RECEPTION SETS R106, MKS 1 AND 2

TECHNICAL HANDBOOK - TECHNICAL DESCRIPTION

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Distribution - Class 860. Code No. 3

INTRODUCTION

1. The R106 is a special purpose high grade superheterodyne receiver for the reception of C.W., M.C.W. and R.T. (A.M.) signals. It has very high stability and resetting accuracy.

2. There are four models of the R106 Mk 1 and one model of the Mk 2. Though most of these incorporate variable selectivity, optional A.V.C., variable pitch C.W. oscillator and signal strength meter, one model does not include crystal selectivity or signal strength meter. The main differences are listed in para 29.

COMPLETE STATION

3. The complete station includes the following items:

(a) Reception set, R106, Mk 1 or Mk 2
(b) Coil units as follows:-

(i)	50-100kc/s	Type J
(ii)	100-200kc/s	Type H
(iii)	180-430kc/s	Type G
(iv)	480-960kc/s	Type F
(v)	900-2050kc/s	Type E
(vi)	1.7-4Mc/s	Type JD
(vii)	3.5-7.3Mc/s	Type JC
(viii)	7-14Mc/s	Type JB
(ix)	14-30Mc/s	Type JA

(c) Supply unit, rectifier, No. 5
(d) Supply unit, vibratory, No. 2
(e) Receiver, headgear, double, C.H.R.
(f) Batteries, secondary, portable, 6V, 85Ah.
(g) Lamps, operator, No. 3
(h) Connectors, twin, No. 24A.
(j) Cases, spare valves, No. 4A

BRIEF ELECTRICAL DESCRIPTION

4. Fig 1 shows a block diagram of the receiver. The frequency range is covered in nine bands by separate plug-in coil units. When the crystal filter is not in use the I.F. bandwidth is 3.0kc/s at -6db. With the crystal in circuit the maximum selectivity is 200c/s at -6db.

5. Audio output may be fed to either headphones or a loudspeaker at will. The headphone impedance is 2000Ω and the loudspeaker impedance is 7000Ω. When the loudspeaker is disconnected from the set the output terminals at the rear of the chassis must be short-circuited.

6. The aerial input circuits are designed for coupling to a balanced or unbalanced transmission line of approximately 500Ω impedance, but may be fed from a single wire aerial.

7. The receiver sensitivity over all bands is of the order of 2.0-3.0 microvolts for 1 watt output to a loudspeaker, with 30% modulation.

8. The receiver operates from either a 100 - 250V 50c/s A.C. supply using the Supply unit, rectifier, No. 5 (see Tels K 220/5) or from a 6V D.C. battery supply, using the Supply unit, vibratory, No. 2. The power supplies required are H.T., 250V D.C. at 60mA, and L.T. 6.3V A.C. or D.C. at 3.5A.

9. Terminals are provided at the rear of the chassis for relay control of the receiver when required. These terminals must be short-circuited when not in use.

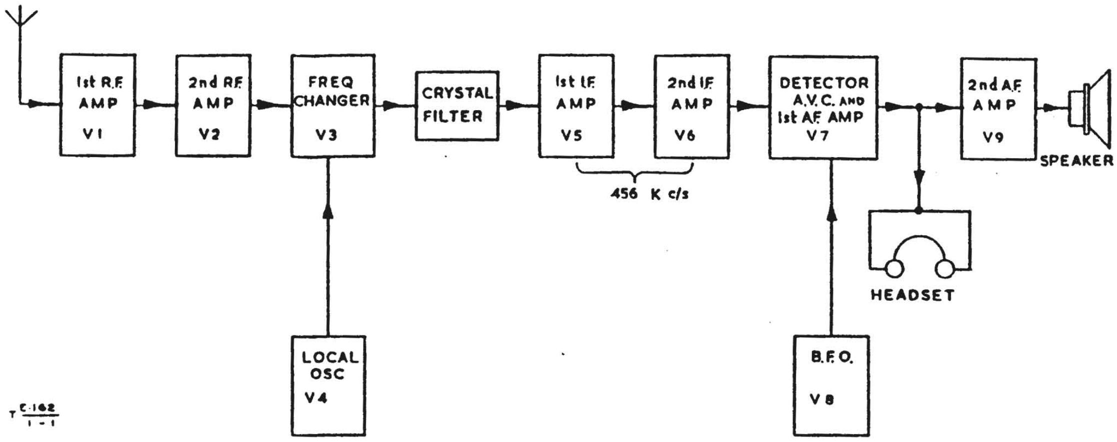


Fig 1 - Block diagram

10. The circuit differences between the Mk 1 and Mk 2 receivers are given in para 29. The changes in components are noted in Table 1001.

BRIEF MECHANICAL DESCRIPTION

11. The receiver normally is provided for table operation and is housed in a steel cabinet with hinged lid. All models can be provided for rack-mounting in which cas only the chassis with a stronger front panel is supplied.

12. The physical dimensions of the receiver in its case, complete with one coil ur are as follows:-

Weight 32lbs	Width $17\frac{1}{2}$ inches
Height 9 inches	Depth 12 inches

The dimensions of individual coil units are as follows:-

Weight 2lbs	Width $10\frac{1}{2}$ inches
Height $2\frac{1}{2}$ inches	Depth $5\frac{1}{2}$ inches

13. The receiver is assembled on a steel chassis to which is attached a steel fro panel. The coil units, (see Fig 2), comprise four separately screened cans which house the aerial, R.F., frequency-changer and oscillator coils together with their associated capacitors. All four sections are mounted on a panel, to which is attached a calibration chart, showing the relationship between dial reading and th frequency coverage of the unit. A table is also attached for the recording of station dial settings.

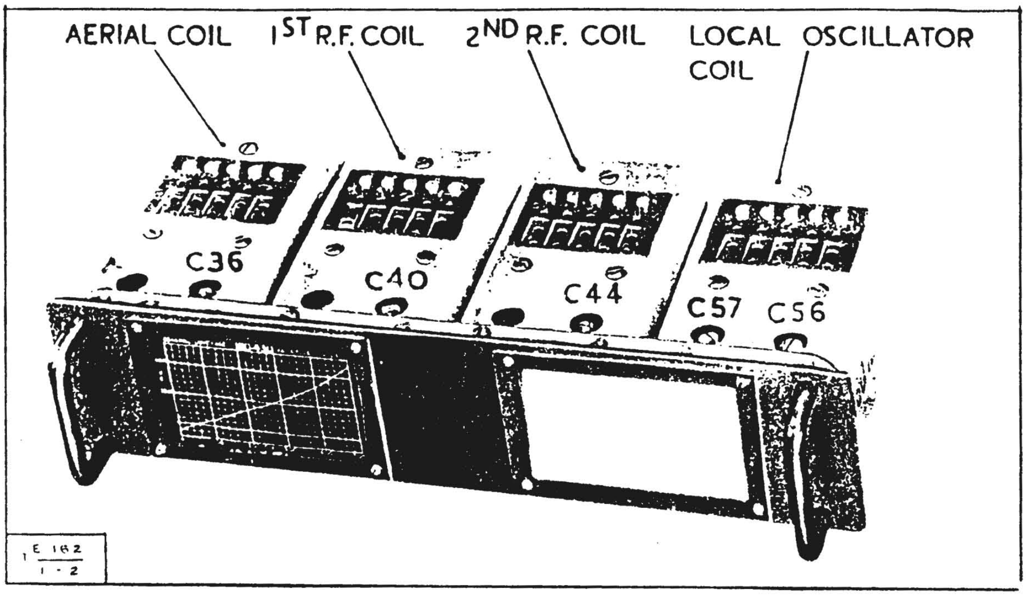


Fig 2 - Typical coil unit

14. The main tuning dial and drive mechanism is designed to provide the highest degree of re-setting and reading accuracy. An effective scale length of over 12 feet is obtained by the use of a 20 to 1 reduction gear. The dial is in two parts, an outer dial engraved with 50 divisions and having 5 equally spaced apertures and an inner dial geared to the outer but rotating on a separate eccentric bearing. The action is such that the numerals appearing through the aperture adjacent to the index indicate the number of divisions that have passed the index. In this way 500 divisions correspond to 10 revolutions of the dial for an angular movement of the driven spindle of 180°. Interpolation to one fifth of a division is easy and the dial may thus be read to one part in 2500. The split, spring-loaded, worm wheel reduction gearing is housed in a substantial die-cast casing. The tuning gang is of very rigid construction, each section being isolated from the case and having its own rotor earth contact.

CONTROLS
(see Fig 3)

15. With the exception of pre-set components all controls are mounted on the front panel, together with the S-meter, headphone output jack and pilot lamp. The designation, circuit reference and function of each control are given in Table 1. The aerial terminals are placed at the left-hand side of the chassis and are accessible through an opening in the side of the receiver case. The power leads are terminated in a four-pin plug, for use with either of the supply units mentioned in para 3.

