

SERVICING TELEVISION RECEIVERS

PHILIPS G6 CHASSIS

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THE original dual-standard version of the G6 chassis, with all its protection circuits and other devices, was a fearsome albeit reliable brute and was the first colour set we had to handle. Personally I was scared to death of it to start with and spent quite a lot of time with the layout and the circuit diagram trying to familiarise myself with its peculiarities so as not to be at a loss when the first call came. The more I pondered on this and that the more confused I became, having the distressing ability to forget within a matter of minutes things I thought I had absorbed: I had the same trouble with VAT, also with anything else which is on paper. Thus handicapped, in the early hours I put down the Philips manual and took up my *Reader's Digest*.

When the first call for service came I took about everything I could think of and actually managed a smile when the customer opened the door.

"Have you a toothache" he asked?

"Only a headache" I reassured him.

This was a few years ago, but I remember it far better than any written word. The trouble was that everything on the screen looked cyan, and normal people seemed to have come from another planet or looked as I felt.

"No red", I chattered. On checking at the tube base a very low voltage was found at pin 4, the red gun first anode pin. Within minutes the 2-2M Ω feed resistor had been replaced and the red restored. "Fantastic" said the customer and the smile on my face showed that my headache had departed, as I was about to do when the picture went off completely.

Sickened, I once more removed the rear cover – without breaking the field hold knob – to find there was no supply to the line output stage. As nothing seemed to have any life in this compartment I turned to the left side supply source where R1073 had sprung open. The resistor looked all right so back it went on its spring with a dab of solder. Switch on, voltage at both ends, lovely. But no picture and nothing doing in the line output stage. In my confusion I had forgotten the switch on the screening box. This makes when the cover is on. On operating the switch manually the juice came through, the PL509 line output valve went green and the resistor sprung apart again.

Slapping the resistor back-on and fitting a new PL509 restored normality for about a week when back we went to replace the PY500.

Many enthralling incidents have occurred since those first days, but the reader will be deprived the recounting of these to return to more relevant matters.

Cleaning up the Design

The early models had several features which were left out of later versions, such as the tube protection circuit which cut off the

line output stage when the field timebase failed (shades of projection TV circuitry here... see September 1955 issue) and led us on a gay dance looking for a line timebase fault when the trouble was due only to a defective ECC81 in the field oscillator stage. The idea was to prevent field collapse damaging the tube due to the concentration of the beam into a single horizontal line. Very few receivers will still be found with this feature.

Another early feature which was discontinued in later versions was the colour on/off button on the front. It should not be confused with the button on the c.r.t. base assembly – this knocks off the luminance to enable the background controls to be set up.

The process of cleaning up the chassis continued with the dropping of dual-standard facilities. The resultant G6 single-standard chassis is much easier to work on (or did we just get used to the basic design that no longer appeared so fearsome?).

The convergence system is another example of the chassis' development. Originally this was a large box which slotted into the left side of the cabinet. Later it became a smaller panel which was exposed when a front screw was slackened to enable part of the slatted woodwork to be removed.

To detail every difference however would take up far too much space.

Line Output Stage Faults

Apart from fairly easily identified faults in other parts of the receiver such as colour changes due to dry-joints or leads actually off the panels (oh yes!) the majority of the faults encountered will be in the line output stage.

Now the first thing to remember about the e.h.t. compartment is that it contains two valves which can emit X rays. Thus while the set is operating the screening *must* be in position. This precaution was proclaimed loud and long years ago but now that we take the non-valve e.h.t. tripler system for granted it is easy to forget the danger still present in earlier designs which employ the cumbersome but efficient thermionic e.h.t. rectifier and shunt stabiliser. The cover must not be removed therefore unless one knows that the line output stage is not functioning (as outlined earlier in relating our first experience) as the safety switch may have been shorted out.

The PL509 and PY500 are in a separate compartment forward of the transformer box and are covered by a domed wire mesh secured by two swing clips.

The faults which usually occur are as follows.

Picture slow to appear, lacking width, poor focus and bad convergence. If the original valves are still fitted or the valves have been in for some time it is highly prudent to replace them both at the same time. The extra cost is well justified. The fact that a new valve has been fitted recently is no justification for not suspecting it.

