Assembly Instructions

WDHD3S

Valve Headphone
Amplifier Kit

WORLD DESIGNS

www.world-designs.co.uk
07972 055492

SAFETY WARNING

Lethal voltages exist in this amplifier. Even though this is a straightforward kit in terms of construction, please do not attempt to build it unless you have some understanding of valve circuitry and can follow safety precautions.

We can't guarantee an "office hours" back-up service, but please phone or email if you run into any problems. Alternatively, visit our forum **www.world-designs.co.uk/forum** where you will find first-class help and advice.

Additionally, if the worst comes to the worst and you cannot get your amplifier going, or simply want it checked, we will get your amplifier up and running for a nominal charge.

For safety, never hold earthed metal work when testing. Make sure your body is isolated by rubber soled shoes. To aid construction use a multimeter, one capable of reading up to 500 volts DC. If you have electrical safety gloves please wear them when testing, since the greatest danger comes from a slip at this time. We recommend you use insulated clip type multimeter probes to avoid having your hand inside the amplifier when testing.

Always remove the AC POWER plug when you are soldering. The larger power supply capacitors will hold a residual charge after switch off, so wear your gloves at all times when working internally.

Additionally be aware that valves do get very hot and will burn skin on contact, therefore please position in a safe place, away from children and animals. Due to the heat dissipation from the circuit the case top surface does get hot and the front panel may be warm to the touch.

FUSE

This amplifier consumes 350mA from the mains and must be fitted with a 500mA slow-blow fuse. If this blows then there is a fault which should be cleared before the fuse is replaced. Do not be tempted to fit a higher rated fuse since this could lead to damage to expensive components.

OUTPUT TRANSFORMERS

The output transformers must be connected to a load whenever the amplifier is switched on - whether a dummy load (100 ohm resistors rated at 2 watts or higher) or an old pair of headphones. This is because the load is an integral part of the circuit (unlike most solid state amplifiers). Running the amplifier without a load will cause unnecessary distress to the output transformers and possible failure if left in this state for a long time.

READING

Before you start building the amplifier read through the instructions at least twice to familiarise yourself with the kit and its components and avoid any mistakes.

SKILL LEVEL

To build this unit you must be able to:

a) solder to a good standard
b) have some knowledge of valve circuitry
c) possess a rudimentary understanding of electricity and electronics
d) have a multimeter and be able to use it
e) know the precautions necessary to avoid electric shocks from the AC mains and amplifier power lines
f) have access to a dummy load or an old pair of headphones
g) identify components, particularly resistors, using either the markings or a multimeter.

A NOTE ON TINNING

For ease of use we make every effort to provide tinned copper wire with this kit, however there are occasionally supply problems and we are unable to do so. We recommend that you “tin” any bare copper wire before making a joint.

A NOTE ON HEAT-SHRINK

If you have not used heat-shrink before, the only difficult thing is to remember to slide an appropriate length of heat-shrink over the wires BEFORE soldering the joint! Slide the sleeving completely over the bare wires and carefully apply heat from a mini heat-gun (available cheaply over the internet) or from a cigarette lighter, taking care not to damage any PVC insulation nearby. We supply plenty of heat-shrink, so do practice a couple of times before you set out.

BUILD SEQUENCE

Before you start building it is a good idea to check the parts supplied against your parts list. Please be aware that “picking errors” do happen even if very infrequently - make sure that you check the value and rating of each component carefully. A schematic of resistor colour coding is given at the end of this booklet. Use the check column on the parts list to cross off your components. To help you through the build process you will find throughout the manual diagrams and photographs labelled **Fig. 1**, **Fig. 2** and so on. These will bear correlation to the text and to the highlighted figure in the margins.

FITTING THE HARDWARE

Fig. 2 Fit the earth terminal to the rear of the case. If necessary remove some of the paint around the earth terminal hole so that the terminal makes electrical contact with the case. Remove the earth terminal binding nut and fit the terminal using a serrated washer on the inside of the panel. Tighten the nut fully.

Fit phono sockets to the rear panel - red towards the bottom of the amplifier, and black towards the top. Fit the solder tags so that each pair of tags point towards each other and bend them away from the chassis. When you have tightened the nuts fully check with a continuity meter that the phono plugs are electrically isolated from the chassis.

Fig. 3 Fit the potentiometer to the front panel using the washer and nut provided. Scrape some paint away from inside the chassis to make sure that the body of the potentiometer is grounded.

Fit the headphone socket to the front panel using the washer and nut provided. Offer up the front panel to the chassis to make sure that the socket sits centrally in the hole in the fascia, and adjust if necessary. Note that the PCB star earth will be connected to the chassis via the headphone socket - it is important to scrape some paint away from the inside of the chassis where it meets the socket. Tighten the nut fully and check for electrical continuity between the body of the socket and the earth post.