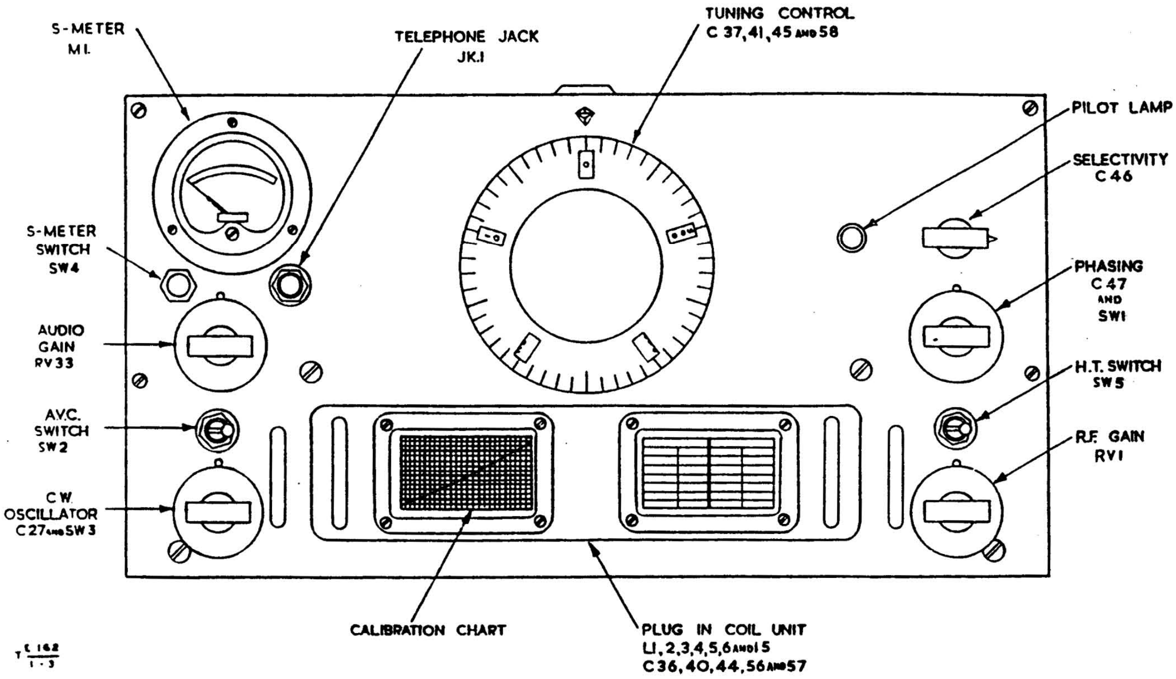


Fig 3 - Front panel controls

Table 1 - Front panel controls

Designation	Circuit reference	Function
Tuning control	C37; C41; C45; C58	Main tuning control. Clockwise rotation increases dial reading and frequency
H.T. switch	SW5	H.T. on/off toggle switch operatin from left to right
Plug-in coil	L1 - L6 and L15 C36: C40; C44; C56; C57	R.F. and local oscillator tuned circuits
R.F. GAIN	RV1	Varies the gain of the 2nd R.F. and two I.F. stages, V2, V5 and V6

Table 1 - (contd)

Designation	Circuit reference	Function
AUDIO GAIN	RV33	A.F. volume control
Selectivity control	C46	Controls selectivity of I.F. stages when the crystal filter is in circuit. When crystal filter is not in use this control acts as a normal I.F. trimming capacitor
PHASING control and crystal filter switch	C47 SW1	Rotation from zero opens switch SW1 and brings crystal into operation. This control is then used for eliminating interfering signals
C.W. OSC. control and switch	C27 SW3	Clockwise rotation from zero closes switch in H.T. line to B.F.O., V8. This control varies the pitch of the beat note
A.V.C. switch	SW2	A change-over switch. Disconnects the grids of the R.F. and I.F. valves, V1, V2, V5 and V6 from the signal diode (Switch to left for A.V.C. ON)
S-meter switch	SW4	Normal on/off switch. Connects S-meter in circuit when required

TECHNICAL DESCRIPTION

General

16. The circuit diagram of the R106 Mk 1 is shown in Fig 1001. The aerial, R.F. and oscillator coil circuits shown are for the J type coil unit covering from 50-100kc/s. Fig 1002 shows the respective circuits for all the coil units. The circuit of the R106 Mk 2 is similar to the Mk 1 except as noted in Table 1001 and Fig 1001. Top and bottom views of the chassis are shown in Figs 4 and 5.

Aerial and R.F. stages

17. V1 and V2 are conventional R.F. amplifiers. The aerial is transformer coupled to the grid of V1 on all ranges by L1 and L2. V1 and V2 are transformer coupled by L3 and L4. A.V.C. bias is fed to the two stages via R28 and R31 respectively.

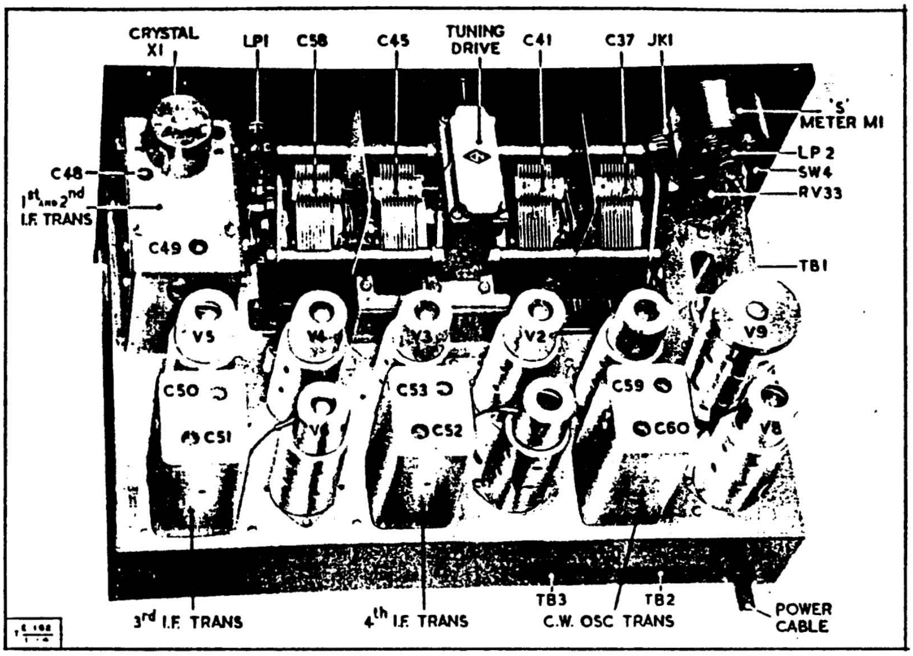


Fig 4 - Chassis, top view

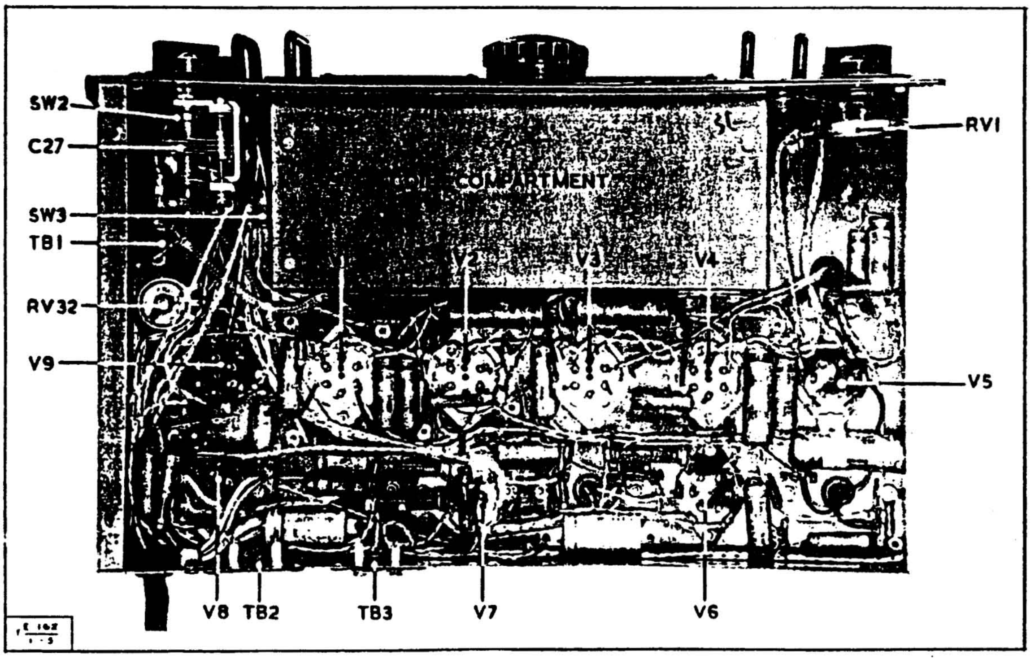


Fig 5 -- Chassis, bottom view

Gain compensation

18. The R.F. stages are designed to ensure uniform gain throughout the tuning range. High inductance primary coils are used in the interstage R.F. transformers. The coils are designed so that the primary circuit, as a whole, resonates broadly at a frequency outside the low frequency limit of the coil unit. The primary circuit therefore shows increasing impedance as the tuning of the receiver approaches the low frequency end of the band, thus compensating for the decreasing impedance of the secondary.

19. In the 14-30Mc/s band a different arrangement has been employed. The inter-stage R.F. transformer has three windings (see Fig 6). The primary winding is closely coupled to the tuned secondary, being interwound with it and having the same number of turns. A grid winding which consists of a large number of turns of fine wire is also closely coupled to the secondary. This grid winding is resonant outside the low frequency end of the band and compensates for variations in the impedance of the tuned circuit. Gain compensation is not employed on the 50-100kc/s band.