When there is no picture at all and the line output stage seems

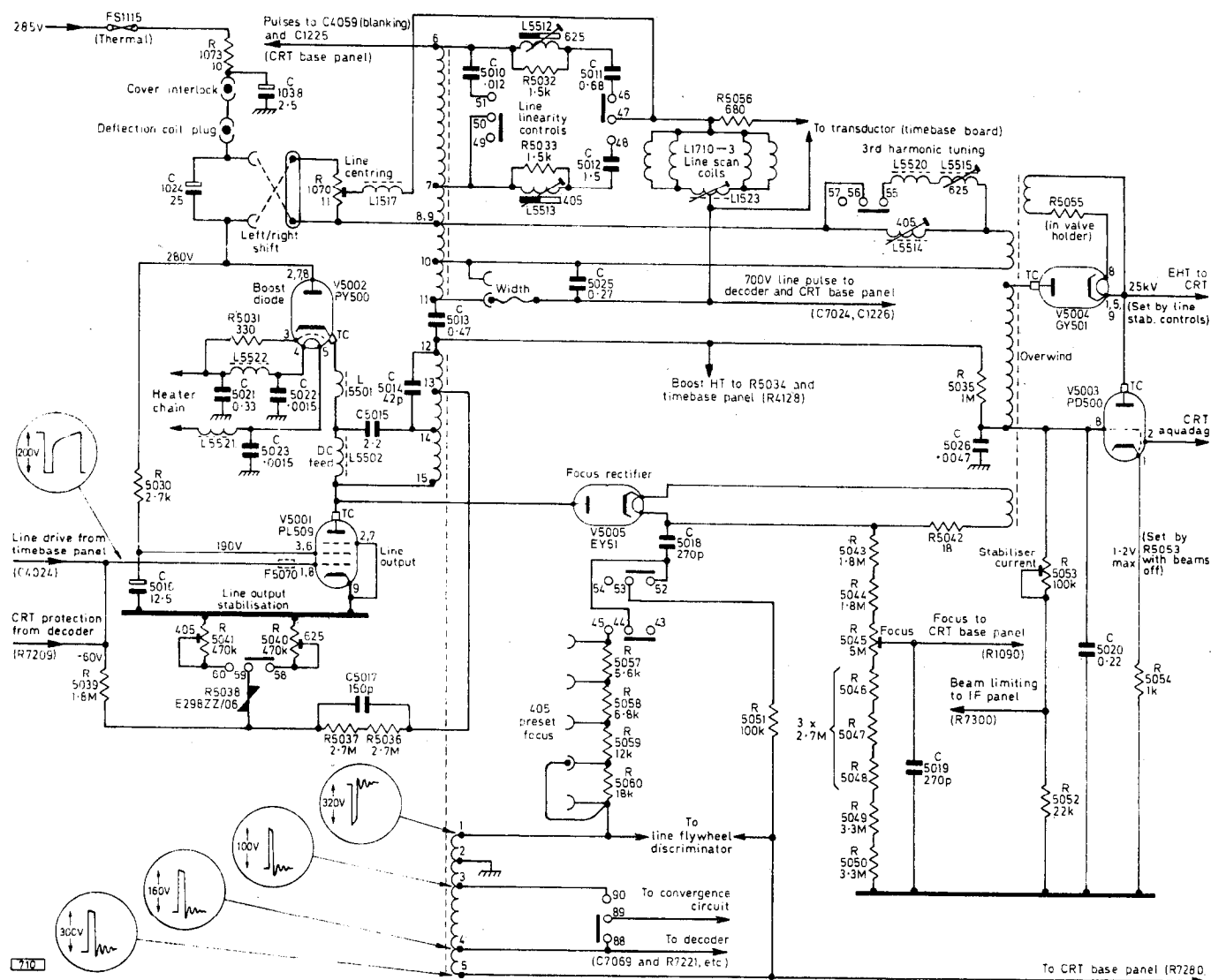


Fig. 1: Line output stage, e.h.t. and focus supply circuit. The system switch is shown in the 625-line position. R5040 and R5041 (line stabilisation controls) are 220k Ω in later versions. C5014 may be 100pF, 20pF or, in later production, omitted: where present it is a good idea to remove it. C1038 and C5026 were not fitted in early models. R1073/FS1115 and C1038 are on the lower chassis (power supply section). R4042 may be wired between V5005 heater and the junction C5018/R5043 and the heater winding on the line output transformer. R5037 and R5036 are 3.3M Ω on single-standard models.

dead although there is h.t. at the PL509 and PY500 top caps suspect the PL509's screen grid feed resistor (R5030, 2.7k Ω) which can go open-circuit at odd times.

A picture which fluctuates, sometimes quite regularly, on off, on off, with varying focus and usually a corresponding noise from the e.h.t. compartment, will be due to a faulty PD500. Replacement involves some screw slackening and a bit of heaving about but is no real problem. Check for corrosion at the point where the GY501 and the PD500 are joined. Remember to replace the screening before testing as the peg on the cover has to engage the h.t. supply switch on the upper left.

Non-operation of the line output stage can also be the result of a shorted boost line capacitor (C5013, 0.47 μ F). As this is returned to the h.t. line there is no overheating when it shorts. Another cause of no e.h.t. is when the d.c. feed coil (L5502) to the anode of the PL509 is defective.

When the valves are not responsible for lack of width, resistors R5036 and R5037 should be checked as they can change value. R5039 is also suspect. Capacitor C5017 can cause fluctuating width and this can be misleading as it tends to suggest poor e.h.t. regulation.

EHT Shunt Stabiliser

The object of the PD500 shunt stabiliser valve is to present the e.h.t. rectifier with a constant load. On dark scenes the e.h.t.

current is low and without the stabiliser the e.h.t. voltage would tend to rise, resulting in a smaller picture. The circuit is so arranged however that on dark scenes the PD500 conducts more heavily, thus drawing more current from the GY501 and keeping the e.h.t. sensibly constant. On light scenes the tube draws more current and without the stabiliser the e.h.t. would tend to fall, causing the picture to expand. As the stabiliser grid is backed off under these conditions however the PD500 draws less current, the total drain is more or less the same and the picture remains the same size.

The 1k Ω resistor R5054 is the one on top of the e.h.t. compartment. A meter connected across it will indicate the current drawn by the PD500. The correct reading is 1.2V with the beam switches off. R5053 is set to produce this 1.2V and correct beam limiter operating conditions (the earthy end of R5053 connects to R5052 and also goes back to the i.f. panel where it is connected via R7300 to the beam limiter control R7301). By beam switches we mean the A1 (or G2) switches on the convergence panel. If R5053 is not set correctly the stabilisation won't work properly, with a dull picture, ballooning on advancing the brightness control, etc. The beam limiting system operates via the a.g.c. circuit.

Focus Faults

Whilst poor focus can be due to the line output stage valves

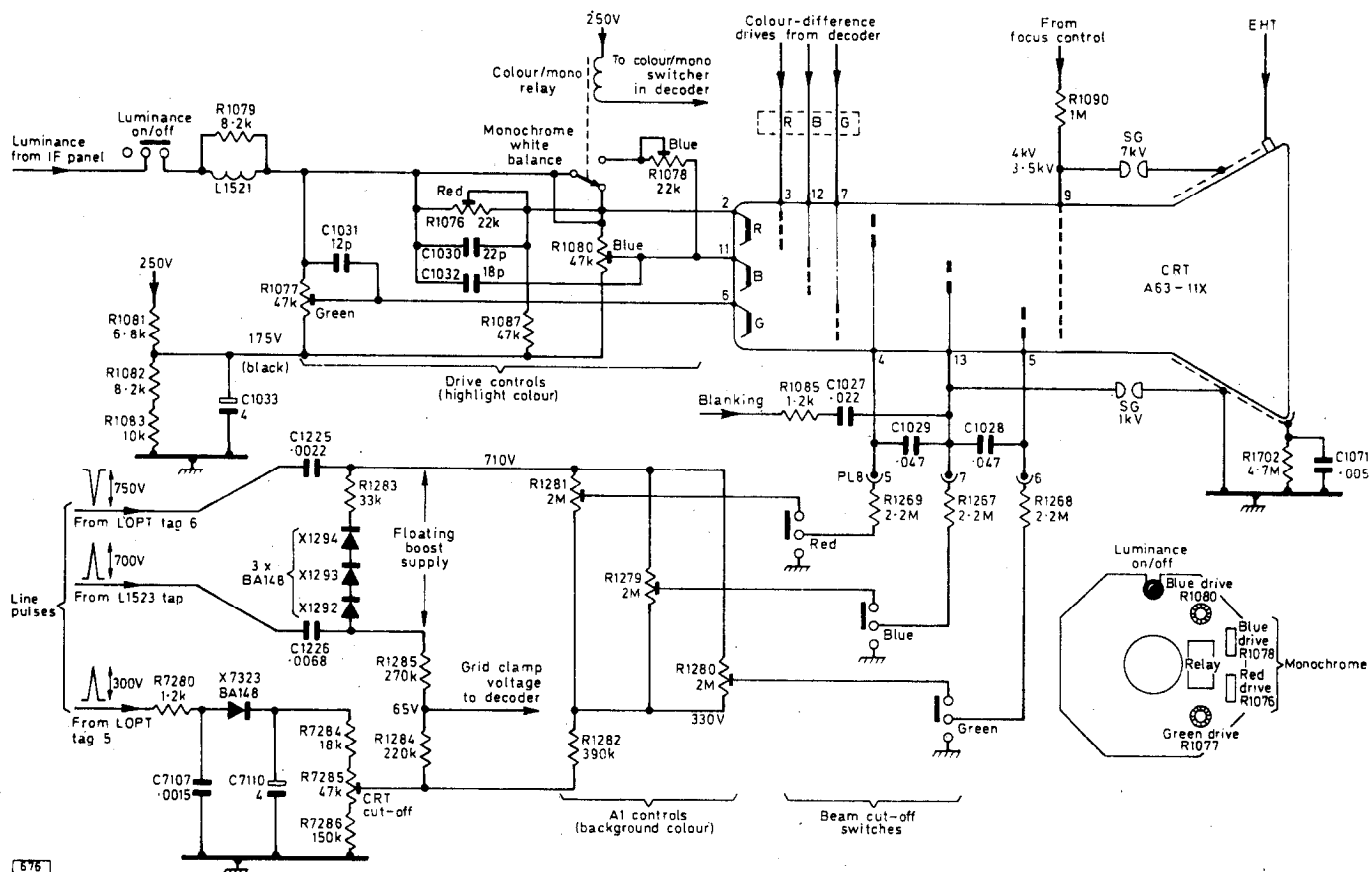


Fig. 2: C.R.T. supply and drive circuits. The first anode presets and switches are mounted on the convergence box. The colour/monochrome relay switch is shown in the colour (relay energised) state – R1076 is shorted out and R1078 is open-circuit in this condition: on monochrome R1076 is brought into circuit to reduce the red drive while R1078 provides increased blue drive. This arrangement was fitted in early production only. In later versions R1282 is 220kΩ, R1284 180kΩ and R7284 is deleted.