Figs. 1 / 2 Fit the power transformer using the mounting kit supplied. Insert the bolt from the underside of the case, then fit a pad to the inside of the case followed by the toroid, another pad and, finally, the top plate and nut. Align the toroid so that the secondary leads (Orange / Orange / Yellow and Red / Black) lie closest to the PCB position. Tighten the nut to clamp the toroid firmly in position.

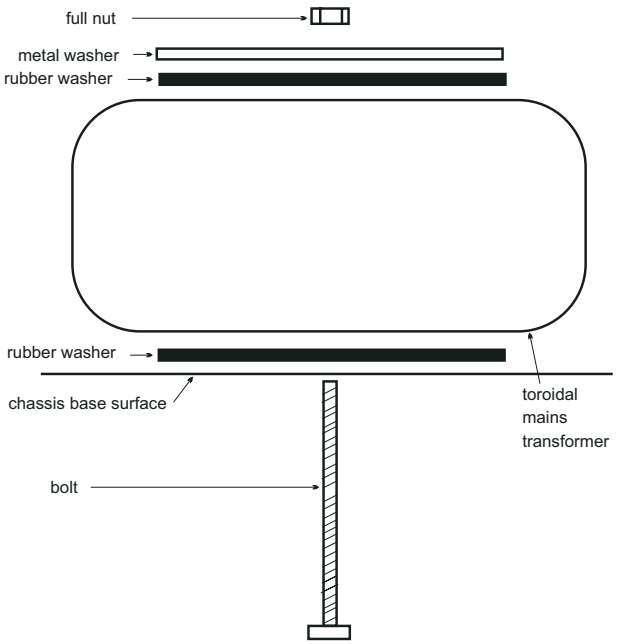


Fig. 1 Toroid Mounting Kit

Fit the output transformers to the chassis, using M4x10 screws, serrated washers and nuts, positioning the secondary leads (blue x 4 and purple x 4) towards the outside of the chassis.

Fit the stand-offs for the PCB using M3x12 screws from the underside of the chassis.

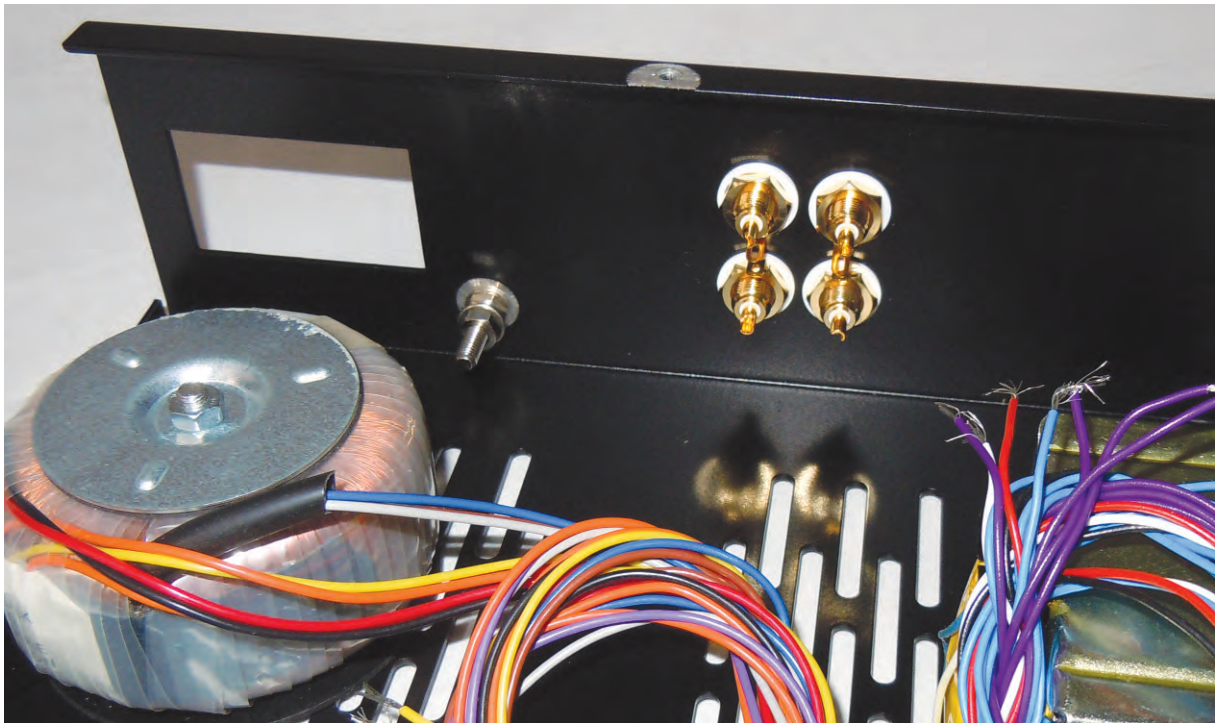


Fig. 2 Hardware Fittings (rear panel)