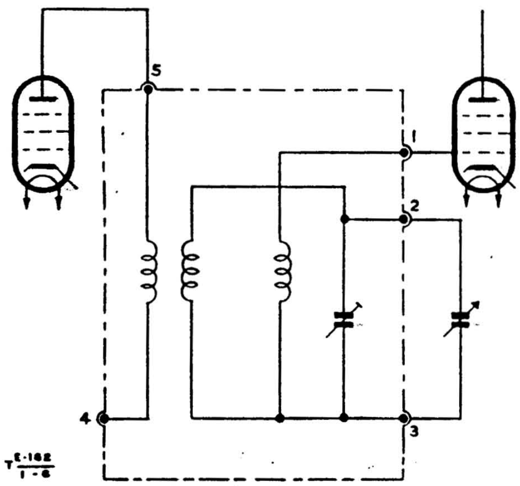


Fig 6 - Gain compensation, 14-30Mc/s band

Frequency-changer and local oscillator

20. V2 is coupled to the frequency changer, V3, by the R.F. transformer L5 and L6. A separate local oscillator employing a Hartley circuit is used. The output from the local oscillator, V4, is fed from the cathode via C7 to the screen of V3. The frequency-changer operates with fixed cathode bias and A.V.C. is not applied.

Frequency drift

21. Frequency drift is minimised by employing high stability components in the tuned circuits and by minimising the effects of any temperature change. Drift due to gradual changes in room temperature is reduced by the use of air dielectric trimmers and tuning capacitors and coil formers having a low temperature coefficient of expansion. The R.F. coil unit is plugged into the set under the chassis to minimise heating from the valves. The temperature in the receiver is also kept down by using a separate power supply unit and a well ventilated cabinet.

Crystal filter

22. The crystal filter circuit is conventional in design and operates at the nominal I.F. frequency of 456Kc/s. Two controls are provided together with a switch ganged to the phasing control for short-circuiting the cyrstal when it is not required. With

the crystal in circuit, the bandwidth in the broad position of the selectivity control, is approximately 2.5kc/s and in the sharp position approximately 200c/s, at 6db down. With the crystal in circuit the phasing control can be adjusted to suppress any one interfering signal differing from the desired signal by 300c/s or more. The bridge circuit component values are such that balance is obtained with the phasing control set at approximately the centre of its capacity range. When the crystal is short-circuited by turning the phasing control fully anti-clockwise to zero, the selectivity control acts as a normal I.F. trimmer and should be set for maximum sensitivity.

I.F. stages

23. The output from the crystal unit is matched to the first I.F. stage, V5, by the tapping on L9. The two I.F. stages, in addition to cathode biasing via R4 and R9 respectively, have A.V.C. applied to their grids through R3 and R8. The gain of the two I.F. stages together with the second R.F. stage is manually controlled by th R.F. gain-control, RV1.

Detector and A.V.C.

24. The detector and A.V.C. circuits employ the first diode of V7. A.V.C. is fed via R19 to the filter circuits of the controlled valves when the A.V.C. switch is ON When the A.V.C. is switched OFF, the mean grid bias of the controlled valves is main tained by the second diode, at approximately the same potential as that existing under no signal conditions with A.V.C. ON. The by-pass capacitor, C15, in the seco diode circuit, removes any stray signal pickup or feedback which could produce partial A.V.C. with the switch in the OFF position.

A.F. stages

25. The audio amplifier section of V7 is a pentode in the Mk 1 receiver and a trio in the Mk 2 receiver. The anode load R18 and V9 cathode resistor, R25, differ in the two receivers due to different valve characteristics. R16 and R17 are omitted in the Mk 2.

26. The A.F. output from V7 is resistance-capacitance coupled to the grid of V9 fc loudspeaker operation. When the headphone plug is inserted in JK1, C18 is disconne from the grid of V9, which is then earthed through the jack, JK1.

C.W. oscillator

27. The C.W. oscillator is provided with a variable pitch control on the front par This control also operates the switch SW3, in the H.T. line to the valve. Capacitc C20 prevents feedback via the heater circuit.

S-meter

28. The S-meter operates in a bridge circuit (see Fig 7). It is calibrated in S-units and dbs above S9. The bridge circuit is initially balanced by R32, so th the meter deflection is zero under no signal conditions with the R.F. gain control set to 9.5. Fig 8 shows the relation between meter readings and the actual sign input to the receiver in microvolts. It will be seen from Fig 8 that each S-unit is equal to a change of approximately 4db. The 40db range above S9 level is used for comparative checks on extremely strong signals.

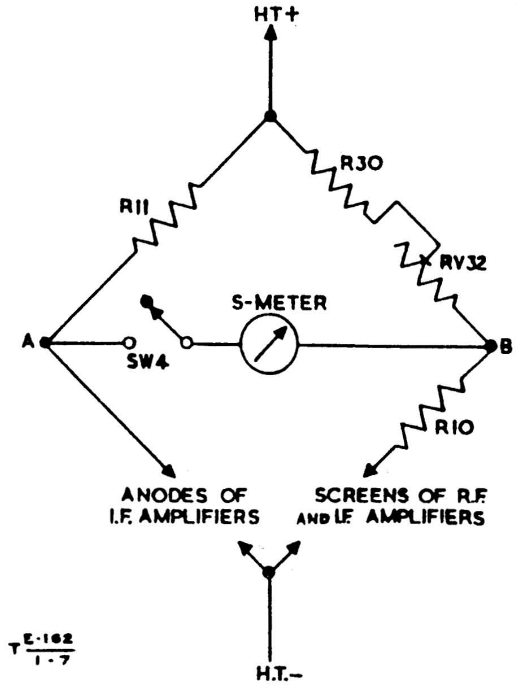


Fig 7 - S-meter, circuit detail

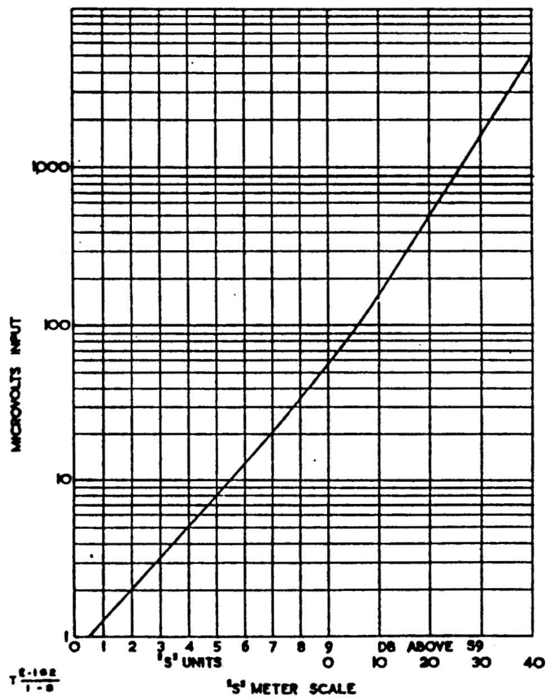


Fig 8 - S-meter, sensitivity curve

Differences between models

29. The foregoing description covers all models, the main differences being listed below:-

R106, Mk 1

(a) H.R.O. Senior: This is the original model which is complete with amateur bandspread (see para 32), crystal filter and S-meter

(b) H.R.O. Junior: This is similar to H.R.O. Senior but without the special facilities enumerated in (a) above

(c) H.R.O.-M: This is similar to the H.R.O. Senior, less bandspread but is provided with a plug-in crystal gate

(d) H.R.O.-MX: Similar to H.R.O.-M but with built-in crystal gate.

R106, Mk 2

(a) H.R.O.-5: This is similar to H.R.O.-MX but uses metal valves instead of glass. (see para 25 and Table 1001 for component changes

POWER SUPPLY UNITS
(see Figs 1003 and 1004)

30. The Supply unit rectifier, No. 5 (Fig 1003) consists of a standard full-wave rectifier circuit using an indirectly heated rectifier, V1 (CV 1863). The smoothi circuit uses a capacitor input filter C3, L1, followed by a further stage consisti of C4A, C4B and L2. An R.F. choke, L3, is included in the output lead. The H.T. supply is fused in the negative return lead by FS1. (250mA). The primary circuit is tapped for mains supplies from 100-170W and 200-250V A.C. R.F. bypass capacit C1 and C2 filter the primary circuit. The indicator lamp, LP1, is wired across th L.T. circuit.

31. The Supply unit, vibratory, No. 2 (Fig 1004) comprises a non-synchronous vibrator driven from a 6V battery through an R.F. input filter and spark suppressi circuit. The indicator lamp, LP1, is wired into the input circuit. The chopped D.C. from the vibrator is stepped up by T2 and fed to the full-wave cold-cathode rectifier, V1 (CV 692). Comprehensive smoothing circuits are provided to remove a traces of interference from the vibrator circuits.

BANDSPREAD COILS

32. Some receivers of either Mk may be equipped with a set of coils giving a bandspread facility. Table 2 shows the frequency coverage of these coils. It wi be noted that a portion of the range in each case is extended to cover almost the whole of the tuning dial scale. These coil-sets are aligned for a particular receiver and differ further in that the coil-set for a receiver with metal valves (Mk 2) will not operate with a receiver using glass valves (Mk 1) without realignment.

