6 VERTICAL AMPLIFIER TYPE 'H'

6.1 GENERAL

The vertical amplifier type 'H' is a dual range, general purpose amplifier with switch selected input sockets. It has a frequency response from DC - 25Mc/s (-3db) at 100Mv/cm, with less than 1% overshoot, and from DC - 5Mc/s (-3db) at 10Mv/cm.

Direct coupling is used to minimise phase shift, and except in the input stage, transistors are used to reduce the total heat dissipation.

6.2 CIRCUIT DESCRIPTION

The vertical amplifier type 'H' is shown in fig. 3.8 and is balanced throughout.

V21 and V22 constitute the input stage, and act as a long tailed pair to provide a balanced push pull output from a single ended input. Shift is applied to V22 grid via RV38 and the attenuator network R35, R34. In the X10 gain position, the shift is attenuated ten times by the addition of R37.

The signal is applied to V21 grid via a two stage step attenuator and RV24 varies the gain by approx. $2\frac{1}{2}$:1 to give a continuous variation of gain between steps. The network C20, R27, R29 is used to maintain the input capacity of V21 constant, despite changes in gain.

The push pull output at the anodes of V21 and V22 drive emitter followers TR21 and TR22.

In the X1 position of gain control, transistors TR23 and 24 are shorted out, so the signal at the emitters of TR21 and 22 is connected to the output amplifier TR25 and 26.

This is a long tailed pair, with feed back in the emitter circuit to obtain the required high frequency bandwidth, and the emitter followers TR27 and 28 couple the signal to the 'Y' plates.

Sync signals are taken from the emitter of TR27.

In the X10 position of the GAIN SWITCH, transistors TR21 through to 24 act as complementary pair connected cascode circuit. The loop gain is very high and a large amount of feedback is provided to maintain the gain constant at X10.

A negative supply is provided for the input stage tail and shift circuit, by MR21, C26, R62 and C27.

6.3 'H' AMPLIFIER TEST PROCEDURE

Set DC Balance

Adjust the 'Y' SHIFT, in the X1 position, to centre the trace, then switch to X10 gain and recentre the trace using the DC BAL. control. Repeat this procedure until there is no change in trace position when switching from X1 to X10 settings.

Set Gain

Connect the CAL signal to a selected input socket, switch to 0.2v/cm, X1 gain setting, and adjust the SET GAIN X1 to give 5 cms of trace height.

Switch to X10 gain setting and 2v/cm and adjust RV43 to give 5 cms of trace height.

Repeat the above procedure until both settings are correct.

Variable Gain

Variation of the GAIN CONTROL will cause the trace to shift vertically. RV26 should be adjusted, so that a signal expands symmetrically about the centre of the screen as the gain control is rotated.

Set Attenuator

The eight trimmer capacitors of the INPUT ATTENUATOR SWITCH C12, C13, C4, C8, C9, C5, C2 and C3 are accessible for adjustment when the righ-hand side plate is removed from the instrument. They are situated at the front of the Vertical Deflection Amplifier in two parallel rows of four, separated by a metal screen.

In order to carry out this adjustment a squarewave generator is required, giving a frequency of approximately 2Kc/s; its output must be variable between 0.2V and 100V. The rise time of the squarewave need not be particularly fast, but it must have good, flat tops and bottoms. The adjustment procedure is as follows:

a. Connect the squarewave generator to the INPUT socket and adjust its output to approximately 0.2V.

b. Set the INPUT ATTENUATOR to 0.1 volt/cm. Adjust the sweep controls to display three cycles of the squarewave on the screen.

c. Adjust each capacitor in turn, to give square corners to the waveform. The INPUT ATTENUATOR switch should be turned to the appropriate setting as shown in the table below. At the same time, adjust the output of the squarewave generator to give a trace of 2 - 3 cm amplitude in each case.

INPUT ATTENUATOR Setting	Capacitor to be adjusted
0.2 volt/cm	C12
0.5 " "	C13
1.0 " "	C4
2.0 " "	C8
5.0 " "	C9
10.0 " "	C5

When this procedure is correctly carried out, the 20 volts/cm and 50 volts/cm ranges are automatically correct.

d. The capacitors C2 and C3 affect compensation only when the High Impedance probe is in use. To adjust them proceed as follows:

e. Remove the squarewave generator from the input socket and plug in the High Impedance probe. Connect the output of the generator to the probe tip.

f. Set the INPUT ATTENUATOR to 0.1 volt/cm and the squarewave generator output to give approximately 2 cm vertical deflection.

g. Adjust the probe trimmer, which is accessible through a hole in the probe body, to give a flat top to the squarewave.

h. Switch the INPUT ATTENUATOR to the 1 volt/cm range. Readjust the squarewave generator output as before, and adjust C2. Set the attenuator to the 10 volts/cm range and adjust C3. All other ranges will automatically be correct.