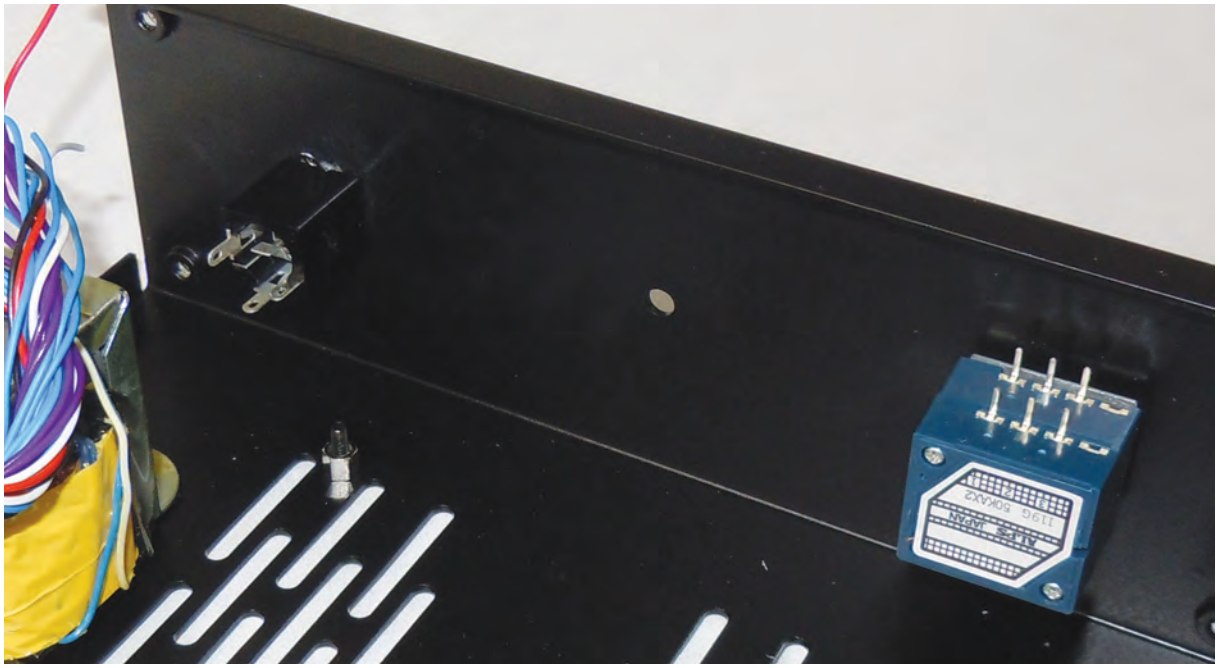
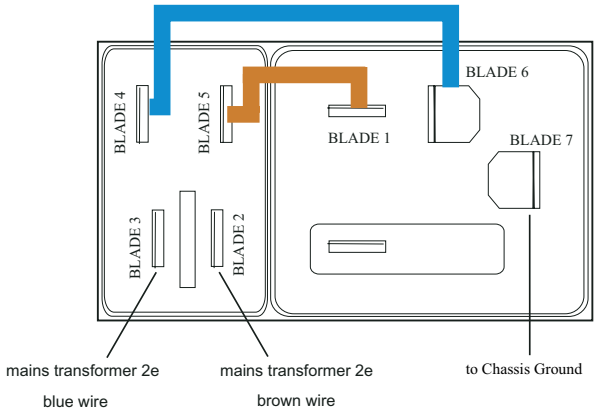


Fig. 3 Hardware Fittings (front panel)

WIRING THE MAINS SUPPLY

Fig. 4 Using a short length of 1mm brown wire link Blades 1 and 5 of the IEC input. Using a short length of 1mm blue wire link Blades 4 and 6 of the IEC input. These joints should be insulated with heat-shrink sleeving. Take approx 75mm Green / Yellow wire and solder one end to Blade 7 of the IEC input and the other to a solder tag.