Table 2 - Bandspread coils

Coil-set	General coverage	Bandspread	Dial
A	14 - 30Mc/s	28 - 29.7Mc/s	50 - 450
B	7 -14.4Mc/s	14 - 14.4Mc/s	50 - 450
C	3.5 - 7.3Mc/s	7 - 7.3Mc/s	50 - 450
D	1.7 - 4Mc/s	3.5 - 4Mc/s	50 - 450

Note: The next page is Page 1001

Table 1001 - Components

Circuit ref	Value	Tolerance and rating		Type	Location
		RESISTORS			
RV1	10kΩ		1.1/2W	Variable	C3
R2	5kΩ	±10%	1/2W		E4
R3	500kΩ	±10%	1/2W		G4
R4	300Ω	±10%	1/2W		H4
R5	50kΩ	±10%	1/2W		D3
R6	100kΩ	±10%	1/2W		E2
R7	100kΩ	±10%	1/2W		D1
R8	500kΩ	±10%	1/2W		J4
R9	2.2kΩ	±10%	1/2W		J4
R10	15kΩ	±10%	1W		K6
R11	2500Ω	±10%	1/2W		L6
R12	500kΩ	±10%	1/2W		L4
R13	50kΩ	±10%	1/2W		K5
R14	250kΩ	±10%	1/2W		M4
R15	30kΩ	±10%	1W		K6
R16 Mk 1	20kΩ	±10%	1/2W		L4
R16 Mk 2	Omitted				
R17 Mk 1	100kΩ	±10%	1W		L6
R17 Mk 2	Omitted				
R18	100kΩ	±10%	1W		L6
R18 Mk 2	50kΩ	±10%	1W		L6
R19	500kΩ	±10%	1/2W		K4
R20	800Ω	±10%	1/2W		L4
R21	60Ω	±10%	2W	Wire-wound	O3
R22	100kΩ	±10%	1/2W		M3
R23	250kΩ	±10%	1/2W		M3
R24	100kΩ	±10%	1/2W		M2
R25 Mk 1	500Ω	±10%	1W		N4
R25 Mk 2	300Ω	±10%	1W		N4
R26	500kΩ	±10%	1/2W		N4
R27	300Ω	±10%	1/2W		B4
R28	500kΩ	±10%	1/2W		B4
R29	300Ω	±10%	1/2W		D4
R30	2kΩ	±10%	1/2W		L6
R31	500kΩ	±10%	1/2W		C4
RV32	1kΩ		1W	Variable	K6
RV33	500kΩ	±20%	2W	Variable	K4
R34	50kΩ	±10%	1/2W		L2
R35	20kΩ	±10%	1/2W		D2

Note: R9 varies with individual receivers between 1kΩ and 5kΩ

Table 1001 - (contd)

Circuit ref	Value	Tolerance and rating	Type	Location
		CAPACITORS		
C1	0.1µF	+20% -10% 400V D.C. wkg		H4
C2	0.01µF	+20% -10% 600V D.C. wkg		H4
C3	0.1µF	+20% -10% 400V D.C. wkg		F4
C4	0.1µF	+20% -10% 600V D.C. wkg		C6
C5	0.1µF	+20% -10% 600V D.C. wkg		E1
C6	0.1µF	+20% -10% 400V D.C. wkg		H4
C7	0.01µF	+20% -10% 600V D.C. wkg		E2
C8	0.25µF	+20% -10% 600V D.C. wkg		J4
C9	0.01µF	+20% -10% 600V D.C. wkg		J4
C10	0.1µF	+20% -10% 400V D.C. wkg		J4
C11	10µF	+15% - 0% 50V D.C. wkg		M4
C12	100pF	+5% 500V D.C. wkg		L4
C13	250pF	±10% 500V D.C. wkg		L5
C14	0.1µF	+20% -10% 400V D.C. wkg		K4
C15	0.01µF	+20% -10% 600V D.C. wkg		M4
C16	500pF	±10% 1000V D.C. wkg		M4
C17	0.1µF	+20% -10% 400V D.C. wkg		D4
C18	0.1µF	+20% -10% 600V D.C. wkg		N5
C19	10µF	+15% - 0% 50V D.C. wkg		O4
C20	0.1µF	+20% -10% 400V D.C. wkg		M1
C21	0.1µF	+20% -10% 400V D.C. wkg		M1
C22	0.1µF	+20% -10% 400V D.C. wkg		B4
C23	0.1µF	+20% -10% 400V D.C. wkg		B6
C24	0.01µF	+20% -10% 600V D.C. wkg		B4
C25	0.1µF	+20% -10% 600V D.C. wkg		C6
C26	0.01µF	+20% -10% 600V D.C. wkg		C4

Table 1001 - (contd)

Circuit ref	Value	Tolerance and rating	Type	Location
C27	5-35pF		Variable	M1
C28	0.01μF	+20% -10% 600V D.C. wkg		N4
C29	0.001μF	±10% 500V D.C. wkg		L2
C30	100pF	±5% 500V D.C. wkg		D2
C31	100pF	±5% 500V D.C. wkg		F5
C32	100pF	±5% 500V D.C. wkg		F5
C33	2pF	±50% 400V D.C. wkg		M3
C36	see Table 1002			A5
C37	12-225pF		Variable gang	B4
C40	see Table 1002			C5
C41	12-225pF		Variable gang	C4
[illegible]	see Table 1002			E5
C45	12-225pF		Variable gang	E4
C46	100pF		Variable	G5
C47	10pF		Variable	G5
C48	3-30pF		Trimmer	G5
C49	6-85pF		Trimmer	H5
C50	6-85pF		Trimmer	H5
C51	6-85pF		Trimmer	J5
C52	6-85pF		Trimmer	K5
C53	6-85pF		Trimmer	K5
C56	see Table 1002			C2
C57	see Table 1002			C2
C58	12-225pF		Variable gang	C1
C59	6-85pF		Trimmer	L2
C60	6-85pF		Trimmer	L2
C61	50pF	±5% 500V D.C.		C2
C62	100pF	±5% 500V D.C.	1002 type	G4
C63	350pF	±10% 500V D.C.	1002 type	F4
C64	450pF	±10% 500V D.C.	1002 type	E4
C65	880pF	±10% 500V D.C.	1002 type	JD4
C66	1600pF	±10% 500V D.C.	1002 type	JC4
C67	2600pF	±10% 500V D.C.	1002 type	JB4
C68	40pF	±5% 500V D.C.	1002 type	JA1
C69	1200pF	±10% 500V D.C.	1002 type	JA1
C70	850pF	±10% 500V D.C.	1002 type	JA4

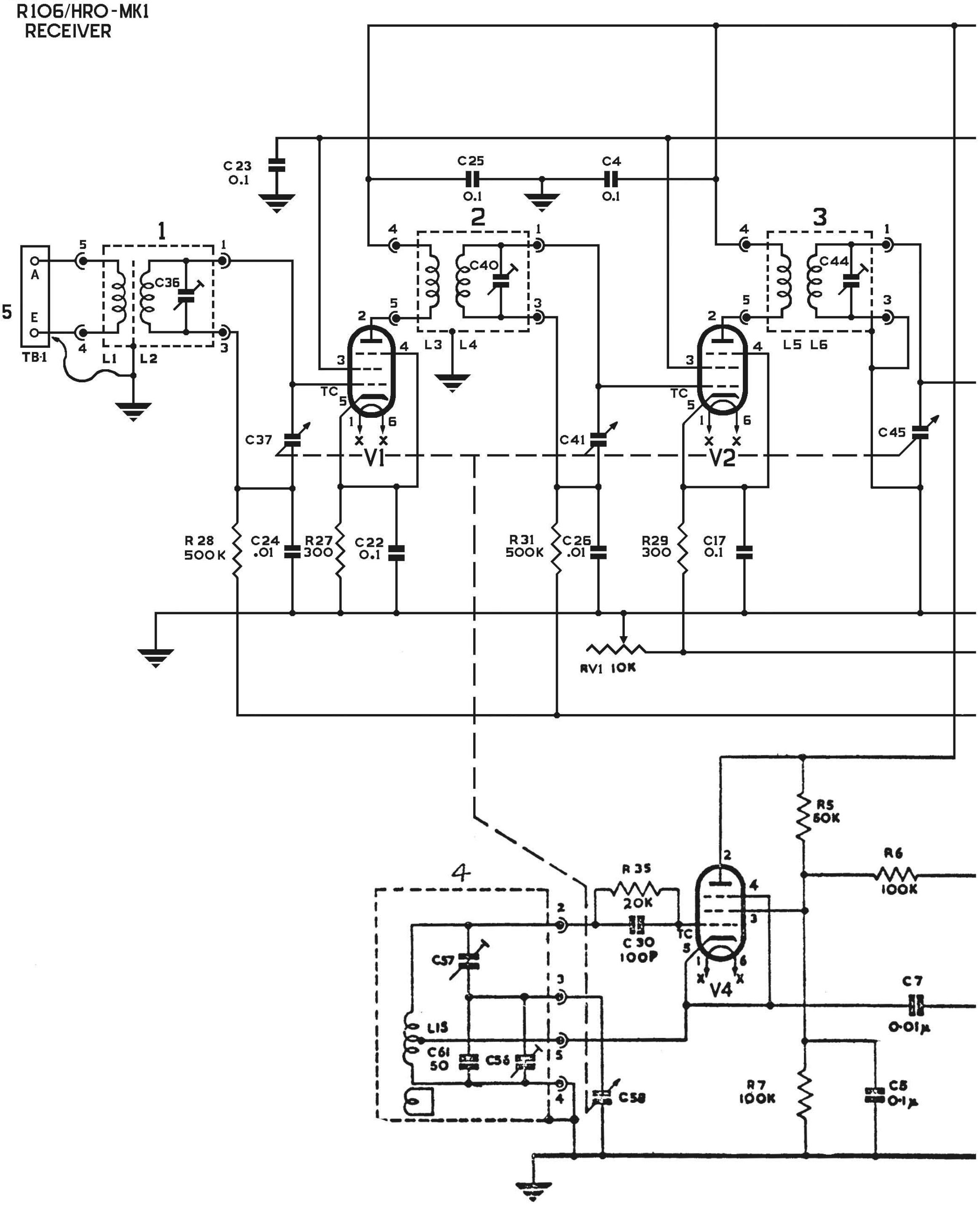
Table 1001 - (contd)