Adjustment of High Impedance Probe Compensation Trimmer

This adjustment is best carried out with a squarewave generator at an output frequency of 1Kc/s. Connect the probe to the INPUT socket and apply to the signal generator output. The compensation trimmer is accessible through the hole in the body of the probe and should be adjusted to give square wave corners to a few cycles of the 1Kc/s squarewave displayed on the screen.

Set H.F. Response

Switch to 0.1V/cm sensitivity and X1 gain setting.

Adjust cores in L21 and L22 so that they are nearly out.

Adjust RV51 to be maximum resistance (fully clockwise).

Then adjust C22 for optimum pulse response.

Reduce RV51, this will round off the corner, so readjust C22 to bring the corner back.

Repeat this procedure, of reducing RV51 and restoring the pulse response with C22. The rise time of the pulse will be observed to reduce to an optimum value and then as RV51 is still further reduced, the rise time will increase again. When the optimum rise time has been achieved, adjust L21 and L22 for fastest edge.

If necessary repeat this procedure, to obtain the required bandwidth.

INPUT ATTENUATOR TYPE 'H'

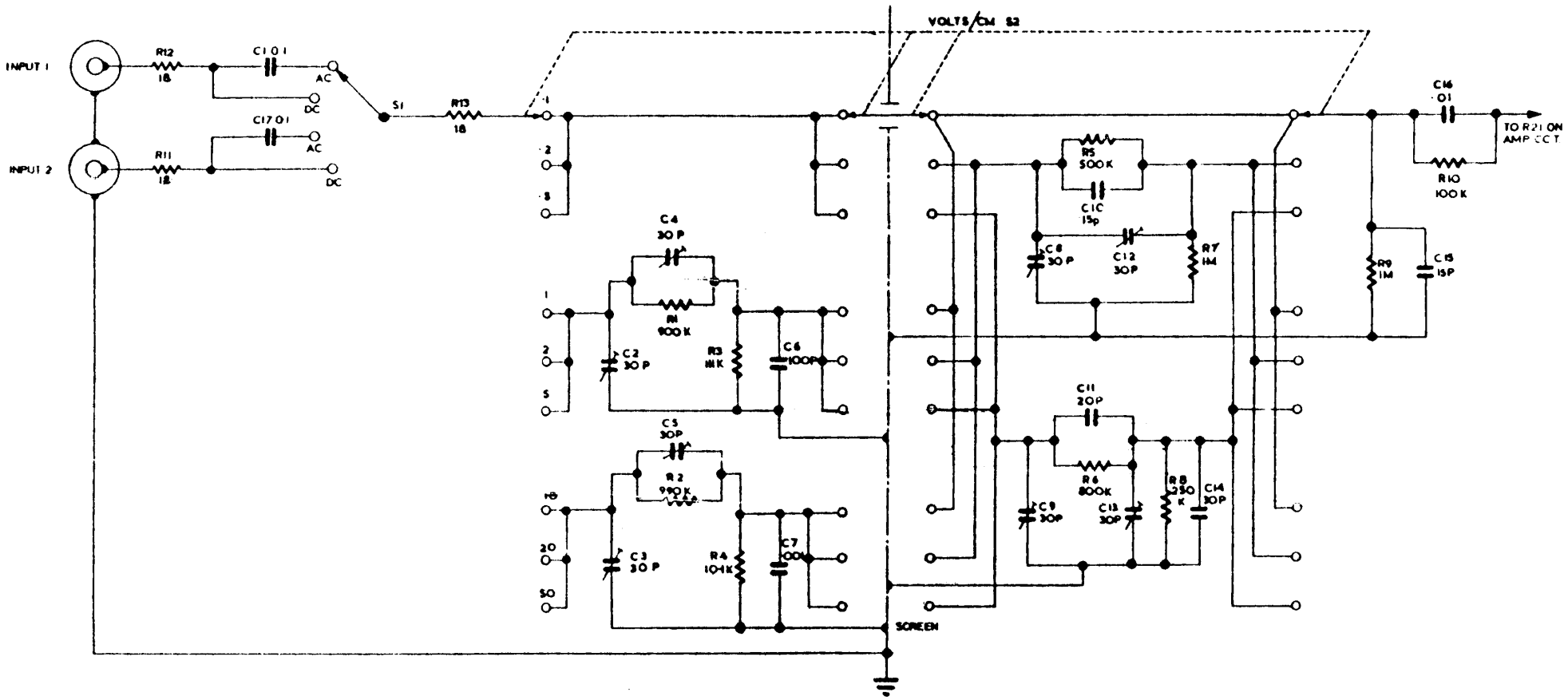
Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @70°C
12M	R 1	900K	HSC	1%	¼w
11M	R 2	990K	HSC	1%	¼w
18M	R 3	111K	HSC	1%	¼w
20M	R 4	10.1K	HSC	1%	¼w
14M	R 5	500K	HSC	1%	¼w
13M	R 6	800K	HSC	1%	¼w
10M	R 7	1M	HSC	1%	¼w
17M	R 8	250K	HSC	1%	¼w
10M	R 9	1M	HSC	1%	¼w
S10410	R10	100K	C	10%	¼w
S18010	R11	18	C	10%	¼w
S18010	R12	18	C	10%	¼w
S18010	R13	18	C	10%	¼w
16K	C 1	0.1	POL	20%	400v
16J	C 2	6-30pf	CER TRIMMER		350v
16J	C 3	6-30pf	CER "		350v
16J	C 4	6-30pf	CER "		350v
16J	C 5	6-30pf	CER "		350v
59K	C 6	100pf	SM	10%	350v
61K	C 7	1000pf	SM	10%	350v
16J	C 8	6-30pf	CER TRIMMER		350v
16J	C 9	6-30pf	CER "		350v
63X	C10	15pf	SM	5%	350v
64X	C11	20pf	SM	5%	350v
16J	C12	6-30pf	CER TRIMMER		350v
16J	C13	6-30pf	CER "		350v
65X	C14	30pf	SM	5%	350v
63X	C15	15pf	SM	5%	350v
67J	C16	0.01	POL	10%	400v
16K	C17	0.1	POL	10%	400v
57D	S 1		Switch AC/DC		
36P	S 2		Switch VOLTS/CM		