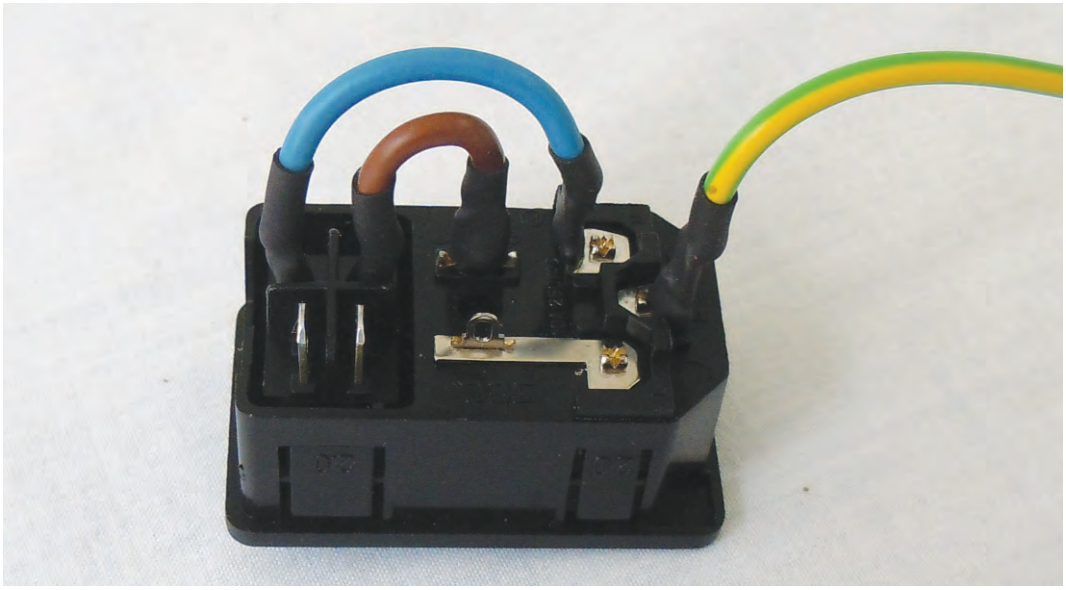


Fig. 4 IEC Input Links

Fig. 5 Select the AC voltage for the power transformer to suit your AC mains supply voltage as follows:

220 - 240V : Solder the grey and purple primary wires together and insulate the joint. Twist these wires together and coil them neatly out of the way. Twist the blue and brown wires together, pass them through the piercing in the chassis, and solder blue to pin 3 and brown to pin 2 of the IEC input. These joints should be insulated with heat-shrink sleeving.

100 - 120V : Twist all the primary wires together, pass them through the piercing in the chassis, and solder the blue and purple wires to pin 3 and the brown and grey wires to pin 2 of the IEC input. These joints should be insulated with heat-shrink sleeving.

Making sure that the power switch is positioned nearest the outside of the chassis, fit the IEC input into the hole in the chassis and snap it into place. The lugs should provide a secure fix. Connect the Green / Yellow wire from Blade 7 to the chassis Earth Post.

NB: The fuse is held in a pull-out tray in the IEC input - you may wish to fit it now. Please note the precautions on fuse rating in the Safety Warning at the beginning of the manual.

