units needed the bearings in the blower repacked. The blowers were noisy and slow to start. By removing the relay panel and letting it hang by its cables, and removing the panel containing the bias pots in the same fashion, easy access can be obtained to the blowers.

The bearings have one side open, allowing grease to be introduced. I used some general purpose lithium based stuff I had lying around. Blowers are now much quieter.

PLATE TANK TUNING AND LOADING (ex VK1BG)

Everyone knows that you must be very careful with the plate tuning and loading controls of an amplifier such as this when it is operating near full power. I did too, but a careless twitch on the plate tuning capacitor caused an enormous bang within the unit which blew the HT fuse and shut the whole thing down. I did not uprate this fuse, but when I replaced it I was relieved to find that no other damage had been done. The result could have been much worse, and I am resolved to be even more careful with that control in future.

VK3BRZ comment:

If you haven't already done so, fit a planetary reduction drive to the AM-17's plate tuning control. I used one from my junk box, but I think you can still get them from Dick Smith Electronics. You'll find tuning the amplifier much easier.

You can calibrate the plate current limit at which it operates very easily; you don't even need to have the power switched on. Simply use a variable power supply (with floating +&- outputs) and a digital multimeter (2A range). Connect the supply across the relay, and adjust the shunt variable resistor so that the relay pulls in at the desired current. I set it for 700mA, figuring that the bottles will survive that for a brief instant.

VK4TZL Comment

A good mod is the RF Tuning Control reduction drive … after doing this you don't need the reflexes of an F18 pilot to tune it. I also found that both the adjustable resistors that set the trip current on the HT and screen supplies were U/S. Both have been replaced with fixed value 20 watt types after a bit of testing to get the trip currents right.

As regards the tuning...leave the ancient protection in...it works, and I've had the same bang with one of mine, but the relay/resistor combination in the EHT return leg seems to work fine, and does a passable job of protecting things. With it in place and the resistor across the relevant resistor set to....I'll have to measure it....I can't pull more than 490 ma Ia without tripping off the Amp...a good safe setup (I think).

SCREEN RESISTORS (ex VK3BRZ)

The screen supply to the tubes is through a couple of ½ watt Philips resistors. In the event of a tube flash over, these will vanish, allowing the screens to float to a high voltage, and immediately puncture the screen bypass capacitor. Bye-bye sockets! I replaced the resistors with chokes made by winding 22 SWG enamelled copper wire over the body of 100 ohm/1 W metal film resistors in the manner of parasitic chokes. Then I fitted a metal oxide varistor at each screen pin to ground. I used the V375LA40. Now the screens will be clamped to no more than 500V in the event of a flashover.

CATHODE BYPASSING (ex VK3BRZ)

The cathode by-passing looked a bit shonky to me. The disc ceramic capacitors on the cathode pins have fairly long leads, and this is a very low impedance point. I replaced them with new capacitors using two in parallel on each of the cathode pins, mounted with virtually no lead length.

POWER OUTPUT (ex VK3BRZ)

My AM-17 will now produce well over 550W PEP under speech conditions and about 450W of continuous carrier, The static regulation of the plate supply, with its choke-input filter is not that good, allowing the voltage to sag with continuous carrier drive but under speech conditions it holds up well. Owners should be aware of this. If you set up the amplifier with carrier the PEP will be much higher with speech drive. I used the Bird 4410 with PEP indication to set up my unit. Finally I built an input attenuator to trim the output power to the desired level.

VK1BG Comment

I have not gone for the maximum output from my unit and in fact have changed the mains taps on the plate transformer to drop the HT a little. I think that it motors at about 300 watts PEP out most of the time, and I have found this to be plenty. Peddling too hard increases the risk of EMC problems and may invite comment from lower powered stations to the effect that your Rx may need an upgrade.

POWER SUPPLY MODS (ex VK4TZL)

I have fitted Varistors to all transformer primaries and to the two screen grid pins and turned the resistors into inductors as well. All diodes in the power supplies were replaced with 1N5408 devices and some suspect resistors in the bleeder chains.

CONTROL SYSTEM (ex VK4TZL)

I use the Amp in remote mode, which reduces tube dissipation substantially whilst in the "standby" state. PTT was taken from across the 22k resistor in the 50v control supply. As I could only get 26vdc coaxial relays for a decent price, I have the coils in series across the 50v supply via a remote relay that is switched by the sequencer….this seems to work ok and should the supply fail the Amp won't go to transmit and the coax relays will remain unenergised and simply pass drive RF straight to the antenna (i.e I don't think there is any way the Amp can be driven without a load…unless the antenna falls down or the coax breaks.

4CX250 TUBE OPERATION GUIDELINES. (ex VK1BG)

The AM-17 handbook is not much good in describing how best to set up the amplifier for SSB linear service. A very good text on getting the best from 4CX250's is The VHF/UHF DX Book, a publication by a number of English authors from DIR Publishing Limited. It is written for English conditions, and may over state the need for low IMD when applied to our environment. However the sections which deal with the peculiarities of the 4CX250 and especially the significance of indicated screen current are excellent.