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Colin Hinson

In the village of Blunham, Bedfordshire.

AIR PUBLICATION

116E-0730-1

(Formerly A.P.2531F, Vol. 1)

**U.H.F. SINGLE CHANNEL
RECEIVER RADIO
5820-99-932-5694 (R.7351)**

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL



Ministry of Defence

FOR USE IN THE
ROYAL AIR FORCE

(Prepared by the Ministry of Technology)

A.L.21, Mar. 69

NOTE TO READERS

The subject matter of this publication may be affected by Defence Council Instructions, Servicing schedules (Volume 4 and 5), or "General Orders and Modifications" leaflets in this A.P., in the associated publications listed below, or even in some others. If possible, Amendment Lists are issued to correct this publication accordingly, but it is not always practicable to do so. When an Instruction, Servicing schedule or leaflet contradicts any portion of this publication, the Instruction, Servicing schedule or leaflet is to be taken as the overriding authority.

The inclusion of references to items of equipment does not constitute authority for demanding the items.

Each leaf, except for the original issue of preliminaries, bears the date of issue and the number of the Amendment List with which it was issued. New or amended technical matter will be indicated by black triangles positioned in the text thus: — ◀——▶ to show the extent of amended text, and thus: — ▶◀ to show where text has been deleted. When a Part, Section or Chapter is issued in a completely revised form, the triangles will not appear.

The reference number of this publication was altered from A.P.2531F, Vol. 1 to A.P.116E-0730-1 and the security grading changed from RESTRICTED to UNCLASSIFIED in March 1969. No general revision of page captions has been undertaken, but the code appears in the place of the earlier A.P. reference and the word RESTRICTED is removed on new or amended leaves issued subsequent to that date.

LIST OF ASSOCIATED PUBLICATIONS

	<i>A.P.</i>
<i>U.H.F. multi-channel receiver radio 5820-99-932-5695 (R7109) — Naval Receiver Outfits CUJ/CUL</i>	116E-0731
<i>U.H.F. multi-channel transmitter radio 5820-99-932-5691 (T7096) and amplifier radio frequency 5820-99-932-5692 (A7349) — Naval Types 692/693 Series</i>	116E-0253
<i>U.H.F. single-channel transmitter radio 5820-99-932-5698 (T7355) and amplifier radio frequency 5820-99-932-5693 (A9365)</i>	116E-0252
<i>12-24 channel remote control equipment — ground</i>	116M-0501

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PART I

LEADING PARTICULARS AND GENERAL INFORMATION

LEADING PARTICULARS

Stores Ref.	...	...	...	...	...	...	...	10D/19267
Type of receiver	...	...	...	...	...	...	...	Double superheterodyne
Frequency range	...	...	...	...	...	...	...	225.0 Mc/s to 399.9 Mc/s
Channel spacing...	...	...	...	...	...	...	...	100 kc/s
Intermediate frequencies	...	...	...	...	...	...	...	24 Mc/s and 1.975 Mc/s
Local oscillators	...	...	...	...	...	...	...	Crystal controlled
Power supplies	...	...	...	...	...	...	...	Single-phase AC, 45 c/s—65 c/s, nominally 230V or 115V
Power consumption	...	...	...	...	...	...	...	160W
Receiver sensitivity	...	...	...	...	...	...	...	With an RF signal across the aerial terminals of 1 μ V, modulated 30 per cent at 1000 c/s, the signal plus noise/noise ratio at the output is greater than 10 dB.
IF bandwidth	...	...	...	...	...	...	...	For 6 dB down: not less than 60 kc/s For 60 dB down: not greater than 140 kc/s
AF output	...	...	...	...	...	...	...	With an RF signal across the aerial terminals of 5 μ V modulated 100 per cent at 1000 c/s:— Monitor output—200 mW Line output—between 2.0V and 3.5V for any load between 100 and 1800 ohms. Attenuated line output—maximum 5 mW into 600 ohm G.P.O. line.
Dimensions in cabinet...	...	...	...	...	...	...	...	Height 13 $\frac{1}{2}$ in. Width 23 $\frac{3}{4}$ in. Depth 24 in.
Weight	...	...	...	...	...	...	...	80 lb. excluding cabinet
Weight of cover assembly	...	...	...	...	...	...	...	51 lb. excluding connectors

Addendum 1

APPROVED MODIFICATIONS

Mod. No.	Class	Topic 2		Label	Brief details of change
		Leaflet	A.L. No.		
4604	B/2	B.1	2	1	Amplifying unit (IF) Type 7112 Add 2C66, 2C67, 2C68 and 2C69 to clear spurious oscillations at certain frequencies.
4682	B/3	B.2	3	1	Amplifying unit (RF) Type 7111 Add hole in unitor bracket flange to accommodate dowel pin when RF unit is fitted to chassis, to allow the unit to seat properly. Change screw from cheesehead to roundhead.
4738 (or replacement)	B/3	B.4	5	1	Chassis assembly Type 7354 5SKT25 substituted by type with red ring or red to improve insulation under condensation.
4748	B/2	B.3	4	1	Amplifying unit (AF) Type 7113 3C12 substituted by 500V working type and connected from anode to h.t. positive to avoid breakdown of the capacitors when no loudspeaker connected.
4936	B/2	B.5	6 and 22	2	Amplifying unit (AF) Type 7113 Change C10 from $\pm 25\%$ tolerance to one of $\pm 10\%$ to ensure that specification limit of 120 Hz can be met in all instances.
4944	B/2	B.10	11	1	Air blower Type 7344 Delete mains fuse in neutral line, and change fuse in live line to one of surge-proof type.
4947	B/2	B.11	12	2	Chassis assembly Type 7354 Delete mains fuse in neutral line, and change fuse in live line to one of surge-proof type.
4949	B/2	B.9	20	1	Power unit Type 7352 Change fuses due to introduction of surge-proof type.
4953	B/2	B.6	7	1	Mounting plinth Type 7872 Delete mains fuse in neutral line. Holder now to be used for SPARE fuse.
5009	B/2	B.7	8	2	Power unit Type 7352 Add resistors in parallel with the coils of the DR and HT relays to prevent contact chatter.
5082	B/2	B.8	9	3	Power unit Type 7352 Change 6R4 from 1K-ohm to 220 ohms to ensure that bias line can be adjusted to 48V in all conditions.
5339	B/2	B.18	21	2	Blower, air, Type 7344 Change phasing capacitor for one of higher voltage rating.
5493	B/2	B.12	13	3	Blower, air, Type 7344 Introduce a new type air filter.
5558	B/2	B.13	15	1	Test set Type 7618 Change label fitted to inside of cover for one with more practical test figures.

cont'd.