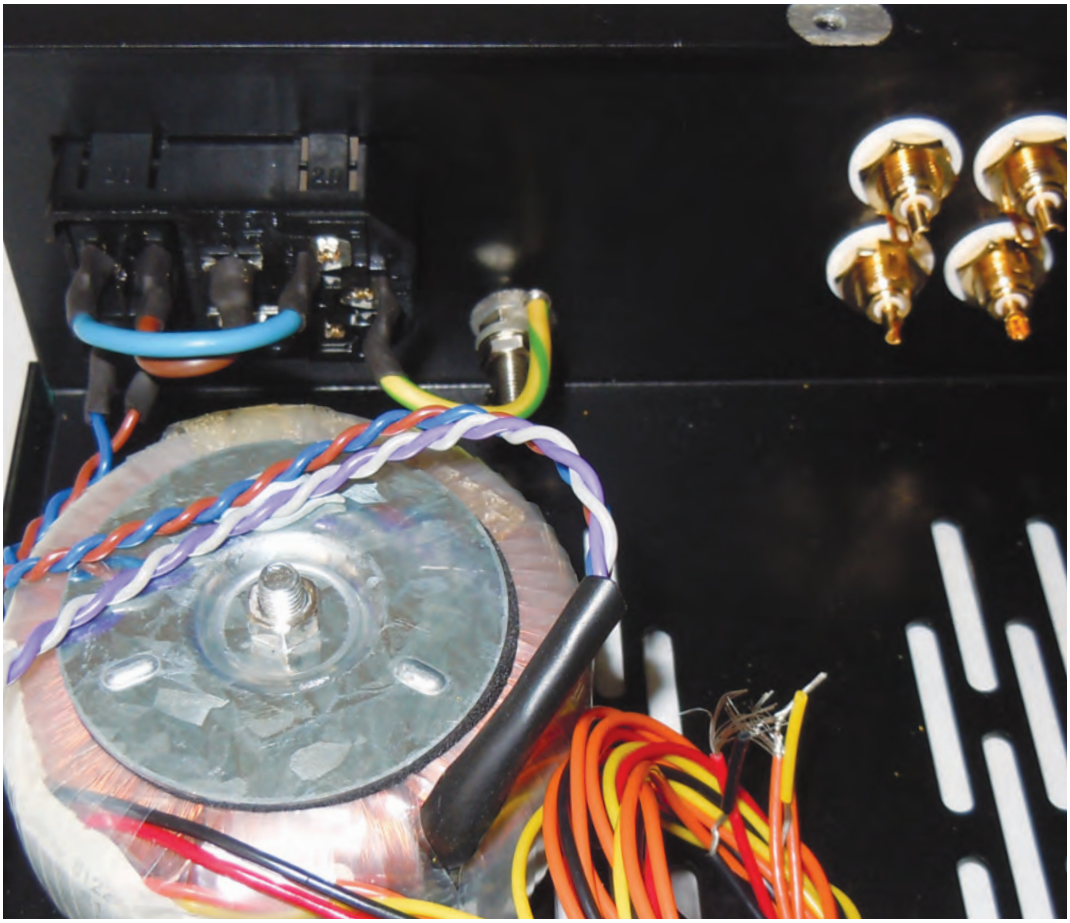


Fig. 5 IEC Input Wiring

POPULATING THE PCB

The PCB is double-sided. In this manual the side with the component “legends” (indicating where the components should be sited) printed on it is referenced as the **component** side and the other side as the **solder** side.

Where possible it is advisable to solder the legs of the components to both sides of the PCB. The holes in the PCB are “plated-through” meaning that soldering both sides is not strictly necessary. It is nonetheless good practice to ensure a good joint and to provide mechanical security - the board is subject to repeated heating and cooling which can produce stress and cracked joints.

If you ever need to “drill out” any holes in order to fit upgraded components it is ESSENTIAL to solder both sides of the joint.

When fitting PCB Pins they should be pressed into place with a hot soldering iron (make sure the pins get hot before pushing them fully home) and then soldered on each side of the board.

Where possible it is good practice to fit components with the lowest profile (eg links or low value resistors) first and those with the highest profile (eg large capacitors) last.

FIT THE VALVE BASES.

Fig. 10 The valve bases should be fitted to the component side of the PCB. Make sure that you solder the legs on both sides of the PCB to give a secure mechanical (as well as electrical) joint.

FIT THE PCB PINS.

Figs. 7 / 10 We have highlighted the PCB pin positions in colour on the photograph overleaf so that you can find them easily (the picture also shows the soldering points for the heater links, highlighted in white). Solder the pins so that they project on the component side of the board in the following positions:

POWER SUPPLY: HTR CT Y, HTR– OR, HTR+ OR, BLACK, RED (5 pins, highlighted in light blue in Fig. 7)

OUTPUT TRANSFORMER PRIMARIES / TERTIARIES: OPTXL BLACK, RED HT L, FBL, FBLG, OPTXR BLACK, HT R RED, FBR, FBRG (8 pins, highlighted in red in Fig. 7)

OUTPUT TRANSFORMER SECONDARIES: B3, P1, B4, P2, B2, P3, B1, P4 for both channels (16 pins, highlighted in yellow in Fig. 7)

INPUTS: IPL, IPLG, IPR, IPRG (4 pins, highlighted in dark blue in Fig. 7)

OUTPUTS: OPL, OPLG, OPR, OPRG (4 pins, highlighted in green in Fig. 7)

LED: LED–, LED+ (2 pins, highlighted in orange in Fig. 7)