there are times when the picture size is right and does not vary. This could well indicate that all is not well around the focus network. Some 4.5kV is required at pin 9 of the c.r.t. base for sharp focus. This is the pin which has the insulation around it to prevent eager little fingers getting burnt.

In these receivers the focus potential is not derived from the e.h.t. system. A separate focus rectifier (EY51) is employed, its anode being connected to the PL509 anode contact on the line output transformer. From its cathode a chain of high-value resistors eventually connects to chassis. The focus control is the third resistor from the cathode. Obviously then if one of the first two resistors changes value, going high, the focus potential available will fall below that required. Focus control adjustment will "take up the slack" at first but the time will arrive for a check on the resistor chain to reveal which of the resistors has departed from the ranks of the righteous. Decomposition of the resistors can occur which can make the focus fluctuate above or below the norm. The control itself is not above suspicion but seems to survive pretty well. If, as happens, one of the resistors on the earthy side of the control goes open-circuit the focus will be poor and adjusting the control will have no effect.

Striations

Another trouble spot involving resistors is in the line linearity circuit. There are two linearity coils in dual-standard sets, one in single-standard versions. The damping resistor(s) are 1.5kΩ and if they go high-resistance the resultant ringing produces vertical rulings down the left side of the screen, fading away towards the centre. We have said resistors but as 405 is unlikely to be still in use R5033 should not cause concern.

The Line Output Transformer

The line output transformer is a fairly expensive item and is no

easy job to replace. It should not be suspected lightly therefore. Early models employed a 42pF capacitor (C5014) across one of the windings and this was inclined to go short-circuit giving the effect of shorted turns in the transformer.

It is a good idea to clip this capacitor out and leave it out. Referring again to early models, disconnect the connection from R7209 on the decoder board (c.r.t. protection) to the PL509 control grid and leave it off. If you happen to be dealing with a no raster fault this action may produce a nice white (well nearly white) line across the screen to indicate that you have been a silly billy to suspect the line output stage and that the fault is in the field timebase after all.

Don't forget to check the boost capacitor C5013 – I know you would have checked this first, but you may not have been able to find it since it can be inside or underneath the housing.

Line Oscillator

There is nothing mysterious about the line oscillator: just a nice ordinary PCF802 in an ordinary circuit. Apart from the system switch in early versions the only item likely to give trouble is the PCF802 itself. No nasty capacitors that leak or short (well they haven't to date so far as we are concerned, not like some we could mention). Thus apart from an occasional valve change for line hold troubles or non-operation, the stage has proved pretty well trouble free.

Setting up the Line Hold

Mark you, if the adjustments have been disturbed or a component change made the setting up procedure is not all that straightforward and merely adjusting the core of L4501/2 may not produce a reliable hold. It is necessary first to disconnect one reference waveform by shorting the junction of R4071-R4075 to chassis. Then adjust the core of coil L4501/2 to produce a

Single-standard field timebase: V4004 has a single 220Ω (R4117, not a drop-off type) cathode bias resistor. A 120Ω drop-off resistor (R4135) is added in its anode circuit between the field output transistor (former primary winding and V4004 pin 6. R4097 is reduced to 2.2MΩ. The up/down shift plug and socket arrangement is removed.

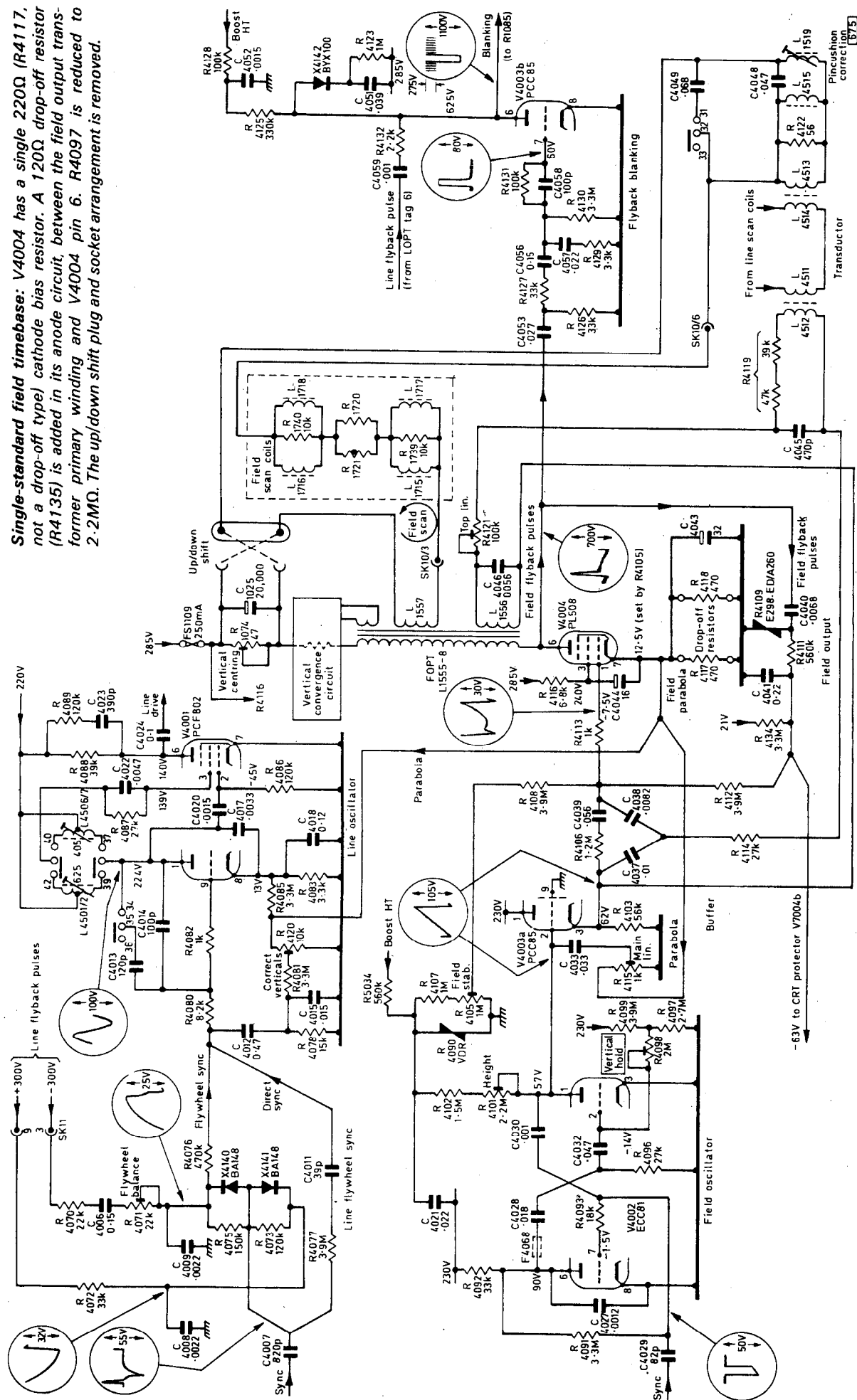


Fig. 3: Circuit diagram of the timebase printed panel, with the 405/625 line switching shown in the 625-line position. In later versions R4075 is 130kΩ and R4134 and the c.r.t. protection circuit are deleted.