Mod No.	Class	Topic 2		Label	Brief details of change
		Leaflet	A.L. No.		
5873	B/2	B.15	17	1	Drive unit radio Type 7353 Add 0.02 μ F to the crystal oven to eliminate interference.
5876	B/2	B.14	16	4	Power unit Type 7352 Add 1 μ F to eliminate mainsborne interference.
6105	B/2	B.17	19	4	Blower, air, Type 7344 Change wiring to lamp ILP1 to give additional warning of supply failure.
6331	B/2	B.16	18	5	Power unit Type 7352 Substitute 6FS6 fuse link by one of the surge-proof type.
6970	B/3	B.19	23	3	Chassis assembly Type 7354 Replace telephone jack, 5935-99-943-9132 by telephone jack, 5935-99-911-6369 and add 680 ohms (5R15) to obviate failure of 3C12 and 3T1 in the amplifying unit (A.F.) Type 7113.
8209	B/3	B.20	24	4	Chassis assembly Type 7354 Change metering label to type with blank column to record actual readings obtained.
8211	B/3	B.21	25 & 26	2	Test set Type 7618 Change metering label to type with blank column to record actual readings obtained.
8327	B/3 on failure	B.22	27	6	Power unit Type 7352 Change pillars supporting the fuse panel to accommodate longer fuse holders.
9346	B/2	B.23	28	2	Drive unit radio Type 7353 Add 220 ohms (4R23) in series with 5C41 in the crystal oven to minimise sparking at the contacts of the thermostat.
9571	C/3	B.24	30	5	Blower, air, Type 7344 Remove the louvres from the air filter housing cover to reduce the working pressure of the cooling airflow.
1595	C/3	B.25	32 ◀34, 36 & 37▶	3	Amplifying unit (AF) Type 7113 Relocate 3C11 on the top of the chassis and replace certain wiring by p.t.f.e. insulated wire to obviate overheating.
1786	D/3	◀B.26	33▶	2	Amplifying unit (RF) Type 7111 Alter fork coupling to enable it to be secured by grub screws, reducing 3rd line servicing.
1950	C/3	◀B.27	35 & 38▶		Power unit Type 7352 Introduce 33 ohm (6R18) in series with MR2 to maintain correct voltage across the sealed relays.
A2534	C/3	B.29	40	3	Drive unit, radio Type 7353 Make access hole to adjust 4C4 without removing the drive unit from the chassis.
A2567	C/3 on failure of Relay Armature 10F/0119882	B.28	39	8	Power unit Type 7352 Introduce interchangeable relay of improved internal design in lieu of Relay Armature 10F/0119882.

cont'd.

Mod. No.	Class	Topic 2		Label	Brief details of change
		Leaflet	A.L. No.		
A2872	C/3 W.O.T.S.A.C.	B.30	41	4	Drive unit radio, Type 7353 Replace obsolete C6, C15, C16, C19 and C25 (5910-99-999-3918) and C24 and C32 (5910-99-946-4828) by Capacitor, Fixed (5910-99-932-5688) using a different method of attachment.
A2980	C/3	B.32	43	9	Power unit Type 7352 Introduce two 6.8K ohm to apply reduced h.t. to the valves in the amplifying unit (RF) Type 7111 when in the standby condition. Mod. No. A2981 is associated.
A2981	C/3	B.31	42	5	Chassis assembly Type 7354 Introduce additional wiring to apply reduced h.t. to the valves in the amplifying unit (RF) Type 7111 when in the standby condition. Mod. No. A2980 is associated.
A3107	B/2	◀ B.33	45 ▶	5	Drive unit radio Type 7353 Introduce electronic temperature control module (panel, electronic circuit 5999-99-618-3280), remove the bimetallic thermostat and associated components from the crystal oven and introduce thermistor bead to give greater stability of frequency control.
◀ A3430	C/3 W.O.T.S.A.C.	B.34	50	10	Power unit Type 7352 Replace obsolete rectifier 6130-99-943-1730 (MR1) by rectifier 6130-99-105-1689; this necessitates introduction of four additional wires and a threaded mounting bush.
A3868	B/2	◀ B.35	52 ▶	4	Amplifying unit (A.F.) Type 7113 Introduce a safety circuit to prevent the possibility of h.t. being applied to the GPO lines under certain fault conditions. ▶
◀ A4147	C/3	B.36	53	6	Chassis assembly Type 7354 Attach a warning label, to the inside top lip of the chassis, to warn users of a shock hazard. Mod. No. A2980 is associated. ▶

Addendum 2

INTRODUCTION OF NOMENCLATURES AND REFERENCES OF THE
CENTRAL CATALOGUING AUTHORITY

1. Since this publication was written, it has been decided to change the nomenclature and reference of all units, sub-units and components of the ground u.h.f. equipment from the Air Ministry and Admiralty systems to that of the Central Cataloguing Authority.

2. For the time being, the Air Ministry and

Admiralty nomenclatures and references will continue to be used in this publication, however, since equipments in use may have nameplates bearing the nomenclatures and references of either system the following list is promulgated which relates the Air Ministry and Central Cataloguing Authority's nomenclatures and references.