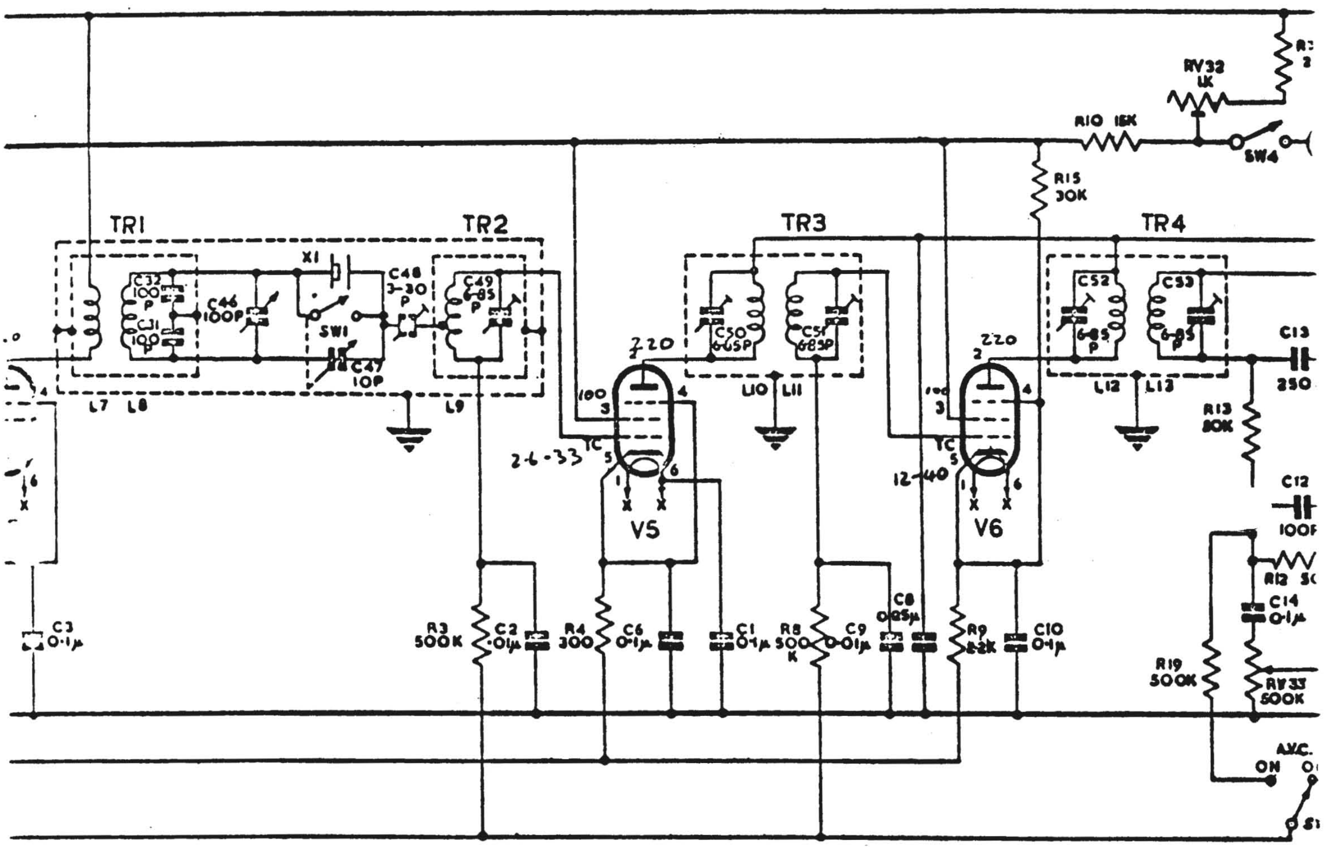
Circuit ref	Type Mk 1	Type Mk 2	Location
VALVES			
V1	CV1900 (6D6)	CV1942 (6K7)	B5
V2	CV1900 (6D6)	CV1942 (6K7)	D5
V3	CV585 (6C6)	CV1936 (6J7)	E5
V4	CV585 (6C6)	CV1936 (6J7)	D2
V5	CV1900 (6D6)	CV1942 (6K7)	H5
V6	CV1900 (6D6)	CV1942 (6K7)	J5
V7	CV1891 (6B7)	CV1990 (6SQ7)	L5
V8	CV585 (6C6)	CV1936 (6J7)	M2
V9	CV609 (42)	CV511 (6V6GT/G)	N5
SWITCHES			
SW1	Crystal filter switch		G5
SW2	A.G.C. switch (toggle)		L3
SW3	C.W. oscillator H.T. switch (toggle)		M3
SW4	S-meter switch (push-pull)		L6
SW5	H.T. switch (toggle)		06

Table 1002 - Trimmer and padder capacitors

Coil set	Frequency range	C36	C40	C44	C56	C57
JA	14 - 30Mc/s	5-28pF	5-28pF	5-28pF	5-28pF	-
JB	7 - 14.4Mc/s	5-28pF	5-28pF	5-28pF	6-38pF	-
JC	3.5 - 7.3Mc/s	5-28pF	5-28pF	5-28pF	5-28pF	-
JD	1.7 - 4Mc/s	5-28pF	5-28pF	5-28pF	5-28pF	-
E	900 - 2050kc/s	5-28pF	5-28pF	5-28pF	5-28pF	6-38pF
F	480 - 960kc/s	6-38pF	6-38pF	6-38pF	7-56pF	6-38pF
G	180 - 430kc/s	5-28pF	5-28pF	5-28pF	5-28pF	6-38pF
H	100 - 200kc/s	6-38pF	6-38pF	6-38pF	8.5-75pF	10-97pF
J	50 - 100kc/s	6.5-45pF	6.5-45pF	6.5-45pF	8.5-75pF	8.5-75pF

NATIONAL
R106/HRO-MK1
RECEIVER

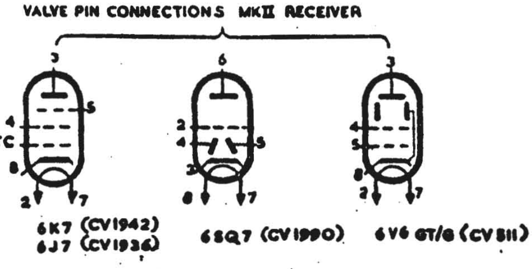




RESISTOR VALUES IN OHMS
…APACITOR VALUES IN FARADS
SHOWN WITH COIL UNIT 'J'(50–100Kc/s)

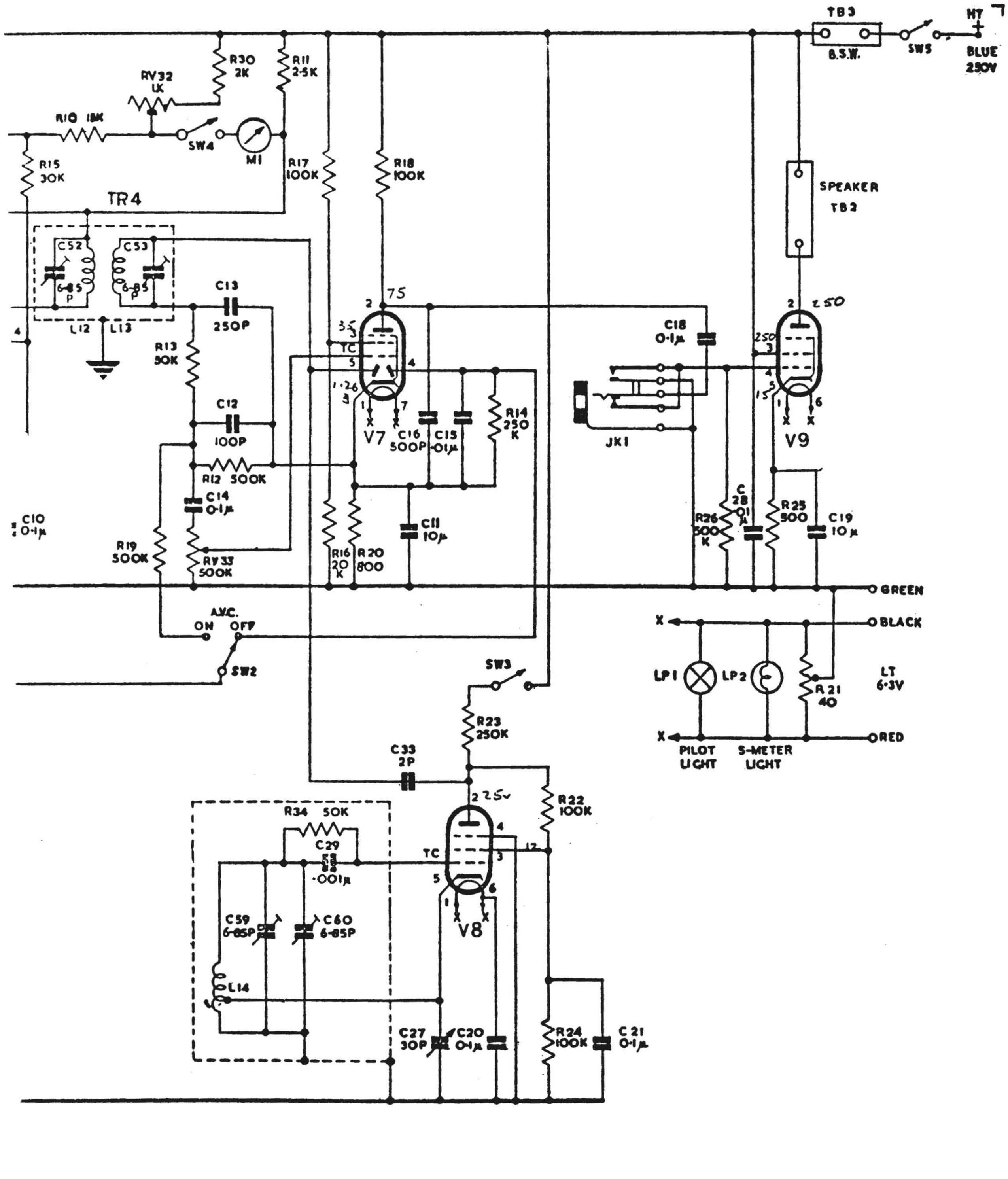
	MK I	MK II
…,V5,V6. =	6D6 (CV1900)	6K7 (CV1942)
=	6C6 (CV585)	6J7 (CV1936)
=	6B7 (CV1091)	6SQ7 (CV1990)
=	42 (CV609)	6V6GT/G (CV511)
=	20K	OMITTED
=	100K	OMITTED
=	100 K	50K
=	300	300