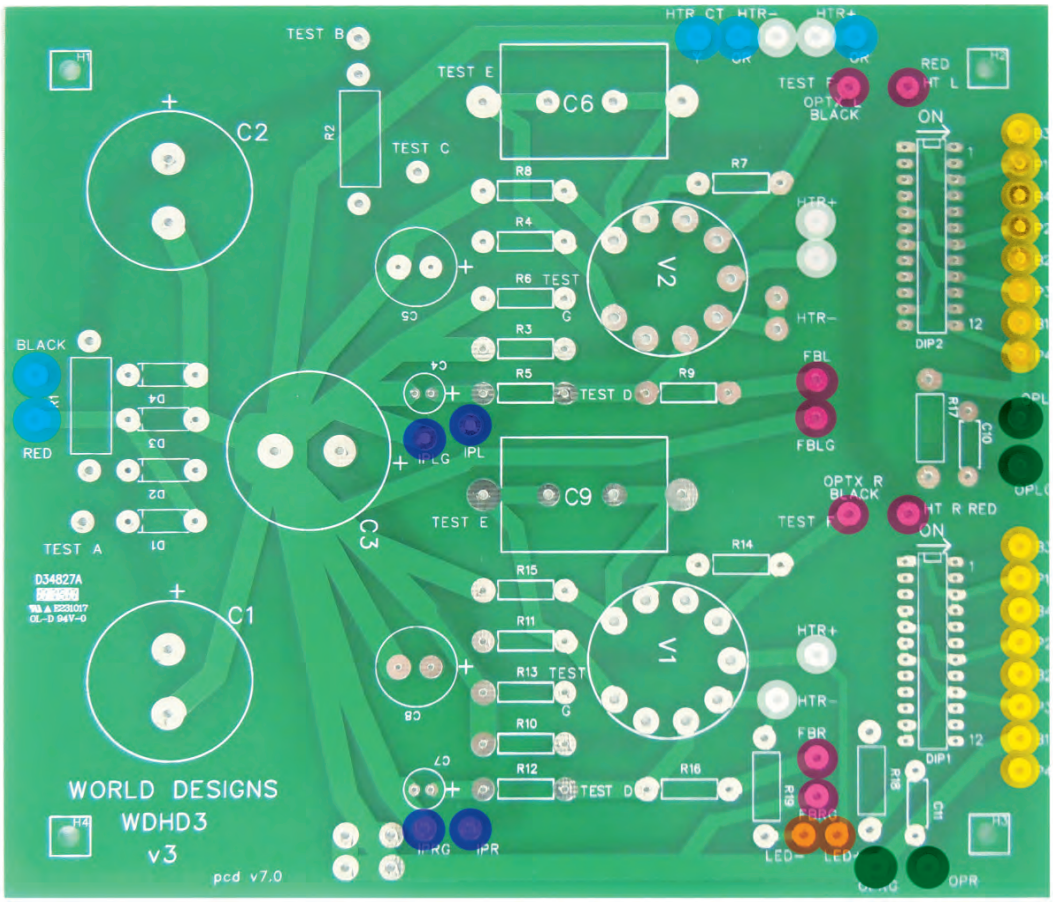


Fig. 7 PCB Pin and Heater Link Positions

FIT THE DIODES.

Figs. 8 / 10

Fit the diodes D1, D2, D3 & D4. Orientation is very important - note that the stripe on the diode matches with the stripe on the PCB legend for correct polarity.

FIT THE RESISTORS.

Fig. 10

Elevate the higher power resistors R1, R2, R4, R6, R11, R13, R17, R18, R19 from the PCB by at least 10mm as they require a cooling flow of air around them.

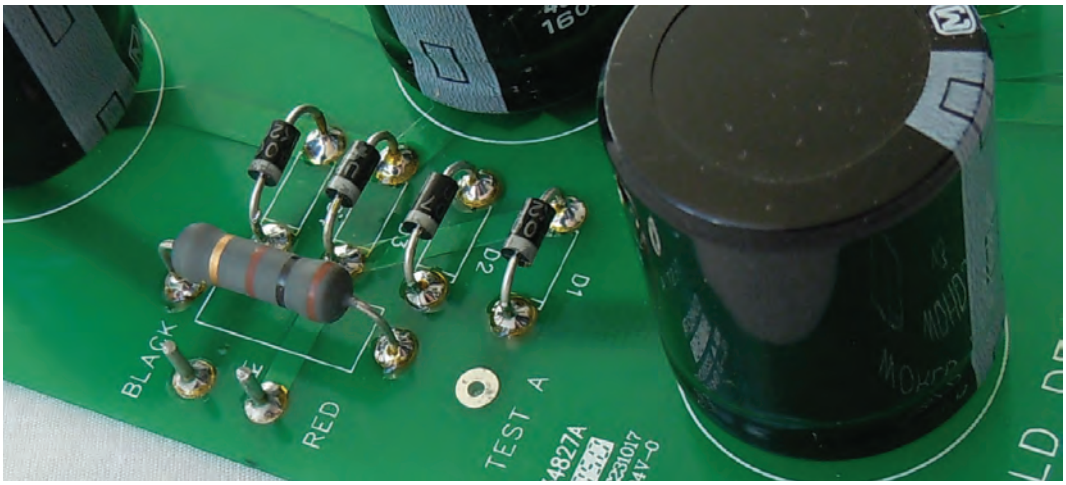


Fig. 8 Diode Polarity

FIT THE DIL SWITCHES.

Fig.10 Orientation is important - note the "on →" printed on the PCB and on the switches (the individual switches "1" and "12" are also printed as legends on the PCB). Be very careful when soldering not to accidentally link across solder points with excess solder.

FIT ALL THE CAPACITORS.

Figs. 9 / 10 Note that the electrolytic capacitors C1, C2, C3, C4, C5, C7, C8 are polarized, and ensure they are fitted correctly. The PCB is printed with a + sign where polarity needs to be observed. The capacitors are normally printed with a white (occasionally black or gold) bar which denotes the negative terminal as shown below.

FIT THE HEATER LINKS.