Air Ministry		Central Cataloguing Authority	
Ref. No.	Description	Ref. No.	Description
10D/19267	Receiver Type R.7351	5820-99-932-5694	Receiver, radio
10P/13247	Receiver unit Type 9096	5820-99-932-5702	Receiver, sub-assembly
10D/19269	Chassis assembly Type 7354	5820-99-932-4001	Chassis electrical equip.
10K/18136	Power unit Type 7352	5820-99-932-4004	Power supply
10D/19268	Drive unit radio Type 7353	5820-99-999-1348	Drive unit, radio
10U/16653	Amplifying unit (RF) Type 7111	5820-99-943-9509	Amplifier, radio frequency
10U/16654	Amplifying unit (IF) Type 7112	5820-99-911-8334	Amplifier, intermediate frequency
10U/16655	Amplifying unit (AF) Type 7113	5820-99-911-8335	Amplifier, audio frequency
10AP/273	Cover assembly	5820-99-999-0841	Cover, electrical, fitted
10AP/299	Cover front Type 1068	5820-99-932-4011	Cover, access, electrical equipment, fitted chassis
10HA/16707	Cable assembly Type 9097	5995-99-932-4015	Cable assembly
10HG/89	Connector Type B4/50F/R7	5995-99-911-8337	Connector
10HG/101	Connector Type B23/40F/R2	5995-99-946-5809	Cable assembly, special purpose, electrical
10AJ/250	Mounting plinth Type 7872	5820-99-932-5711	Pedestal, cabinet, electrical equipment
10K/19476	Blower, air, Type 7344	5820-99-932-3995	Cooler, dry air, electrical equipment
10K/19472	Fan assembly Type 9672	5820-99-999-2648	Cooler, air, electronic equipment
10AP/236	Cover assembly	5820-99-932-4010	Cover assembly, cooler, dry air, electrical equipment
10S/16830	Test set Type 7618	6625-99-943-3377	Test set, radio

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SECTION I

RECEIVER TYPE R.735I

Chapter 1
GENERAL DESCRIPTION

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Introduction

1. The receiver Type R.7351 is used in ground station installations, either fixed or mobile, for the reception of amplitude modulated signals in the range 225.0 MHz to 399.9 MHz.

2. The receiver normally operates with certain other u.h.f. transmitting and receiving equipments. Information on these other equipments is in the publications in the "List of associated publications". Information regarding the propagation of radio waves at u.h.f. with a brief description of the other ground radio u.h.f. equipments is given in A.P.116E-0253-1, Part. 1, Sect. 1, Chap. 1.

3. The receiver Type R.7351 has a double super-heterodyne circuit with both oscillators crystal-controlled and both i.f.'s fixed, the first at 24 MHz and the second at 1.975 MHz.

4. A power unit, which operates from a 50 Hz a.c. supply of nominally 115V or 230V (para. 34) is built into the receiver and provides all h.t., l.t., bias and relay voltages required by the receiver.

5. The receiver is of sub-unit construction, the sub-units being mounted on to a chassis assembly Type 7354 and so forming a receiver unit Type 9096. Table 1 lists the items comprising the receiver unit

Type 9096.

TABLE 1

**Receiver unit Type 9096 (Ref. No. 10P/13247)—
List of sub-units**

Stores Ref.	Nomenclature	Component	
		Type No.	Prefix No.
10D/19269	Chassis assembly	7354	5
10K/18136	Power unit	7352	6
10D/19268	Drive unit radio	7353	4
10U/16653	Amplifying unit (RF)	7111	1
10U/16654	Amplifying unit (IF)	7112	2
10U/16655	Amplifying unit (AF)	7113	3
5999-99	Panel, electronic	—	8
618-3280	circuit		

6. The receiver unit Type 9096 fits into a cover assembly (Ref. No. 10AP/273). This cover assembly is an open-fronted steel case fitted with runners.

7. The cover assembly is common to all major units of the ground u.h.f. equipment except the blower air Type 7344. It is provided with side handles and strengthening bars to take the weight of other u.h.f. equipments when stacked for operation. A mounting plinth Type 7872 (Ref. No. 10AJ/250) is available for

a stack to stand upon. The plinth, which must be bolted to the floor, carries the necessary electrical terminations for the equipment in the stack.

8. A cable assembly Type 9097 (Ref. No. 10HA/16707) comprises part of the rear panel of the cover assembly. On this part is the air blowing port, and the plugs and sockets for the external electrical connections to the receiver. The cables attached to these fixed plugs and sockets extend into the cover assembly and terminate in free plugs and sockets to mate with those at the rear of the receiver unit.

9. Connected in the particular cable which carries the a.c. mains to the receiver unit is an amber indicator lamp and a gate switch which removes the supply when the receiver unit is pulled forwards. The gate switch can be manually locked "on" when the receiver unit is withdrawn. The indicator lamp shows when the mains is present at the switch. The switch is not necessarily "on" when this lamp is lit.

WARNING

When the receiver unit is withdrawn take care that personal contact is not made with any of the high voltage points.

10. The receiver must be provided with forced air cooling if it is to be operated in temperatures above 10 deg. C (50 deg. F). The blower air Type 7344 (Ref. No. 10K/19476) is for use with these receivers (Part 1, Sect. 2).

11. A protective front cover Type 1068 (Ref. No. 10AP/299) should be fitted over the front panel of the receiver when the receiver is in storage or transit. This is secured by four quick-release fasteners. When the receivers are in use the front covers may be fitted into one another and placed on the top of the stack.

Front panel controls (fig. 1)

12. At the top, on the right-hand side, is the double-pole MAINS on-off switch. Next to this is the mains fuse and spare, of 1-amp rating where the supply is 230V, or on 115V of 2-amp rating. The mains (*amber*) indicating lamp, next to the mains fuses, shows when the a.c. supply is connected to the live side of the MAINS-ON switch. The receiver is not necessarily switched ON when this lamp is lit.

13. Two other indicating lamps are fitted to show when the h.t. and l.t. is on to the receivers, red for h.t. and blue for l.t., on either side of the meter. The h.t. to the receiver is delayed by a thermal delay circuit in the power unit. The circuit is set in operation when the a.c. mains circuit is completed to the power unit. No delay occurs if the h.t. is switched off for a period once the delay has operated.

14. The MUTING switch, at the top left-hand corner of the front panel, controls the diode muting circuit in the amplifying unit (IF), Type 7112.

15. At the centre of the panel are the main tuning scales, the tuning knobs and locks. Those on the left-hand side are associated with the r.f. amplifier, while those on the right-hand side with the drive unit radio Type 7353, which is the first i.o. of the receiver.