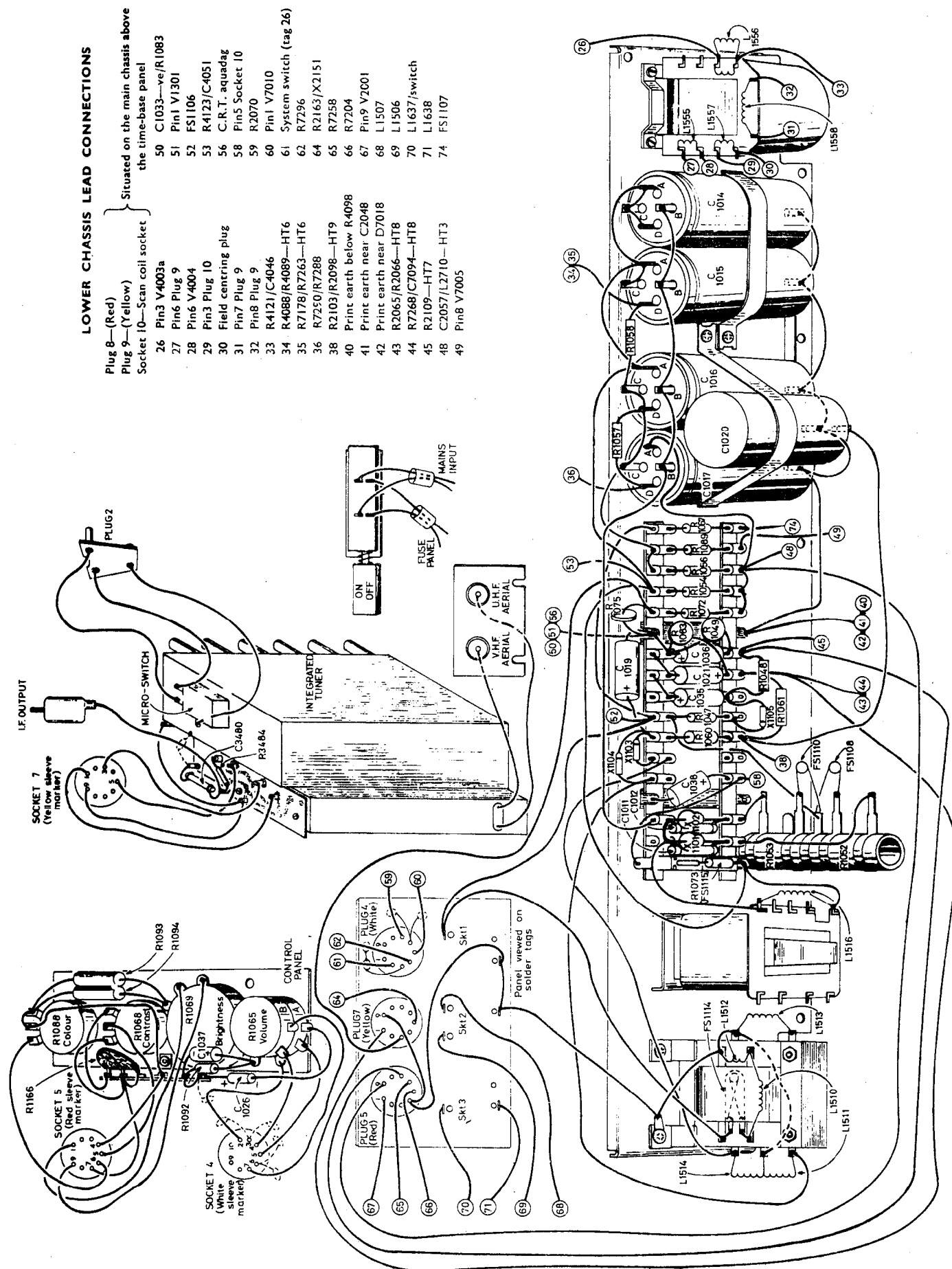


Fig. 5: Wiring to the lower chassis (power supply circuits), control panel and tuner.