VALVE PIN CONNECTIONS MKII RECEIVER

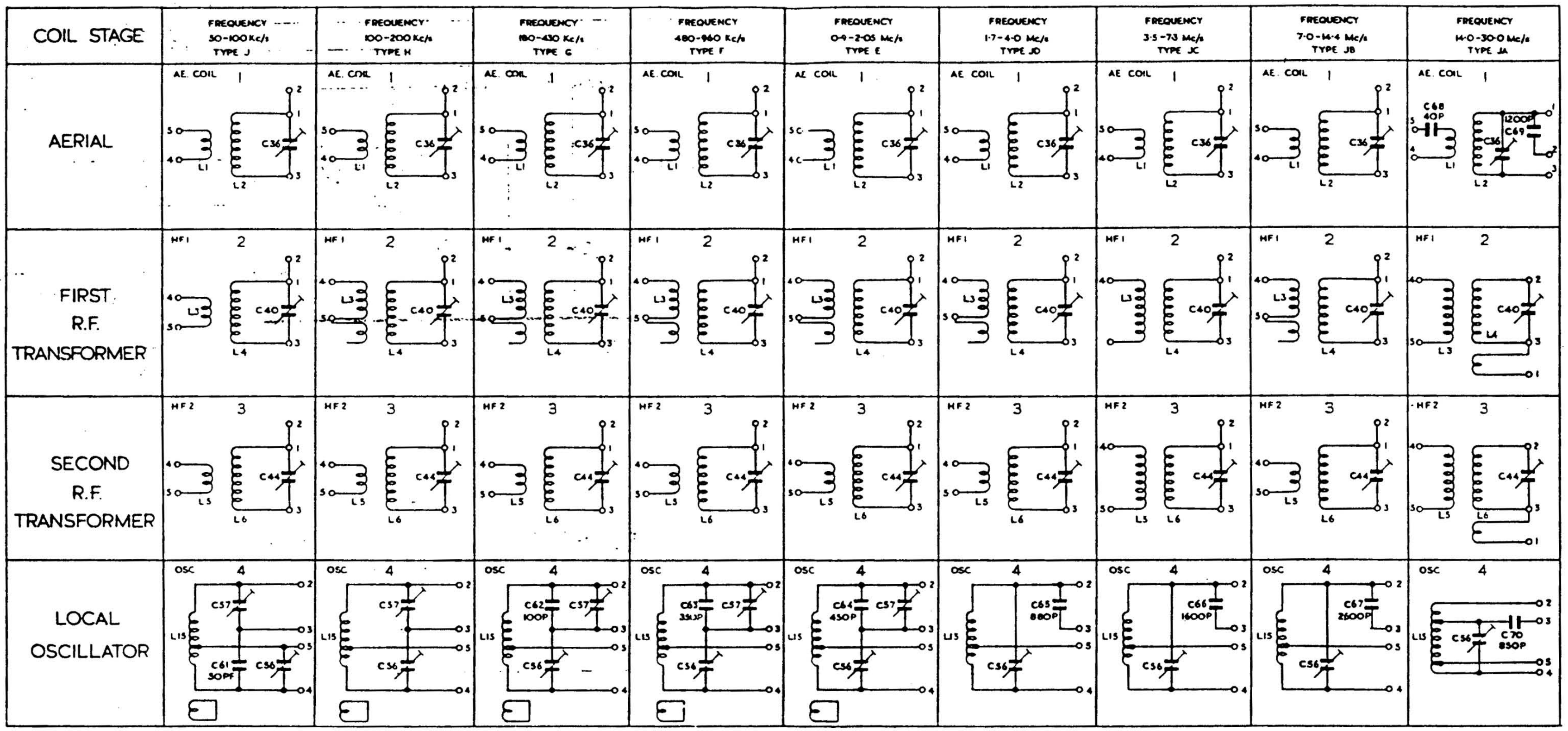


F | G | H | J | K |

Fig. 1001—Reception set R106, Mk I, circuit diagram


TB3
B.S.W.
SW5
HT +
BLUE
250V
R30 2K
R11 2·5K
RV32 1K
R10 18K
SW4
M1
R15 30K
R17 100K
R18 100K
TR4
C52
C53
6-85 P
L12
L13
C13 250P
R13 50K
C12 100P
R12 500K
C14 0·1μ
RV33 500K
R19 500K
C10 0·1μ
V7
C16 500P
C15 ·01μ
R14 250 K
C11 10μ
R16 20 K
R20 800
SPEAKER
TB2
C18 0·1μ
JK1
V9
R26 500 K
C 28 ·01 μ
R25 500
C19 10μ
GREEN
BLACK
LP1
LP2
R21 40
LT 6·3V
RED
PILOT LIGHT
S-METER LIGHT
A.V.C.
ON
OFF
SW2
SW3
R23 250K
C33 2P
R22 100K
R34 50K
C29 ·001μ
C59 6-85P
C60 6-85P
L14
V8
C27 30P
C20 0·1μ
R24 100K
C21 0·1μ

K | L | M | N | O



E-162 / 1-1002

FOR VALUES OF C36, 40, 44, 56 and 57, SEE TABLE 1002

Fig 1002 - Individual coil units

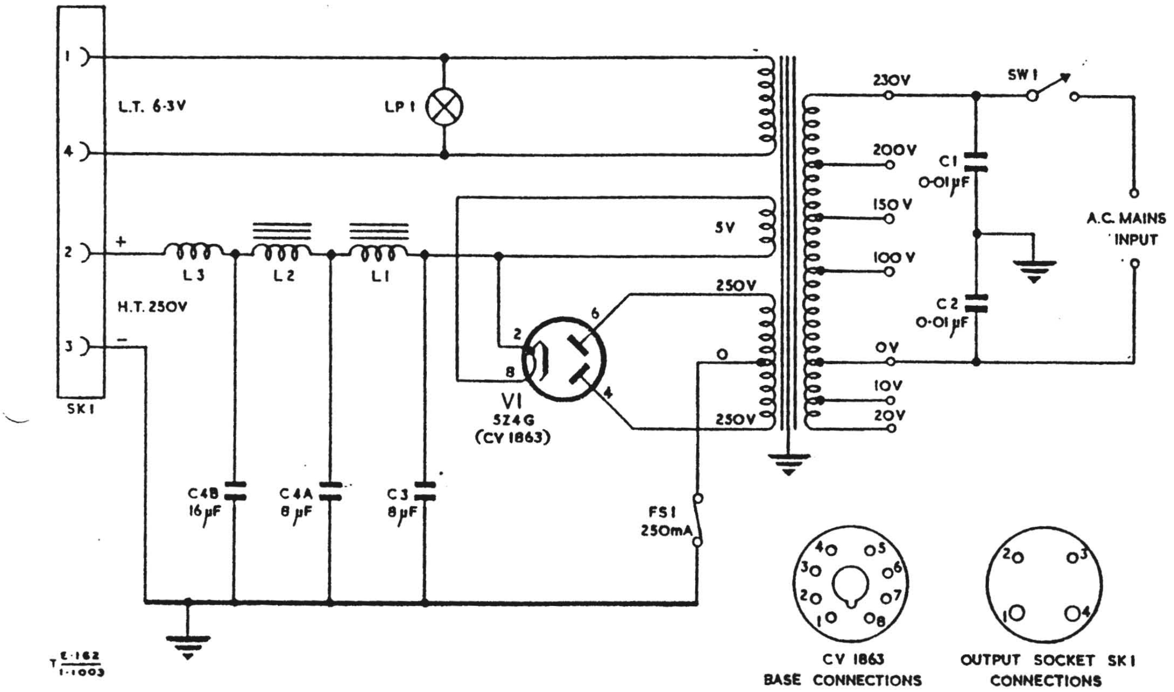
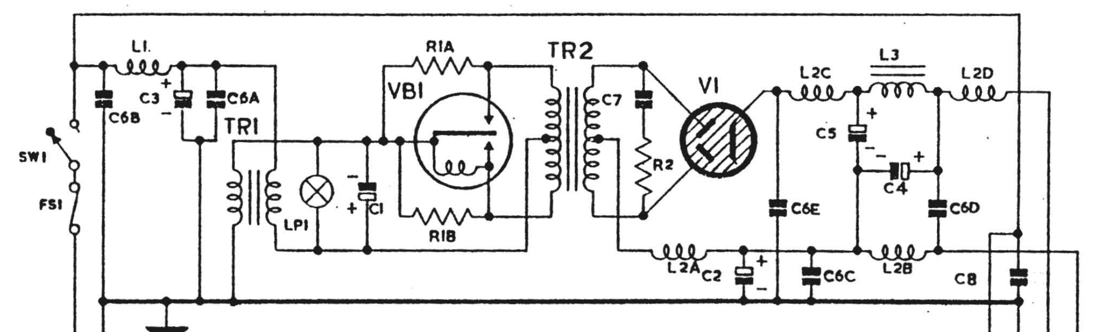