16. At the bottom right-hand side is MONITOR OUTPUT jack and MONITOR GAIN control. Underneath the hinged cover on the right-hand side are the controls which, once preset, should need little further attention. These are: LINE GAIN, to control the amplitude of the audio frequencies transmitted down line; RF GAIN; and the OFF-AGC-DF switch. The DF position of this switch is for use only when the receiver is used as part of certain equipments which determine the direction of arrival of radio signals.

Metering

17. On the front panel is a 0-100 micro-ampere meter and a twelve-position rotary switch. The switch connects the meter to certain parts of the circuit to obtain readings necessary during the setting-up of the receiver and to provide a rapid determination of performance.

18. The first seven positions of the switch connects the meter to certain fixed circuits positions in the receiver, while in the last five switch positions the meter is connected to a nine-pole plug at the end of an extension lead. This plug may be fitted to either of two sockets. Normally to the one on the power unit but if required to another on the drive unit. In this way a number of current and voltage readings may be obtained for assistance in fault finding.

Operation

19. A simplified block diagram is given in fig. 2 which shows not only the stages of the receiver and the routing of the signal, but also the particular sub-unit in which the various stages are located. All sub-units are numbered, marked on each sub-unit and on the chassis where the sub-units are mounted. These numbers, in Table 1, are used as a prefix to all component references.

20. Certain sub-units are common to both the single-channel receiver R.7351 and the multi-channel receiver R.7109, while other sub-units are common to both the multi-channel receiver R.7109 and the multi-channel transmitter T.7096. It has been arranged that the prefix number of these sub-units remains the same regardless of the main unit in which it is being used.

◀WARNING

When H.T. switch is OFF, 180V d.c. is still applied to the valves in the amplifying unit (RF) Type 7111. ▶

21. The amplifying unit (RF) Type 7111 contains three triodes operating with grids at r.f. earth thus obtaining reasonable gain with stability and

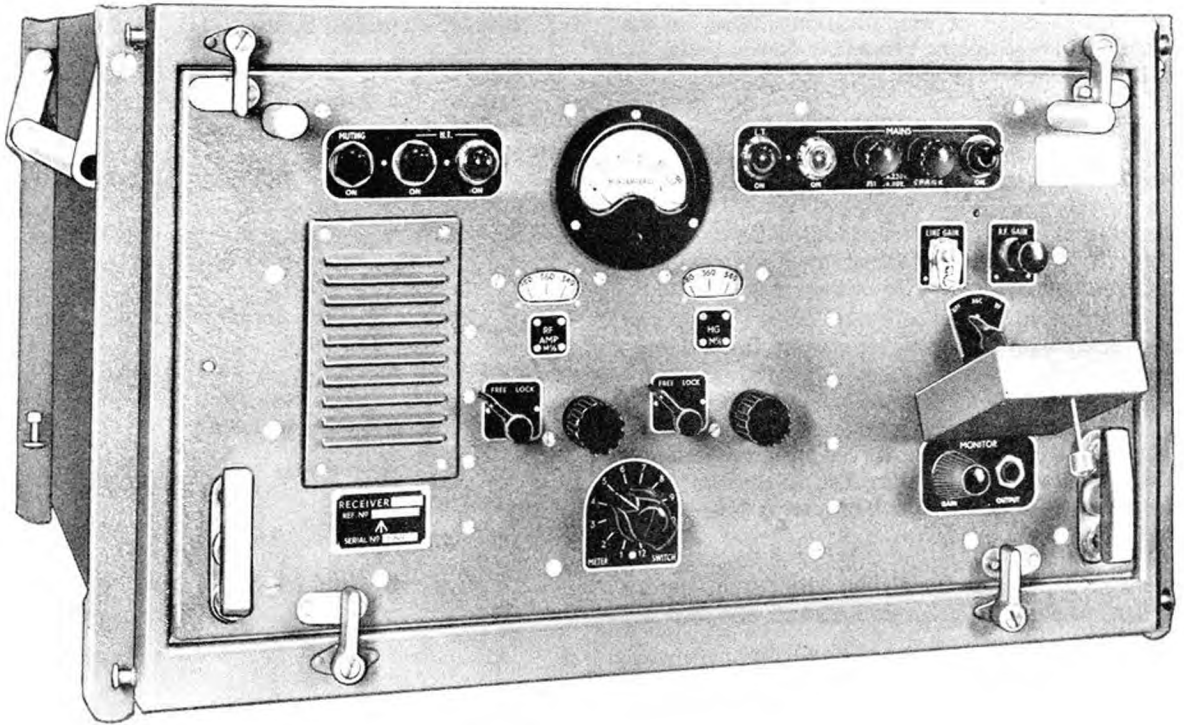


Fig. 1. – Receiver Type R.7351 – front panel

low noise.

22. The first two stages provide amplification at the signal frequency while the third is mixer with an output at the first i.f. of 24 MHz. The output of the drive unit radio Type 7353, which is the first l.o. of the receiver, is at one third the frequency required by the mixer. The drive, however, is sufficient for the third harmonic to be generated in the mixer.

23. Tuning of the r.f. amplifying unit is provided by three semi-butterfly circuits ganged to RF AMP control on the front panel.

24. The drive unit radio Type 7353 provides the r.f. l.o. frequency for the receiver first mixer. The first stage of the drive unit is an oscillator/multiplier using a ◀ temperature controlled ▶ quartz crystal to provide frequency stability. The output is at three times or four times the frequency of the crystal, the particular harmonic being determined by the operating frequency.

25. The oscillator is followed by an amplifier, a

frequency doubler and an output stage, thus, since the third harmonic is generated and used in the mixer stage (*para. 22*), the drive unit signal at the first mixer is eighteen or twenty-four times the frequency of the crystal.

◀ 26. The quartz crystal (*para. 24*) is enclosed in an oven which maintains the temperature of the crystal at $75^{\circ} \pm 1.5^{\circ} \text{C}$, temperature control being effected by a thermistor bead (in the oven) in conjunction with the panel, electronic circuit 5999-99-618-3280 (oven control module) on top of the chassis of the drive unit radio Type 7353.▶

27. All tuning capacitors of the drive unit radio Type 7353 are ganged and controlled by the H.G. (Harmonic Generator—by which the drive unit was originally known) control on the front panel.