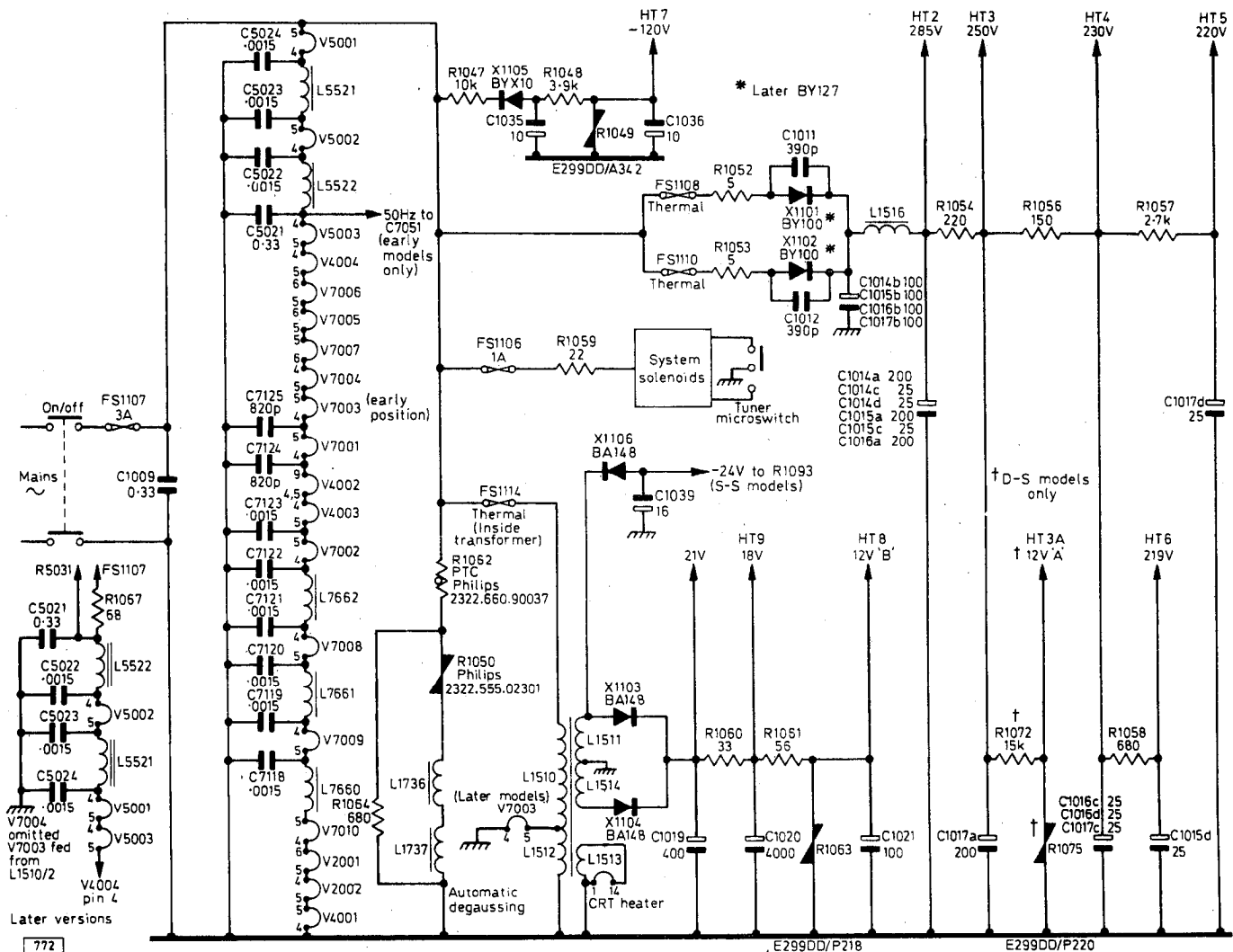


Fig. 6: Power supply circuits. The h.t. rail voltages are slightly higher on single-standard chassis.

hovering picture. Remove the short from the junction of the two resistors and then short pin 2 of V2002 (line sync pulse amplifier on i.f. panel) to chassis. Set R4071, again for an almost locked picture. Remove the short and you should have a locked picture come rain or shine.

The Field Timebase

If the field timebase does give trouble, and it hasn't given us much, the first suspects must be the valves, particularly the ECC81 multivibrator. This can give rise to several fault conditions ranging from total field collapse (thus a single horizontal line across the centre in all but early models where R7209 should be disconnected as outlined earlier) to a jittery picture or loss of hold. There is a buffer stage between the ECC81 and PL508, employing half a PCC85 (V4003). Speaking for ourselves only, we have not had to replace one of these to date. Having said that, we'll probably from now on be plagued with PCC85 trouble, but never mind.

When the field hold control has to be adjusted in the same direction until it reaches the end of its travel, resistor R4099 will probably be at fault (going high) but the ECC81 should nevertheless be the first suspect.

Output Stage Bias

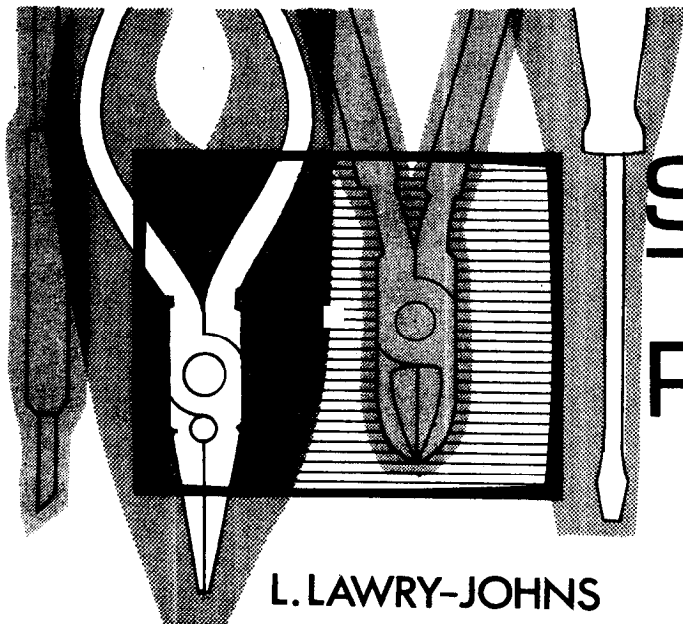
The PL508 output valve can cause some queer symptoms – apart from total collapse or reduced scan – and one must bear in mind the fact that a stabilising circuit is used in the field output stage of these receivers. This is of much the same type as is

common in valve line output stages, and a field output stabilising control (R4105) is provided. Now the trouble with this is that it can be wrongly set without any apparent field scan non-linearity yet nevertheless leaving the PL508 with incorrect bias. Whenever any work is carried out in the field circuit therefore it is necessary to adjust the control – for a voltage of 12.5V at the cathode of the PL508. It should not be assumed from this that the valve is without the normal cathode resistor(s). From the cathode to chassis there are usually two cathode bias resistors, of 470Ω each. There are also two controls, one of 1kΩ (R4115) and one of 10kΩ (R4120). If the PL508 develops internal leakage between its cathode and grid the resultant heavy cathode current can overheat the 470Ω resistors so that one or both drop off their tags. If both drop off the 1kΩ control is left and develops a high voltage across it. This overstrains the decoupling electrolytic C4043 which can pop off and make a mess. Thus one thing leads to another and the drill is to fit a new PL508 and, having replaced the capacitor and resistors, set up the stabilising control R4105 as outlined above.

Bottom Compression

Bottom compression can be caused by the cathode electrolytic C4043 or the screen decoupler C4044 drying up. Whilst the former is a natural suspect the latter is often overlooked, as are the h.t. electrolytics, when compression of the lower part of the raster is being investigated. Note that the two cathode bias resistors of 470Ω each were later replaced by one 220Ω resistor (R4117).

CONTINUED NEXT MONTH



SERVICING TELEVISION RECEIVERS

PHILIPS G6 CHASSIS

CONCLUDED

Power Supplies

When the main chassis is lowered and one looks down the back of this lot for the first time one's first reaction is to put it back up and join the Foreign Legion. After a time however the mass of electrolytics and wirewound resistors down the bottom can be assigned their separate functions and it will be noticed that the electrolytics are mainly cross connected. Very little actually goes wrong in these regions except for poor earthing of the electrolytics. This causes a horizontal band of light to move slowly down (or is it up?) the screen, with perhaps a slight hum on the sound. A general tighten up of the clamps and earthing tags seems to clear this trouble without the need to replace any of the cans.

The other trouble spot has already been mentioned. This is the 10 Ω resistor on the left side supplying the line output stage. Whilst it can go open-circuit on its own account, more often it parts company with its mounting springs due to overheating. This of course directs attention to the right side line output stage.

Should any supply line be absent, a quick check for voltage across each end of each wirewound resistor will reveal which has become open-circuit. It should be appreciated that not all the lines are positive: HT7 is 120V negative.

Audio Circuit

The sound output stage uses a PCL86 valve. This has a habit of suddenly cutting out with a loud crack and just as suddenly coming on again. Tapping the valve may well produce these symptoms so there is no problem here. It is essential however to check the value of the cathode resistor R7293 which should be 180 Ω . The valve can pass considerable current which damages the resistor. If this point is ignored there will be further trouble in a short time.