VERTICAL AMPLIFIER TYPE 'H' (continued)

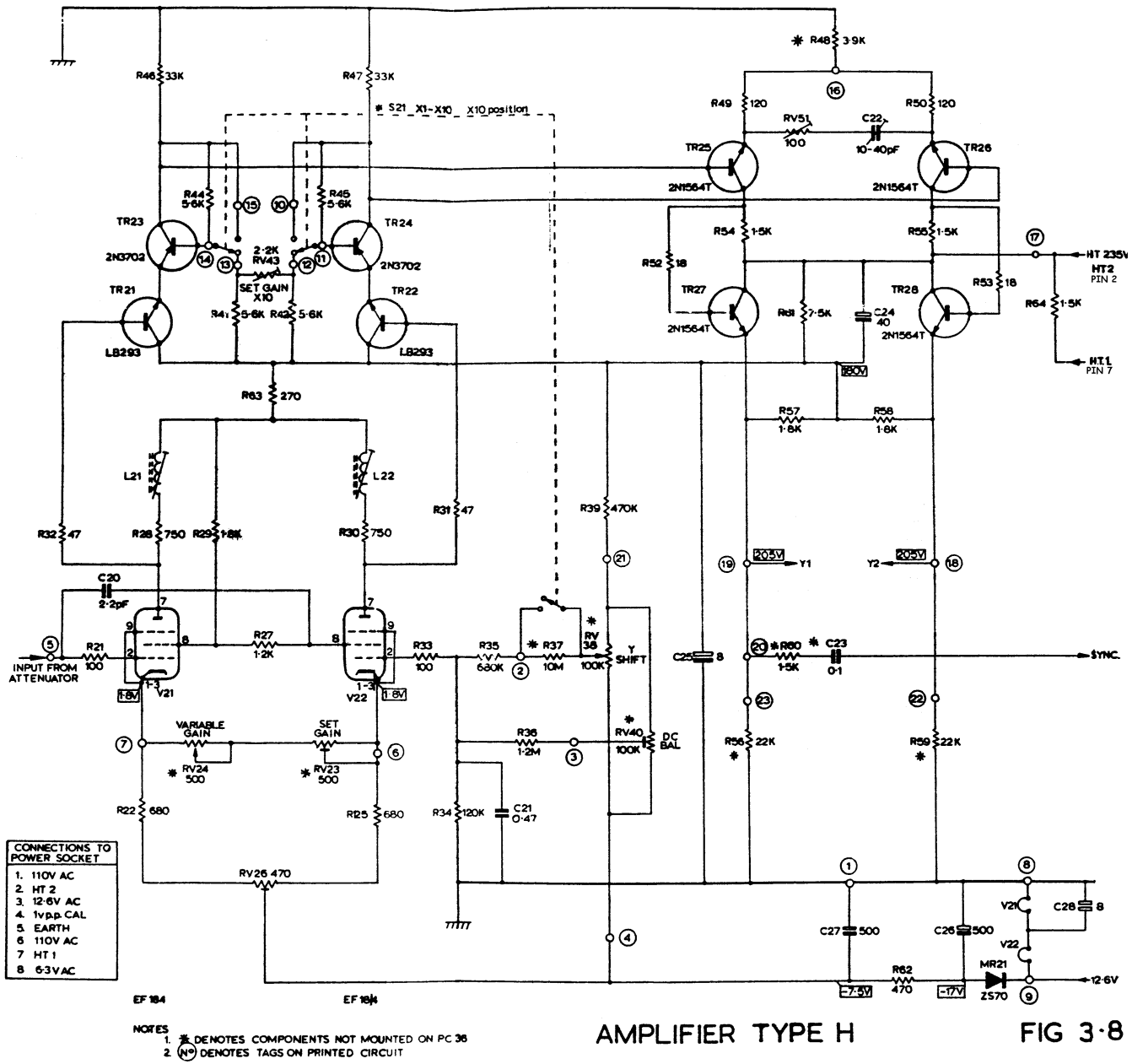
Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @70°C
S10110	R21	100	C	10%	¼w
S68110	R22	680	C	10%	¼w
119C	RV23	500	Potentiometer Preset 'Set Gain X1'		
82C	RV24	500	Potentiometer 'Var. Gain'		¼w
S68110	R25	680	C	10%	¼w
16C	RV26	470	Potentiometer Preset 'Bal.'		¼w
S12210	R27	1.2K	C	10%	¼w
S75105	R28	750	C	5%	¼w
S18210	R29	1.8K	C	10%	¼w
S75105	R30	750	C	5%	¼w
S47010	R31	47	C	10%	¼w
S47010	R32	47	C	10%	¼w
S10110	R33	100	C	10%	¼w
S12410	R34	120K	C	10%	¼w
S68410	R35	680K	C	10%	¼w
912510	R36	1.2M	C	10%	¼w
910610	R37	10M	C	10%	¼w
24C	RV38	100K	Potentiometer 'Y Shift'		¼w
S47410	R39	470K	C	10%	¼w
125C	RV40	100K	Potentiometer Preset 'DC Bal.'		¼w
S56210	R41	5.6K	C	10%	¼w
S56210	R42	5.6K	C	10%	¼w
56C	RV43	2.2K	Potentiometer Preset		⅛w
S56210	R44	5.6K	C	10%	¼w
S56210	R45	5.6K	C	10%	¼w
122L	R46	33K	MO	5%	1.5w
122L	R47	33K	MO	5%	1.5w
155L	R48	3.9K	MO	5%	6w
S12110	R49	120	C	10%	¼w
S12110	R50	120	C	10%	¼w
113C	RV51	100	Potentiometer Preset		⅛w
S18010	R52	18	C	10%	¼w
S18010	R53	18	C	10%	¼w

VERTICAL AMPLIFIER TYPE 'H' (continued)