28. The 24 MHz signal output of the amplifying unit (RF) Type 7111 passes via coaxial cable to the amplifying unit (IF) Type 7112. The first stage amplifies the 24 MHz signal and passes it to the second mixer of the receiver.

29. The second oscillator of the receiver is a double-triode which operates in a Butler oscillator circuit with a crystal providing frequency stability, on its third overtone. The output of the oscillator is at 22.025 MHz which, when mixed with the 24 MHz first i.f. in the pentode, second mixer stage, produces an output at the second i.f. of 1.975 MHz.

30. Three stages of amplification follow at the second i.f. 1.975 MHz. These are conventional i.f. amplifiers band-pass coupled by tuned circuits.

31. The amplifying unit (IF) Type 7112 has two outputs, one the demodulated a.f. which is passed via a noise limiter stage and audio cathode-follower and then to the amplifying unit (AF) Type 7113. The other output is at the second i.f. (1.975 MHz). This is taken from the last i.f. transformer and passes via cathode-follower V10B. This output may be used by the direction finding equipment (*para. 16*) or any other equipment requiring an output from the receiver at the i.f.

32. All the i.f. amplifying stages except the last are controlled by an a.g.c. derived from the detector stage. This is amplified and applied to the controlled stages via a gate circuit which ensures a delay in the application.

33. Two separate output stages are fitted, one for monitor purposes of either 300-ohm or 600-ohm im-

pedance, and a line output which operates into a 600-ohm load. The monitor out-put, which may be taken from the front panel jack or from the socket at the rear of the receiver, is capable of providing 2 W of a.f. The line output voltage is stabilized and remains substantially constant for wide variations of load. Where the receiver is to operate into 600-ohm G.P.O. lines, a separate line output is provided attenuated to the level prescribed by the G.P.O.

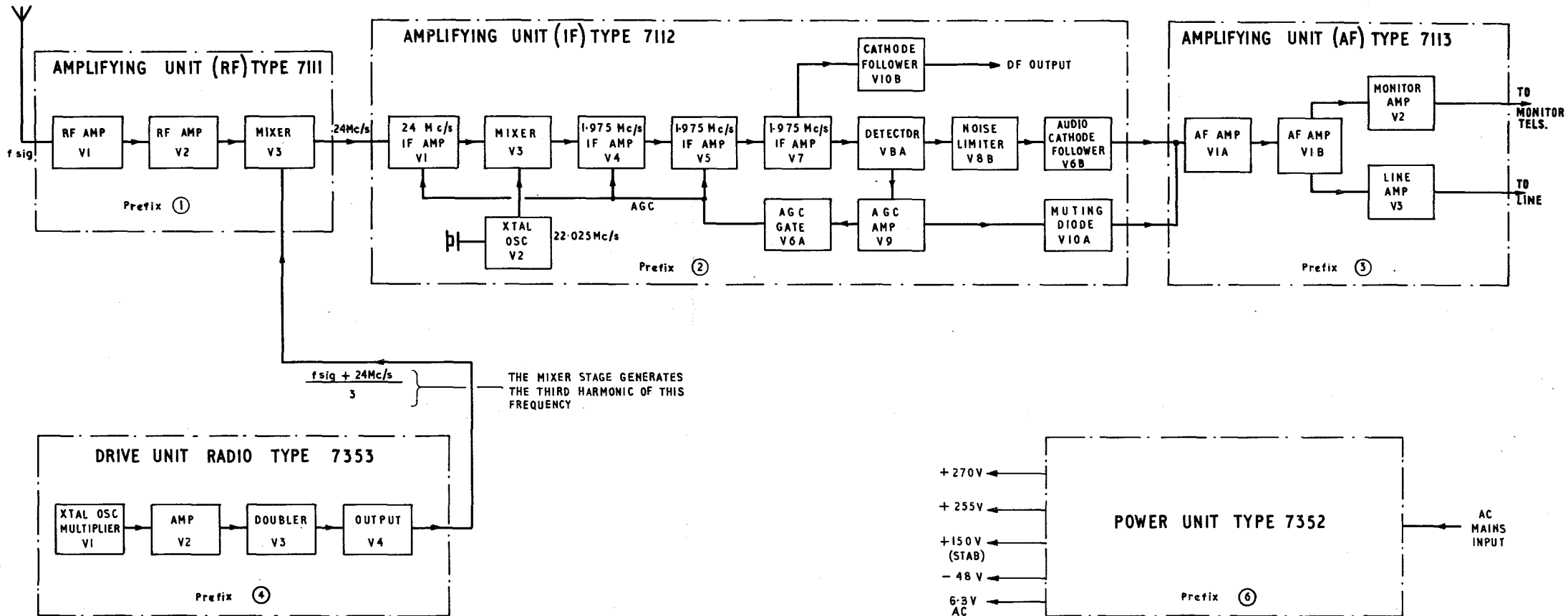
34. A diode muting circuit is incorporated as part of the amplifying unit (IF) Type 7112 and this is operated by the a.g.c. amplifier. When in operation the diode muting valve short-circuits the audio input to the first audio amplifying stage of the amplifying unit (AF) Type 7113. Operation of the circuit depends upon the strength of the r.f. signal and upon the setting of RF GAIN.

35. Power supplies are obtained from the power unit Type 7352. The input is 45 Hz-65 Hz a.c. mains and adjustable in 5 V steps from 105 V to 130 V and in 10 V steps from 200 V to 250 V. The outputs of the power unit are:

- (1) H.T. 270 V, 255 V and 150 V stabilized.
- (2) L.T. 6.3 V a.c.
- (3) Bias and relays. Negative 48 V d.c.

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A.P. 2531 F, Vol. 1, Part 1, Sect. 1, Chap. 1 (A.L.1)



THE MIXER STAGE GENERATES THE THIRD HARMONIC OF THIS FREQUENCY

AIR DIAGRAM
6127D/MIN.
ISSUE 1 PREPARED BY MINISTRY OF SUPPLY FOR PROMULGATION BY AIR MINISTRY ADVERSALITY

R7351
CUK

Receiver unit Type 9096 - block schematic diagram

Fig. 2

Chapter 2

SETTING UP INSTRUCTIONS

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ILLUSTRATIONS

Fig. 1

Front panel controls... ..