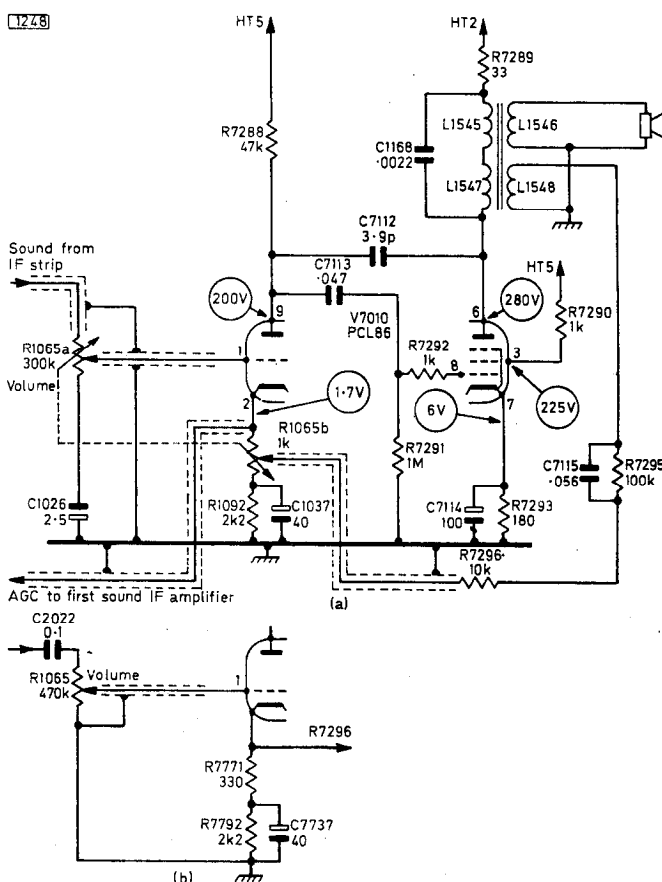
Video Circuits

The colour-difference drive technique used in these receivers means that there is a separate output stage for the luminance signal and three colour-difference output stages. The output from the former is applied to the tube cathodes via the drive controls (these are set to obtain the right white and greys); the latter three outputs are applied to the c.r.t. grids. Thus the mixing process is carried out by the tube itself.

From a picture quality and general brightness/contrast level point of view the luminance output stage is most critical and it is essential for this to give of its best at all times. There is a great deal of difference between the design of the original dual-standard

luminance output stage and the later single-standard version. In the original circuit the brightness control varies the potential applied to the screen grid (pin 9) of the valve whereas in later models this potential is fixed and the brightness control operates via the black-level clamp in the control grid circuit. Also, the original circuit uses conventional cathode bias with a 330 Ω resistor shunted by a zener whilst later versions have the cathode returned direct to chassis with all the bias applied to the control grid.

When the picture is light and lacking in contrast suspect the PFL200 and, in the original circuit, check the associated





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The drive for the G-Y amplifier control grid is obtained by mixing measured proportions of the R-Y and B-Y outputs. These are applied via the green amplitude control R7236. The original design had the R-Y and B-Y pentode cathodes coupled by a tint control: in this circuit all three cathodes should read 1V. The addition of a tint control is a dubious advantage and it was omitted in later versions.

Occasionally one encounters intermittent colour faults due to the coupling capacitors in these stages.

The Decoder

The full circuit of the decoder, with an admirable description by Caleb Bradley, appeared in the December 1973 issue, with notes on faults and setting up in the January 1974 issue. This is a complex piece of design work which takes a lot of explanation and space to present: we do not propose to repeat it. Any reader who seriously intends to service these sets should have the service manual for the dual-standard and single-standard versions or the volumes of *Radio and Television Servicing* which contain them. He should also appreciate that the receiver to be worked on may not have an identical layout or circuit to those shown but may be a mixture of the two basic designs.

Fault Location Guide

In the event of suspected trouble in the decoder the Philips G6 *Fault Location Guide* can be consulted. This will unerringly lead to the stage where the fault is, all that then remains to do being to check a limited number of components to ascertain which is causing the trouble. We have used this plan for some years and find it invaluable from every point of view, not the least of which being that it saves the writer thinking too hard, something he doesn't do very often.

Troubles Encountered

Most of the troubles we have encountered consist of valve defects, diode failures, faulty crystals, intermittent preset controls and the occasional changed value resistor. A defective capacitor

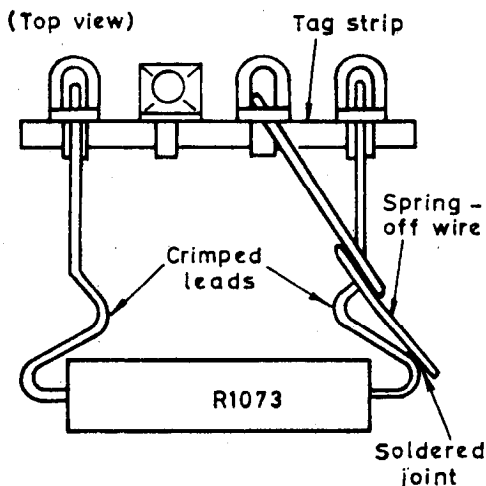


Fig. 9: The spring-resistor assembly R1073/FS1115 which is mounted on a tagstrip near the mains transformer and is included to protect the valves in the line output stage in the event of certain fault conditions. To reconnect, the spring-off wire must be soldered to the outside of the bend in the resistor's leadout wire, using ordinary 60/40 resin-cored solder. If it is necessary to replace either the resistor or the spring-off wire, the new parts must be carefully fitted as shown above. Slip the bent end of the spring-off through the second tag from one end of the strip, then turn it approximately 45° to the strip before soldering it to the outside of the crimped part of the resistor's leadout wire.

A different arrangement is used in earlier models.