Fig 1003 - Supply unit, rectifier, No. 5, circuit diagram



COMPONENT LIST

C1	2000 µF ELECTROLYTIC 12 V D.C.	R2	68 Ω ¼ WATT
C2	25 µF ELECTROLYTIC 12 V D.C.	VB1	VIBRATOR NO.2
C3	10 µF ELECTROLYTIC 50 V D.C.	V1	CV692 (OZ4)
C4	8 µF ELECTROLYTIC 500 V D.C.	L1	L.F. CHOKE
C5	4 µF ELECTROLYTIC 500 V D.C.	L2	R.F. CHOKE
C6	0·1 µF TUBULAR PAPER 450 V D.C.	L3	SMOOTHING CHOKE
C7	0·02 µF TUBULAR PAPER 600 V A.C.	TR1	ISOLATING TRANSFORMER
C8	0·0015 µF MICA	TR2	6V VIBRATOR TRANSFORMER
R1	5 KΩ ¼ WATT	FS1	20 AMP FUSE

Fig 1004 - Supply unit, vibratory, No. 2, circuit diagram

END

ELECTRICAL AND MECHANICAL ENGINEERING REGULATIONS (By Command of the Army Council)

TELECOMMUNICATIONS E 163

RECEPTION SETS R109, MKS 1 AND 2

TECHNICAL HANDBOOK - UNIT REPAIRS

GENERAL

1. No adjustments, except those detailed in this Regulation, will be made to the receiver by unit repair sections since the accuracy and sensitivity of the set depend on very accurate alignment and adjustment carried out in Base workshops.

2. For technical description, circuit diagrams and component tables, refer to Tels E 162.

SETTING-UP INSTRUCTIONS

3. The receiver is set up for normal operation as follows:-

(a) Ensure that the appropriate power supply unit is connected to the set, but it is at this stage switched OFF. For operation from 100-250V A.C. mains use the Supply unit, rectifier, No. 5, and for 6V D.C. battery operation use the Supply unit, vibratory, No. 2.

(b) Select the appropriate plug-in coil unit and insert it in position in the receiver (see para 3, Tels E 162).

(c) Connect the loudspeaker, if required, to the terminals at the rear of the set. If a loudspeaker is not used, these terminals must be short-circuited. Do not stand the loudspeaker on the receiver cabinet.

(d) The aerial terminals are located on the left-hand side of the receiver. If a single wire aerial or unbalanced feeder line is to be used, connect the aerial or feeder lead to the terminal nearest the front panel and connect the flexible earth lead to the other terminal. If a balanced transmission line is used, connect it to both terminals and in this case, the flexible earth lead is not used.

(e) Switch on the P.S.U. and switch on the H.T. to the receiver at SW5; (terminals BSW at the back must be short-circuited if the receiver is not to be used on a relay system).

(f) Tune the receiver by setting the dial to the scale reading given by the calibration chart on the coil unit for the frequency desired.

(g) Set the R.F. GAIN, RV1 and AUDIO GAIN, RV33 to give the required output level.

(h) The selectivity control, C46, when used with the crystal filter in circuit gives minimum selectivity in the vertical position. Selectivity is increased by rotating the knob either way. When the crystal filter is not in use, this control acts as an I.F. trimmer, and should be set to give maximum volume.

(j) The PHASING control and crystal filter switch is used when receiving C.W. or M.C.W. In position 0 the crystal is short-circuited; in any other position the PHASING control may be used to eliminate any one interfering station more than 300c/s away from the required station.

(k) The C.W. OSC. switch and control is used on C.W. to give an audible note, or on M.C.W. to assist in the location of a weak station. Rotating the control varies the pitch of the beat note.

(l) The A.V.C. switch, SW2, may be used as required on R.T. or M.C.W. A.V.C. should not be used when the C.W. oscillator is in operation.

4. If it is desired to change the coil unit while the set is in operation, the H.T. must first be switched OFF at switch SW5.

ROUTINE TECHNICAL MAINTENANCE

Receiver

5. Daily:-

(a) Check all controls for smoothness of action and freedom from backlash, especially the main tuning control. If the tuning control is defective, report immediately. Do not remove the wormwheel casing.

(b) Clean the outside of the case. Examine external cables and plugs ensuring that these are in good condition and that all connections are tight.

6. Monthly:-

(a) Remove the receiver from its case and remove the baseplate. Brush out all dust, being careful not to disturb any R.F. wiring or damage the vanes of the tuning capacitor. Remove the coil unit and clean out the coil compartment. If a portable air blower is available, use this in preference to a brush for cleaning the equipment.

(b) Check all valves for loose top caps and bases, replacing any that are defective. Ensure that all valve pins make good contact with their sockets. Test all valves.

(c) Examine all soldered joints, repairing any that are loose or broken. Check that all components are firmly mounted and that no fixing nuts or screws are loose.

(d) Ensure that the contacts on all coil units and in the coil compartment are clean and make good contact with each coil unit in position in turn. Clean the sliding earth contacts on each gang of the tuning capacitor and lubricate with a trace of grease PX 7.

(e) Check the calibration of the receiver on all bands, using either the Wavemeter, class D, or the Frequency meter, SCR 211. If re-calibration or re-alignment is necessary, the set must be returned to Base workshops.

Power supply unit

7. Monthly:-

Remove the P.S.U. from its case and clean it thoroughly. Check all connecting wires and soldered joints and check the continuity of all choke and transformer windings. Check the external cable to mains or battery. Check all input and output voltages on load. If both types of P.S.U. are held, both units should be checked.

Unit maintenance record

8. On completion of maintenance the appropriate entry will be made on AF B2661 (see Table 1003).

FAULT FINDING

9. In the event of a fault occurring on the receiver, it may be localised:-

(a) by observing the action of the controls

(b) by making the voltage and resistance checks detailed in Table 1001

(c) by detailed testing of components.

10. Table 1001 has been drawn up for a Mk 1 receiver. The corresponding values for the Mk 2 receiver should generally be similar. Where the values differ widely, both are noted. The readings were taken under the following conditions, using Instrument testing, AVO, universal, 46 range, Mk I or 50 range.

(a) S-meter switch OFF

(b) AUDIO GAIN at 10

(c) A.V.C. OFF

(d) C.W. oscillator OFF

(e) Selectivity set vertical

(f) PHASING at 5

(g) R.F. GAIN at 10

(h) H.T. ON

(j) No phones in use and loudspeaker terminals linked

(k) Coil unit for 50-100kc/s range.

11. Table 1002 gives a number of possible faults and the action required.

Note: The next page is Page 1001.

Table 1001 – Voltage and resistance test figures

Valve	Electrode	Valve base pin No. Mk 1	Valve base pin No. Mk 2	D.C. voltage to chassis Mk 1	D.C. voltage to chassis Mk 2	Resistance to chassis Mk 1	Resistance to chassis Mk 2	Remarks
V1	Anode	2	3	250	220	30kΩ	40kΩ	
	Screen	3	4	100	85	24kΩ		
	Cathode	5	8	3.0		300Ω		
	Grid	T/C	T/C	–		750kΩ		1.5MΩ with A.V.C. ON
V2	Anode	2	3	250	220	30kΩ	40kΩ	
	Screen	3	4	100	85	24kΩ		
	Cathode	5	8	1.5		300Ω–10kΩ		Maximum with minimum R.F. gain
	Grid	T/C		–		750kΩ		
V3	Anode	2	3	250	220	30kΩ	40kΩ	
	Screen	3	4	65	85	200kΩ		
	Cathode	5	8	3.0		5kΩ		
	Grid	T/C	T/C	–		80Ω		
V4	Anode	2	3	250	220	30kΩ	40kΩ	
	Screen	3	4	100	85	50kΩ		
	Cathode	5	8	–				
	Grid	T/C	T/C	-2.4		20kΩ		
V5	Anode	2	3	220	200	30kΩ	40kΩ	
	Screen	3	4	100	85	24kΩ		
	Cathode	5	8	2.6–33		300Ω–10kΩ		Maximum with minimum R.F. gain
	Grid	T/C	T/C	–		750kΩ		1.5MΩ with A.V.C. ON
V6	Anode	2	3	220	200	30kΩ	40kΩ	
	Screen	3	4	100	85	24kΩ		
	Cathode	5	8	12–40		2.6Ω–12kΩ		Maximum with minimum R.F. gain
	Grid	T/C	T/C	–		750kΩ		1.5MΩ with A.V.C. ON
V7	Anode	2	6	75	150	220kΩ	100kΩ	
	Screen	3	–	35		20kΩ		Mk 1 only
	Cathode	6	3	1.2		800Ω		
	Grid	T/C	2	–		500kΩ		With maximum A.F. gain
V8	Anode	2	3	25		150kΩ }		With C.W. oscillator switched on
	Screen	3	4	12		85kΩ }		
	Cathode	5	8	–				
	Grid	T/C	T/C	–		50kΩ		
V9	Anode	2	3	250	220	30kΩ	40kΩ	
	Screen	3	4	250	220	30kΩ	40kΩ	
	Cathode	5	8	15	12	500Ω	300Ω	
	Grid	4	5	–		500kΩ		