General

1. This chapter covers the operations necessary to set the receiver Type R.7351 to any one of the 1 750 channels in the range 225.0 - 399.9 MHz and for setting the controls so that the receiver can be operated into remote control lines.

2. It is assumed that the receiver has been correctly installed (Chap. 5) and is in working order.

3. The layout of the switches and controls on the front panel referred to in the instructions, are in fig. 1.

Preliminary

4. Before setting the receiver MAINS to ON, release the four latches and pull the receiver out on its runners to its full extent. Check the amber MAINS lamp on the front panel is not lit.

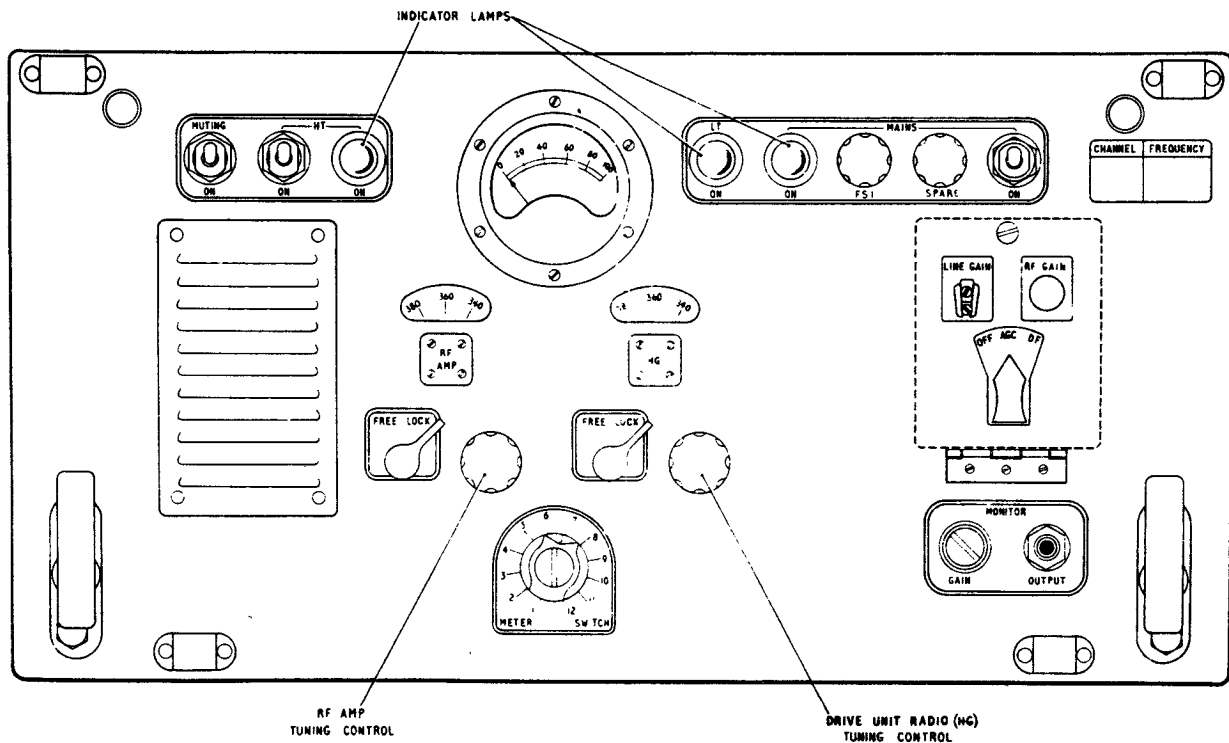


Fig. 1 Front panel controls

5. Check that the mains tapplings on the power unit at the rear of the receiver unit are set correctly (*Chap. 5*) and ensure that the 9-pole test plug is fitted to the orange socket on the power unit.

6. Remove the covers of the crystal oven on the drive unit, and fit a crystal appropriate to the channel required, to the WORKING socket. The crystal required can be determined from the expression:

$$\frac{\text{AERIAL INPUT FREQUENCY} + 24}{\text{MULTIPLICATION FACTOR (18 or 24)}} \text{MHz}$$

7. The multiplication factor may be 18 or 24 depending on the aerial input frequency.

<i>Aerial input frequency</i>	<i>Mult. factor</i>	<i>Crystal</i>
225.0 - 293.9 MHz	18	ZDM or ZDR
294.0 - 399.9 MHz	24	ZDR

Close tolerance crystals (ZDR) must be used for the higher multiplication factor.

Example (i) . . .

Aerial input frequency: -250.1 MHz

$$\frac{250.1 + 24}{18} = 15\ 227.777\ \text{kHz}$$

ZDM or ZDR crystal.

Example (ii) . . .

Aerial input frequency: - 310.1 MHz

$$\frac{310.1 + 24}{24} = 13\ 920.833\ \text{kHz}$$

ZDR crystal.

8. A second crystal fitted to the SPARE socket inside the oven will be maintained at working temperature for any subsequent frequency change. Refit the two covers of the crystal oven ◀(see note)▶. When refitting the inner cover ensure that the heater contacts are not damaged and that good electrical contact is made.

◀**Note . . .**

Before refitting the crystal oven, ensure that the top of the thermistor bead is level with the top of the crystal to ensure correct excursion of the oven temperature.▶

Switching on

9. Check that the mains supply is on and that the amber DANGER HIGH VOLTAGE lamp by the gate switch inside the cover assembly is lit. Close the receiver unit into the cover assembly and ensure that the amber MAINS lamp on the front panel of the receiver becomes lit. Fasten the four corner latches.

10. If the receiver is being cooled by an external air blower Type 7344, *i.e.* ambient temperatures above 10 deg. C (50 deg. F), then switch the air blower on.

11. Set MAINS on the front panel of the receiver

to ON and check that the blue LT lamp is lit. Set HT to ON and wait for the HT lamp to light.

Note . . .

The power unit contains a delay circuit which prevents the h.t. from being applied to the receiver until one minute has elapsed from setting MAINS to ON.

Tuning

12. To prevent the receiver noises, produced during tuning, from being fed down the remote lines, the a.f. output should be disconnected at a convenient place, *e.g.* the line plug board.