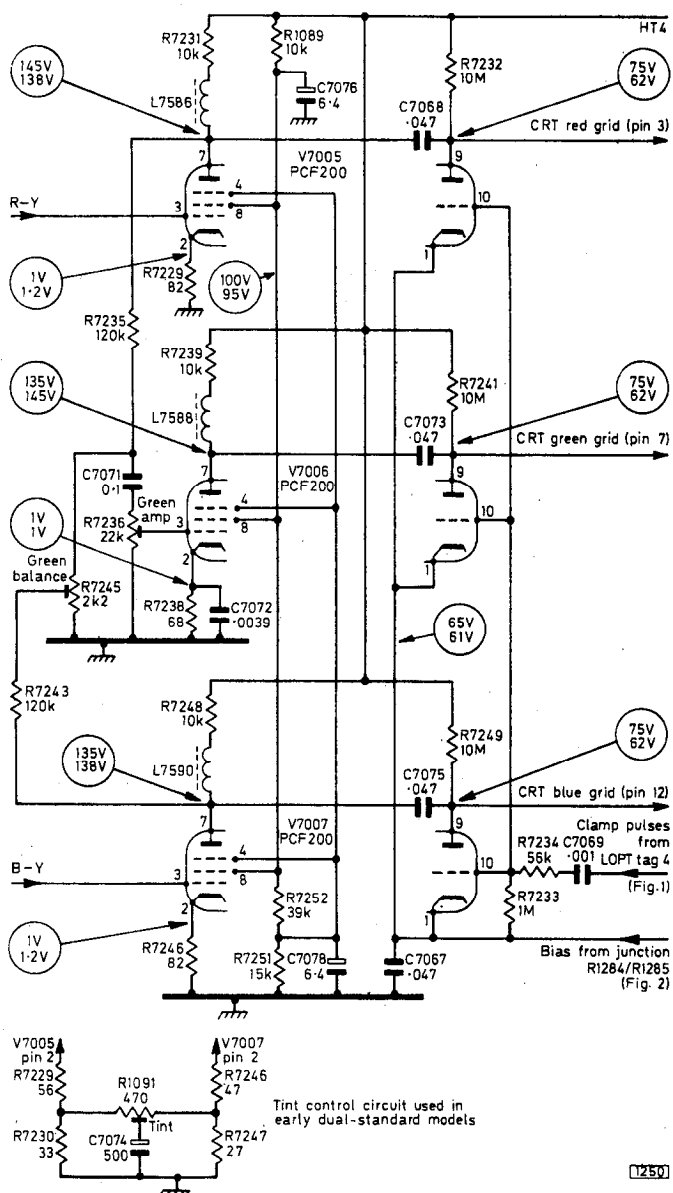


Fig. 10: The colour-difference output stage/clamp circuits. The upper voltages shown apply to the dual-standard chassis (measured on 625 lines), the lower voltages to the single-standard chassis.

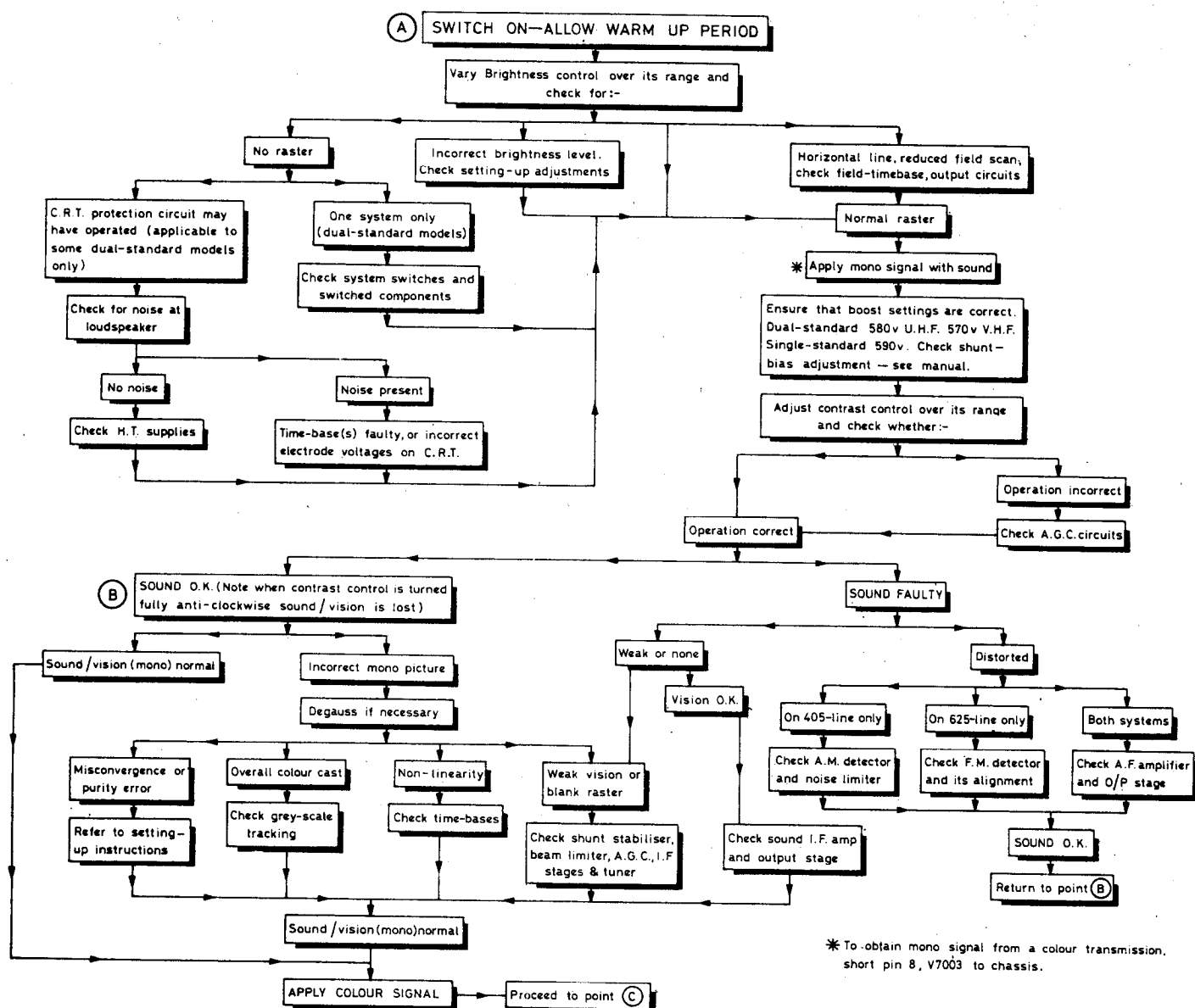
is very rare (in some makes you go for the capacitors first). Due to the large number of diodes used it is only to be expected that one or more will fail during the lifetime of the set.

Other troubles can be due to poor soldering in the coil lead outs and intermittent connections from the small printed panels in the coil cans to the print on the panel. Both problems necessitate removal of the can assembly and some delicate rewiring or resoldering if the complete unit is not to be replaced. Faults in particular assemblies often show up only when the stage concerned has been disturbed, perhaps for some other reason.

The can which seems to give the most trouble is the burst detector coil assembly (can F) which contains the burst and the a.c.c. (automatic chrominance control) detectors. The colour killer turn-on bias is obtained from the a.c.c. circuit rather than, as is usually the case, the ident stage. Thus lack of output from the burst amplifier V7008 (EF184) will result in no colour while low output from the ident amplifier T7015 (BC107) will not result in no colour but in incorrect PAL bistable switching (i.e. green faces) from time to time. In the latter event T7015's emitter decoupling electrolytic C7093 (16μF) is a suspect.

Although capacitor faults are rare there is one other that occasionally gives trouble. The first chrominance amplifier V7001 (EF183) screen grid decoupler C7025 (0.047μF) can short,

G6 Fault Location Guide



burning out the associated feed resistor R7140 (22kΩ). This robs the valve of screen grid voltage of course and the result is no colour.

Over-riding the Colour Killer

To over-ride the colour killer, connect the junction of R7196/R7198 to chassis. Fortunately faults do not happen very often on this panel, but when they do the work involved can be most tedious.