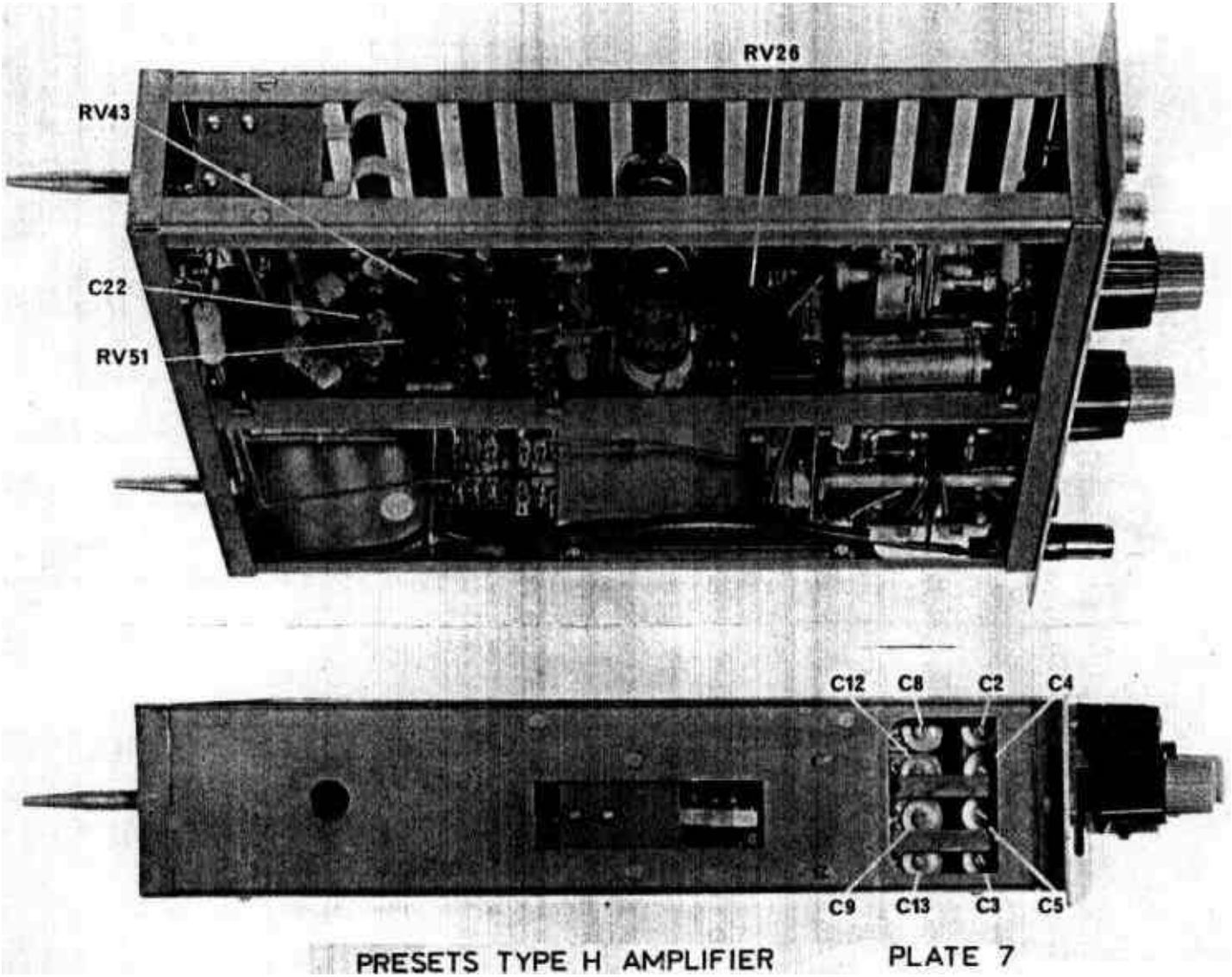
Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @70°C
124L	R54	1.5K	MO	5%	3½w
124L	R55	1.5K	MO	5%	3½w
102M	R56	22K	MO	5%	3½w
152L	R57	1.8K	MO	5%	1.5w
152L	R58	1.8K	MO	5%	1.5w
102M	R59	22K	MO	5%	3½w
S15210	R60	1.5K	C	10%	¼w
113L	R61	7.5K	MO	5%	1.5w
S47110	R62	470	C	10%	¼w
S27110	R63	270	C	10%	¼w
158L	R64	1.5K	MO	5%	3½w
43K	C20	2.2pf	CER	5%	750v
89J	C21	0.47	PE	20%	100v
75J	C22	10-40pf	CER TRIMMER		
16K	C23	0.1	PE	20%	400v
108J	C24	40	ELEC		100v
39X	C25	8	ELEC		300v
109J	C26	500	ELEC		18v
109J	C27	500	ELEC		18v
56X	C28	8	ELEC (Reversible)		25v
26T	V 1		EF184 Valve Mullard		
26T	V 2		EF184 Valve Mullard		
119T	TR21		Transistor LB293 Motorola		
119T	TR22		Transistor LB293 Motorola		
116T	TR23		Transistor 2N3702 Texas		
116T	TR24		Transistor 2N3702 Texas		



ATTENUATOR CIRCUIT TYPE H FIG 3·7



AMPLIFIER TYPE H FIG 3·8



PRESETS TYPE H AMPLIFIER PLATE 7