13. Set the front panel controls of the receiver as follows:

MUTING switch off

RF GAIN control to maximum (fully clockwise)

OFF-AGC-DF switch to OFF

Note . . .

The RF GAIN control, OFF-AGC-DF switch and the LINE GAIN control are concealed under a hinged cover on the right-hand side of the front panel of the receiver.

14. Unlock RF AMP and H.G. and set the controls so that the dial settings are approximately at the frequency required.

15. Plug a headset into the MONITOR OUTPUT jack and adjust MONITOR GAIN to obtain a reasonable level of background noise.

16. Set METER SWITCH to position 1 and adjust H.G. on either side of the approximate setting, to obtain maximum meter reading. Lock H.G. taking care not to disturb the setting.

17. Set METER SWITCH to position 2 and adjust RF AMP on either side of the approximate setting to obtain maximum meter reading. The setting of RF GAIN should be reduced if the meter reading exceeds 60. Maximum meter reading should coincide with maximum background noise in the telephone headset. Lock RF AMP taking care not to disturb the setting.

Note . . .

Crystals of certain fundamental frequency may be used with a multiplication factor of 18 or 24 (para. 6). This means that 'on tune' indications are obtained in at least two places within the frequency range. Ensure that the final setting of the tuning controls is that where the tuning scales are set approximately to the frequency required.

18. The setting of certain preset controls, *i.e.* LINE GAIN, etc., should not normally require adjustment after being set on installation or at periodic servicing. Should the setting of these con-

trols be in doubt then Servicing (*Part 2, Sect. 1, Chap. 2*) or Installation (*Part 1, Sect. 1, Chap. 5*) should be consulted.

Operating instructions

19. Set MUTING to on and RF GAIN to the highest setting consistent with a barely audible noise level.

Note . . .

Too high a setting of RF GAIN renders the muting circuit inoperative.

20. Set OFF-AGC-DF to the position required; AGC is the normal position for R/T.

21. Remove the headset and close and secure the

hinged cover over RF GAIN, LINE GAIN and OFF-AGC-DF. Reconnect the receiver output to the remote line.

Direction finding

22. Where the receiver is operated with a direction finding equipment, set it up in accordance with the foregoing instructions, but OFF-AGC-DF should be left at DF.

Signal indication

23. If the receiver is to be operated with OFF-AGC-DF at AGC or DF, the meter can be used as a signal indicator. The METER SWITCH should be left in position 3. A decrease in meter reading is obtained when a signal is received.

Chapter 3

RECEIVER UNIT TYPE 9096 — CIRCUIT DESCRIPTION

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General

1. A general description of the receiver unit Type 9096 together with a block schematic diagram and a simple explanation of the operation of the receiver unit is given in Part 1, Sect. 1, Chap. 1 of this publication.

2. The circuit description given in this chapter is of the receiver unit Type 9096 alone. The receiver Type R.7351 consists of a receiver unit Type 9096 plus a cabinet and a cable assembly. A technical description of these additional items is given in Part 1, Sect. 2, Chap. 4 and 5 of this publication.

3. The various sub-units of the receiver unit Type 9096 are mounted on the chassis assembly Type 7354. Illustrations showing the construction of the individual sub-units and of the complete receiver unit Type 9096 are given in Part 1, Sect. 1, Chap. 4 of this publication.

Amplifying unit (RF) Type 7111

4. The layout of the amplifying unit (RF) Type 7111 is given in fig. 1 (a) and the circuit in fig. 2. The three valves are specially designed triodes for

operating as grounded grid r.f. amplifiers at u.h.f. The first two stages amplify the signal input and an overall voltage gain of approximately 10 : 1 is obtained. The third stage is the receiver first mixer.

5. In order to obtain adequate amplification of this wide frequency band, i.e. between 225.0 MHz and 399.9 MHz, the construction of the tuning and coupling components is of great importance. Many of the r.f. components are of the "built in" type and their operation is very dependent on their construction.

6. The three tuned circuits are similar in construction and are illustrated in fig. 1 (b). These circuits are of the semi-butterfly type with integral inductance and capacitance which vary together. The stator plates, which are connected in parallel, form one turn of inductance with capacitance between their ends. The rotors have approximately 120° movement and when fully clockwise bridge the gap between the ends of the stators.

7. As the rotors are moved in a counter-clockwise direction the capacitance between the ends of the stators is progressively reduced. At the

same time the inductance also reduces, since an opposing field is produced by eddy currents in the rotors as they move into the inductance formed by the stators. This arrangement maintains a high LC ratio over the large frequency range covered by the r.f. stages.

8. The aerial input at SKT4 (*fig. 2*) passes via the coaxial cable and the coupling capacitor C8 to the first tuned circuit. The capacitor C8 is pre-set to optimum coupling during the original setting-up of the receiver and should not require further adjustment. The capacitor C10 performs the function of a trimmer across the tuned circuit and at the same time matches it to the low cathode impedance of V1.

9. The anode load L3 and the coupling capacitor C13 are integral with the tuning components C16 and L5 (*fig. 1*). The capacitor C13 is formed by the capacitance between one of the supports of the stators and the valve anode connecting plate, mica being used as the dielectric. The inductance L3 is formed by passing an insulated lead from C14 through a screening tube mounted around the outside of the stators. A similar construction exists for L7 and C21 which are mounted on L9 and C23.

10. The trimmer capacitors C15 and C22 and the coupling capacitors C18 and C24 are mounted below the chassis. The coupling capacitors C18 and C24 are screened from other components when their individual covers are fitted.

11. The capacitors C11 and C19 ensure that the grids of V1 and V2 are at r.f. earth potential. These capacitors are formed by the construction of the valve support assembly. A fixed negative bias is placed on the grids of V1 and V2, this voltage is obtained from the negative 48-volt supply and reduced to approximately 1-volt by the divider network R1 and R2 (*fig. 2*)

12. The mixer valve V3 has two inputs, one is the aerial r.f. input signal after amplification by V1 and V2, and the other is the "local oscillator" signal from the drive unit radio Type 7353 (*para 43*). The input from the drive unit is of relatively large amplitude, the third harmonic of this frequency is generated in, and used by, the mixer valve in producing the difference frequency of 24 MHz.