Table 1002 - Fault location

Symptom	Possible fault	Action
1. Set dead	(a) Fault in power supply unit or leads	1. Examine all power leads and plugs 2. (a) Test power unit fuses and indicator lamp. Check rectifier valve. Test SW1, C1, C2 and power transformer. (b) On D.C. working check battery volts. Recharge if necessary. Check fuse and test switch
Set dead, but pilot lamp lights up	(a) No H.T. on receiver	1. Test switch on receiver and examine external connecting leads from P.S.U. 2. Test P.S.U. as follows:- (a) A.C. working: test fuse F1, V1 (CV1863), C3, C4A, C4B, L1, L2 and L3. Test secondary windings of transformer (b) D.C. working: if vibrator not functioning replace with known good one. Test V1A. (CV692) by replacement with known good one. Test all associated smoothing components.
?. Set dead but H.T. and L.T. present	(a) Faults in A.F. stages	1. Check voltage on pins of V7 and V9 (see Table 1001) Test valves by replacing them with known good ones
	(b) Faulty phones or loudspeaker	2. Test loudspeaker and output transformer or phones. Examine jack JK1 for good contact

Table 1002 - (contd)

Sympton	Possible fault	Action
4. No signals but noise present	(a) Fault in local oscillator	1. Measure voltage at pins of V4 (see Table 1) Test V4 by replacement with known good one. If coil unit is suspected change frequency band and report as necessary.
	(b) Fault in R.F. stages	2. Measure voltages on pins of V1, V2 and V3 (see Table 1) replace valves with known good ones. Test receiver on another frequency band
	(c) Fault in I.F. or detector stages	3. Measure volts at pins of V5, V6 and V7. Test valves by replacement with known good ones
5. Low sensitivity	(a) Low H.T. volts	Check supply voltage. Test P.S.U. and replace any fault components
	(b) Valve faults	Replace all valves one at a time. Always replace the old valve if sensitivity does not improve
	(c) Fault in R.F. or I.F. stages	Take action as detailed in 4 above
	(d) Faulty aerial system	Inspect and repair aerial system

Table 1003 - Specimen AF B2661

Army Form B2661

TYPE OF EQUIPMENT ....R106 Mk I........
SERIAL No. OF EQUIPMENT ....AP 656........
Note - Unit tasks are detailed in Working Instructions

DATE (week ending)	UNIT MAINTENANCE LOG 1 DAY	2 DAY	3 DAY	4 DAY	5 DAY	6 DAY	7 DAY
To	be completed by user						

UNIT MAINTENANCE LOG	
INITIAL	DATE
NOTE: UNIT TASKS ARE DETAILED IN RELEVANT EMER	
INITIAL	DATE
INITIAL	DATE
INITIAL	DATE
INITIAL	DATE
INITIAL	DATE
INITIAL	DATE

REPAIR RECORD
(eg VALVE REPLACEMENTS, MAJOR REPAIRS, REME INSPECTIONS etc)

DATE	REMARKS
28.10.52	V9 replaced, screen to grid short circuit
29.10.52	V5 replaced, broken grid cap
29.10.52	Loudspeaker output terminal parted from mounting

Note:- The space indicated by heavy black lines under days 3 and 7 are to be initialled on completion of unit weekly and monthly tasks respectively.

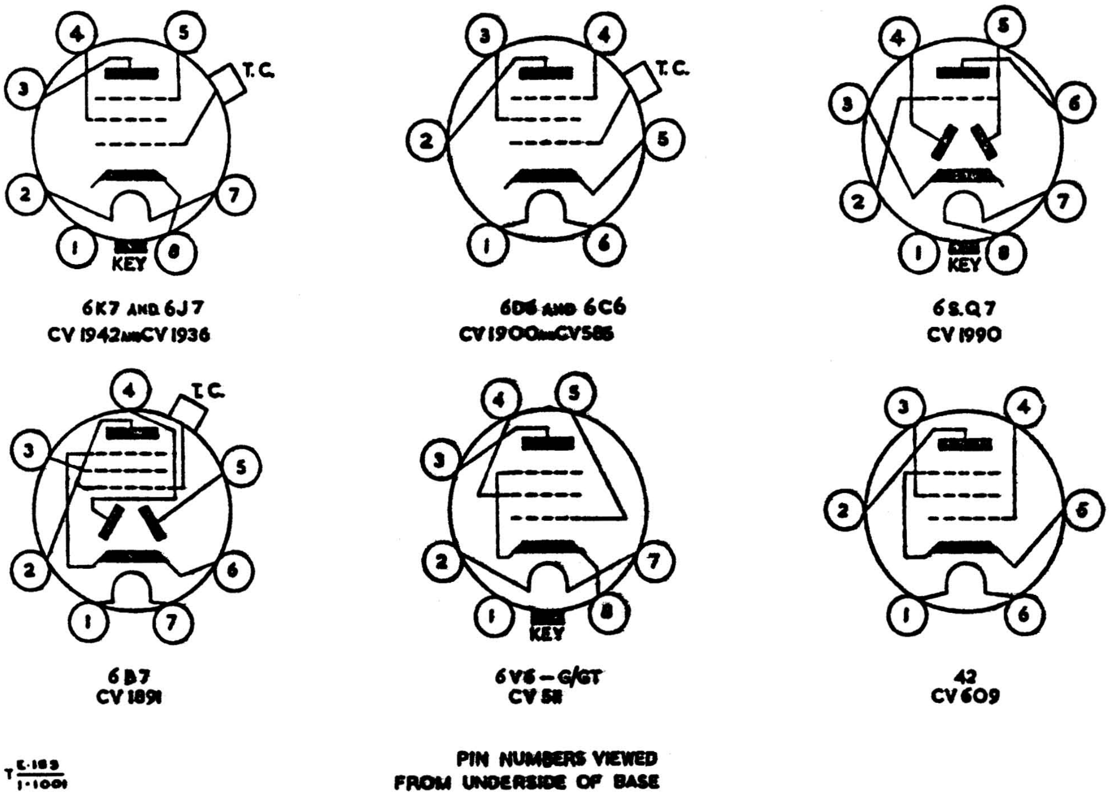


Fig 1001 – Valve bases

57/Maint/4016

END

ELECTRICAL AND MECHANICAL ENGINEERING REGULATIONS
(By Command of the Army Council)

TELECOMMUNICATIONS
E 164

RECEPTION SET R 106

TECHNICAL HANDBOOK - FIELD AND BASE REPAIRS

SUBJECT INDEX

INDEX TO FIGURES

INDEX TO TABLES

Distribution - Class 860. Code No. 3

INTRODUCTION

1. This regulation should be used in conjunction with Tels E 162 and E 163 which contain the technical description, circuit diagram, component values and unit repair information.

MECHANICAL ADJUSTMENTS AND REPLACEMENTS

Removal of ganged capacitor assembly (Figs 1 and 2)

2. Remove the four panel retaining screws from the front panel and the three screws from the rear of the case. Lift the cabinet clear of the chassis. Turn the tuning dial anticlockwise beyond zero so that the dial stop A is engaged and the capacitor vanes are fully meshed. Loosen the grubscrew securing the dial to the drive shaft and remove the dial. Do not disturb the annular ring gear within the dial. Unsolder the leads to the capacitor sections. Remove the four bolts securing the capacitor assembly baseplate to the mounting shelf and withdraw the whole assembly from the chassis. To replace the assembly, reverse the procedure detailed above.

Dismantling the drive assembly

3. Remove the dial and ganged capacitor assembly as detailed in para 2. The correct relative positions of the two parts of the dial are shown in Fig 1. Care must be taken to ensure that, with the dial window displaying the 0 at 11 o'clock, the two retaining springs are in the position shown in Fig 1 and the dial grubscrew is at 3 o'clock, when seen from the front of the dial. The two springs must not be above the opposite sides of the holes in the dial, which position will show a 0 in the dial window but with the grubscrew lying almost opposite the 0. If assembled incorrectly the springs will be stretched against the sides of the holes instead of travelling clockwise across the space provided.

4. Remove the top cover of the gearcasing by removing the four screws, B. Secure the two halves of the split pinion, C, by a piece of stiff wire wrapped around the teeth. Remove the four screws, D, from the drive shaft bush, E and remove the bush. The drive shaft and worm can now be freed from the pinion and withdrawn from the gear housing bringing with it the two washers, spring and ball bearing.

5. To replace the assembly reverse the procedure detailed above. Note the word 'top' embossed on the drive shaft bush. Correct orientation of this bush is essential to obtain the correct positioning of the eccentric bearing supporting the numbered dial plate.