Figs. 7 / 11 We have highlighted the solder points for the heater links in white on the photograph at Fig. 7 so that you can find them easily. Note that the links should be fitted to the **solder** side of the PCB and care should be taken to ensure that the sharp ends of the components, where they are soldered through the PCB, do not damage the insulation of the wires. Taking twisted pairs of brown and grey wire, use the brown wires to connect point HTR+ (next to pin HTR+ OR) to HTR+ at V2 and onwards to HTR+ at V1. Similarly, using the grey wires, connect HTR– (next to pin HTR– OR) to HTR– at V2 and onwards to HTR– at V1.

("HTR+" and "HTR–" are, in fact misprints on the PCB - the heaters operate on AC) - but the markings make it easier to wire the heaters of both valves the same way round.)

FIT THE LED.

Solder approx 75-100mm red wire to the long leg of the LED and a similar length of black wire to the short leg. Insulate the joints and the bare legs of the LED with heat-shrink sleeving. Twist the wires together to provide mechanical stability and solder the red wire to the LED+ pin and the black to the LED– pin on the PCB. The LED can be passed through the hole in the chassis ready for fixing to the fascia when you come to do this.

Because access is restricted later, solder approx 100mm red wire to each of the pins OPL and OPR, and a similar length of black wire to pins OPLG and OPRG.

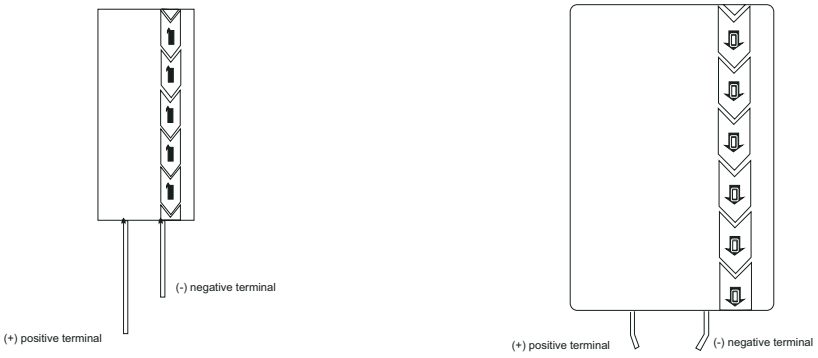


Fig. 9 Capacitor Polarity Markings for C4, C5, C7, C8 (left) and C1, C2, C3 (right)