Pitfalls

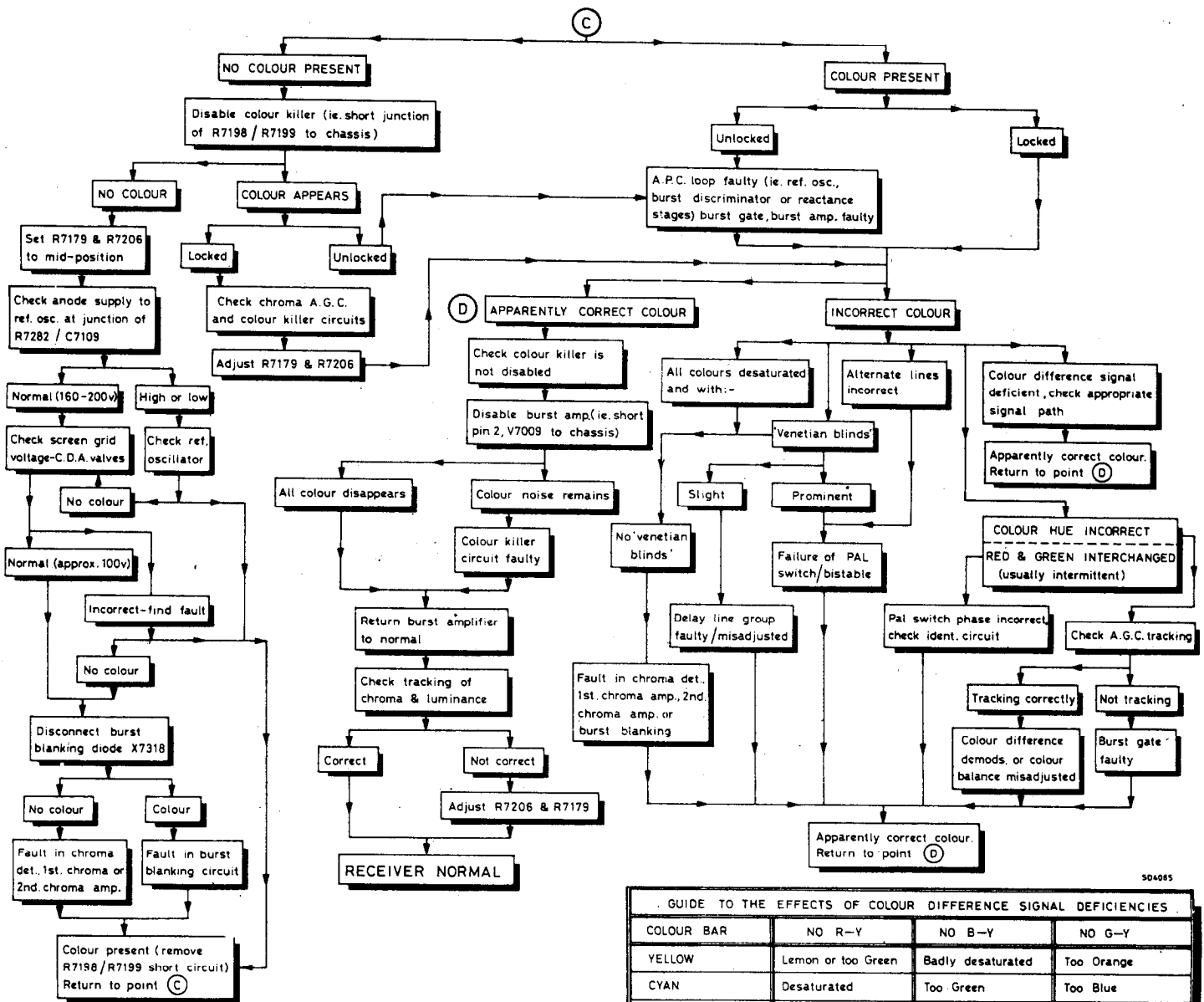
We were asked recently to service a G6 chassis which we had not sold and had not previously serviced. The owner stated quite firmly that he wanted a quote for a new or reguned tube. We asked him why he thought he needed a new tube. "Because although all the other valves light up, the tube heaters don't" was the answer. Upon opening up we found that this was very nearly so except that the PCC85 (V7003) didn't light up either and also there was no sound. Briefly, the situation was that the mains

transformer was out of action, leaving the main series heater line intact and incidentally the high voltage h.t. lines. There was no reading across the primary of the transformer, due to the thermal fuse FS1114 being open-circuit. This little item is inside a plastic housing in the main transformer and was open because of the short across the l.t. supply line caused by a shorted diode. Replacing the diode and repairing the thermal fuse restored normal working. Now this could not have happened (to produce the same symptoms) on the earlier dual-standard versions because a thermal fuse was not fitted in these — the transformer being protected by FS1107 in the mains input only — while V7003 was in the main series heater chain.

Horror Story

This was nothing compared to the horror we had in a short time ago. The set belonged to a friend of our butcher (so we couldn't say no). He had been unable to get it repaired after obtaining it due to a death in the family, or something like that.

After a few checks we found that resistor R1073 was off its spring mount and that this had been caused by a defective PY500. We fitted a nice new PY500 plus a PL509 for good



GUIDE TO THE EFFECTS OF COLOUR DIFFERENCE SIGNAL DEFICIENCIES			
COLOUR BAR	NO R-Y	NO B-Y	NO G-Y
YELLOW	Lemon or too Green	Badly desaturated	Too Orange
CYAN	Desaturated	Too Green	Too Blue
GREEN	Lemon or too Green	Greenish Cyan	Too dark
MAGENTA	Too Blue	Too Red	Desaturated
RED	Too dark	Slightly Magenta	Orange
BLUE	Slightly Magenta	Too dark	Slightly Cyan

measure and hooked up the resistor to its original position. Having restored normal line timebase working we then had to trace a couple of field faults to restore normal height etc, and sort out the system switch. This left us with a red, blue and green monochrome picture! Not to be defeated at this stage, we went through the whole purity and convergence procedure and then set up the grey scale to obtain a reasonable black and white picture. Meanwhile the sound went distorted but this was only a sidetrack as a new PCL86 put that right. No, the point was where was the colour? Ditching the colour killer didn't help so we went down the Philips fault guide, ending up finally on the i.f. panel where we found an $0.02\mu\text{F}$ capacitor wired smack across the input to chrominance i.f. can E, i.e. from the can side of C2052 to chassis. Removing this capacitor sent the whole i.f. strip into oscillation. A closer examination showed that some pretty frantic work had been carried out in several parts, particularly in the area of can A.

To condense many miserable hours of fruitless endeavour into one sentence we eventually replaced the whole panel and were at last rewarded with a good picture in full colour. The customer was very happy but we have not yet recovered. You may ask what this has to do with pitfalls: not much really perhaps, but we thought you would like to know that we get our share of the rough ones.

Line Output Transformer

Finally, some notes on the line output transformer. As

previously mentioned, the set must not be operated with the transformer's screening can removed. All the tappings are externally available, however, at the two ten-way sockets at the side of the transformer can assembly.

It is important that the boost voltage is correct. In the single-standard chassis it should be 590V, in the dual-standard chassis it should be 570V on 405 lines, 600V on 625 lines. Unless the scan coils are faulty, correct boost voltage means that the primary output transformer circuit is operating correctly. Very low boost voltage indicates a heavy load or lack of drive — check the valves first. Roughly correct boost voltage but no raster should direct attention to the c.r.t. base voltages. The boost voltage is set by the line stabilisation control(s) R5040/R5041. This should be done with a monochrome transmission being received, under normal picture conditions. Check the voltage by connecting a high-impedance meter across the boost reservoir capacitor C5013 (line output transformer taps 11 and 12 are available at the lower ten-way socket).

If a fault in the PD500 shunt stabiliser circuit is suspected, check the grid and cathode voltages of this valve — there should be about -15V at the grid, 1.2V at the cathode (set by R5053, see earlier notes on the e.h.t. shunt stabiliser).