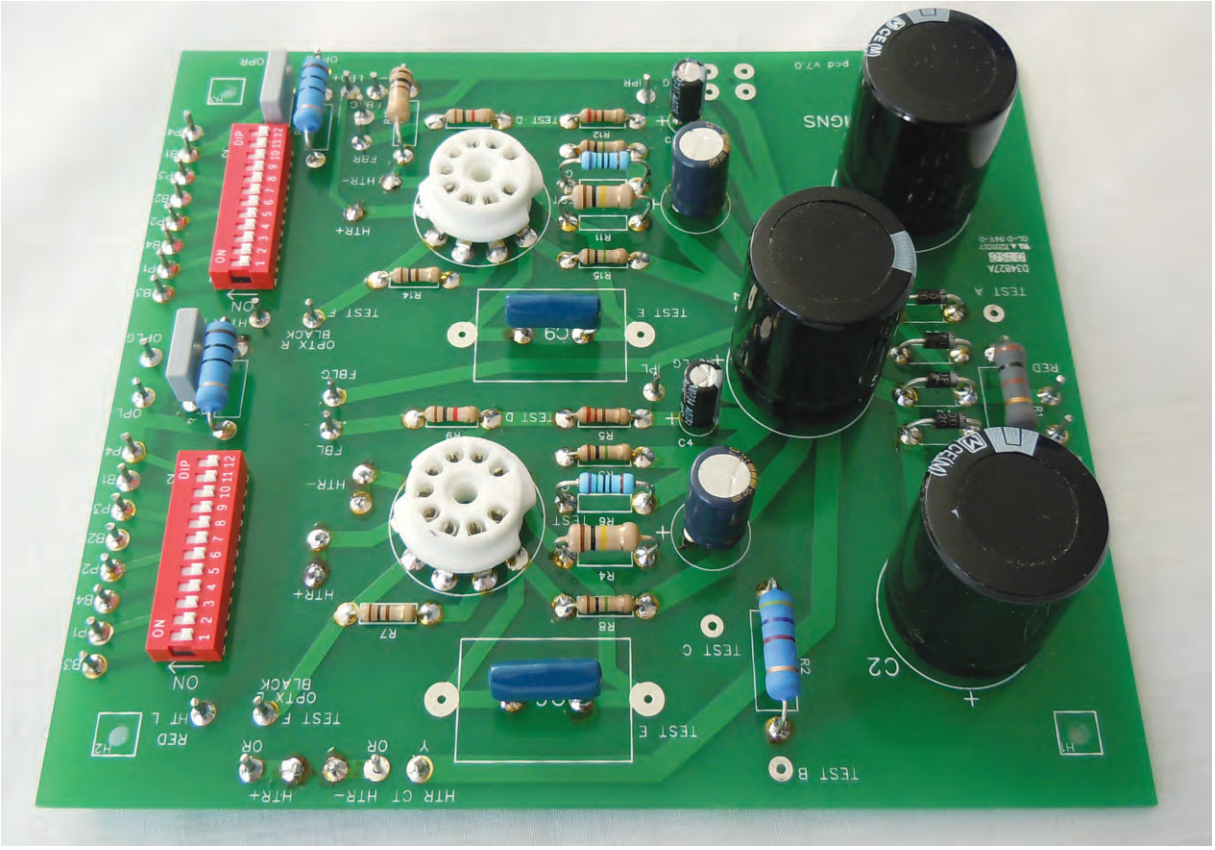


Fig. 10 Populated Printed Circuit Board

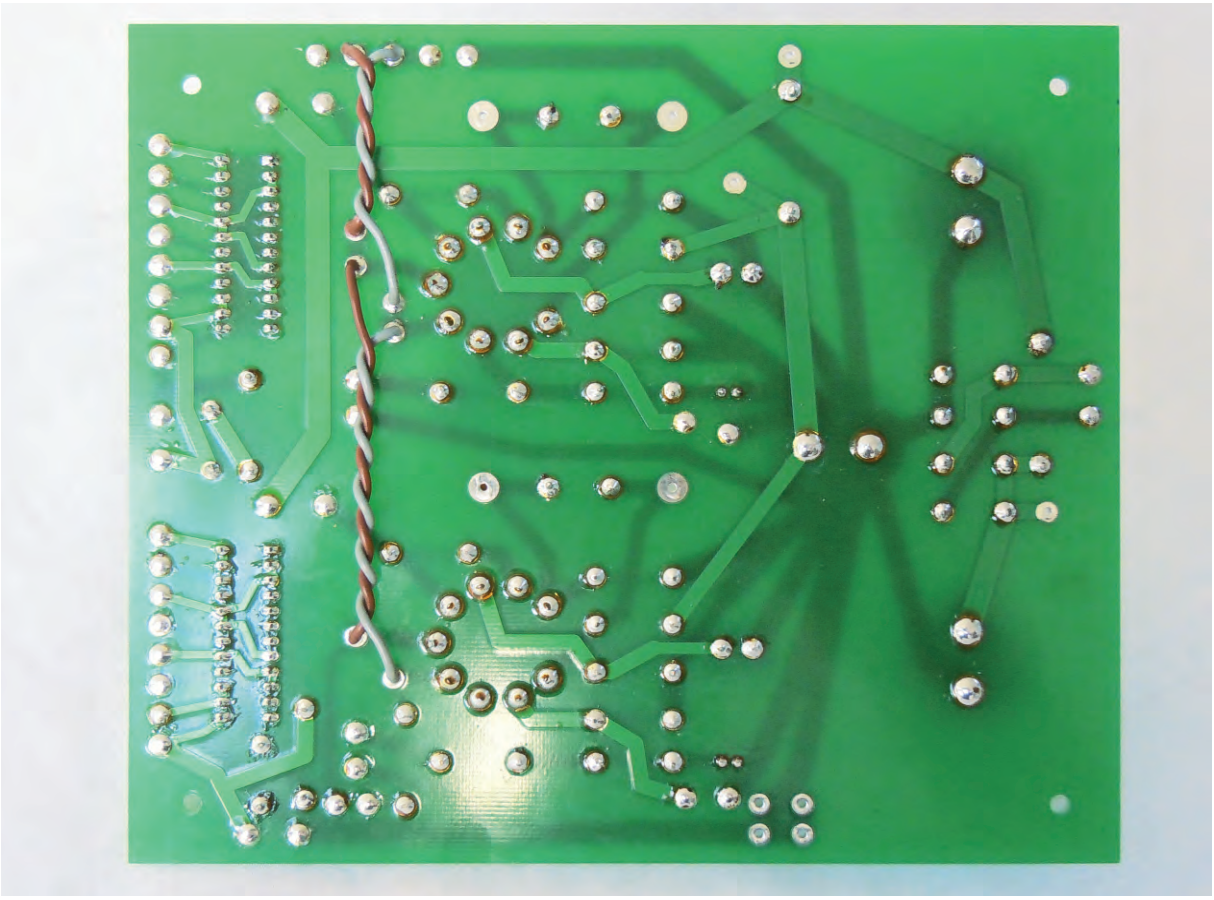


Fig. 11 Heater Links