13. The input from the drive unit radio Type 7353, being of large amplitude, causes grid current and increased anode current to flow in V3. The rise in cathode current can be measured by the meter when switched across R5. Maximum meter reading indicates maximum drive and therefore correct tuning of the drive unit.

14. The anode circuit of V3 is tuned to 24 MHz and is arranged to provide decoupling of the u.h.f. signals and, at the same time, have a low impedance output for the coaxial cable coupling to the amplifying unit (IF) Type 7112.

15. The h.t. supply for the amplifying unit (RF) Type 7111 is obtained from the 250-volt output

of the power unit. One end of the heater of the CV354 valves is internally connected to the cathode. To maintain the cathode at high r.f. potential, therefore, chokes are required in the cathode and heater leads. The heater supply for V3 is obtained from a separate winding on the mains transformer to permit the use of cathode bias. No direct earth connection is made to this winding except via the cathode bias resistor R4 and the meter shunt resistor R5.

Amplifying unit (IF) Type 7112

16. The 24 MHz first intermediate frequency is fed into the amplifying unit (IF) Type 7112 (*fig. 3*) from the amplifying unit (RF) Type 7111 via coaxial cable. The first stage of the IF unit (V1) amplifies this signal and it is then passed to V3 which is the receiver second mixer.

17. The receiver second local oscillator (V2) is a double triode valve connected in a Butler oscillator circuit and crystal-controlled to a frequency of 22.025 MHz. The two signals are injected in series to the grid of the mixer stage V3, the main bias for which is obtained from the cathode resistor R12 and metering shunt R13. With the meter switch set to position 3, to measure mixer cathode current, a slight variation in meter reading when the crystal is removed from its socket will be proof of oscillator operation.

18. Three stages of amplification follow at the second intermediate frequency, 1.975 MHz. The i.f. transformers T3, T4 and T5 have fixed inductive and capacitive coupling while T2 has adjustable inductive coupling. Adjustment of this coupling permits the required overall frequency response to be obtained during manufacture; after this no further adjustment is necessary. Bias for V4 and V5 is obtained from the cathode resistors and the a.g.c. line (*para. 30*). Valve V7 has fixed cathode bias alone.

19. An output is taken from the last i.f. transformer via the capacitor C55 to the cathode follower stage V10B. Output from this stage is at low impedance and is used only when the receiver is used in conjunction with the D/F equipment.

20. The signal is detected by the diode V8A; the load resistors are R28 and R30. A small bias potential (between 1-volt and 2-volt positive) is connected in the diode circuit to ensure the detection of weak r.f. signals by valves having characteristics which are not quite identical. The bias voltage is obtained from resistor R41 which is connected in series with R40, RV1 and R39 across the negative 48-volt supply.

21. The diode V8B is a series noise-limiter; the audio voltages developed across R30 are passed via V8B (when it is conducting) and the coupling components C52 and R32 to the grid of the audio cathode follower stage V6B. The other end of the load resistor R30 is at a.f. earth potential due to C48.

22. This type of noise limiter is self-adjusting to the r.f. carrier signal strength and it will pass

audio signals of up to approximately 90 per cent of full modulation. The short duration, high-amplitude, noise pulses, however, exceed this value and they are limited by the limiter diode.

23. The full detected signal, which is d.c. plus audio, is developed across R28 and R30 (*para* 20). The positive side of this voltage is connected via the long-time-constant circuit, R27 and C51, to the diode anode. This circuit ensures that only the average of the detected signal is applied to the anode. Resistor R29 prevents the audio input to V6B being short-circuited by C51.

24. The cathode of the limiter diode is connected to the junction of R28 and R30 which is slightly less than half the full detected signal. On reception of an unmodulated carrier signal a steady d.c. will flow through the diode.

25. When the signal becomes modulated, the cathode voltage will vary with the modulation and so therefore will the diode current; the audio voltages across R29 will be the input to the next stage. Should the variations at the cathode of the noise limiter become excessive, i.e. during the reception of a noise pulse, the cathode will become more positive than the anode and the diode current will cease, the audio input to V6B is then disconnected.

26. The audio output of the amplifying unit (IF) Type 7112 is taken from the cathode circuit of the triode V6B. The resistor R34 provides bias for the valve whilst R34 and R35 together form the load. A cathode follower circuit was chosen for this position since its output is at low impedance and it covers a wide frequency range with very little distortion and phase shift. The output is taken via the blocking capacitor C54 to the amplifying unit (AF) Type 7113 and direct from the cathode for the D/F equipment where this is required.

27. The detected signal across R28 and R30 (*para* 20) is also passed to the a.g.c. amplifier valve V9. D.C. coupling is employed here so that both the d.c. and the audio components of detection are present in the circuit. The audio signal is, however, removed by the smoothing circuit comprising the resistors R26 and R43 and the input capacitance of the valve. The valve input capacitance is considerably increased by the capacitor C57 between anode and grid, due to Miller effect. The input capacitance becomes:—

$$C_{ag} (A + 1) \mu F \text{ in excess of normal}$$

where C_{ag} = anode-grid capacity; and
A = stage gain.

28. The complete detector circuit is connected to the negative 48-volt supply and this potential is therefore present at the control grid of the a.g.c. amplifier V9. The cathode of V9 is connected to the negative potential side of R39 so that the standing bias for V9 is the voltage across R40 and RV1. The screen grid is connected to earth and it is

therefore positive with respect to the cathode by the amount of the volts drop across R39. The anode of V9 is taken to the h.t. supply via a large value anode load. The anode potential, with no input signal to the receiver, is arranged to be slightly positive with respect to earth.

29. Upon receipt of a signal the control grid of V9 will become less negative, the anode current will increase and the anode voltage will be reduced and become negative with respect to earth. With the OFF-AGC-DF switch on the front panel of the receiver set in the AGC position, this negative potential is passed to the cathode of the a.g.c. gate valve, V6A.

30. Bias for the 24 MHz amplifier and the first two 1.975 MHz amplifiers is obtained from a common bias line. The voltage on this line may be set by the RF GAIN control, which is situated on the front panel of the receiver. The a.g.c. will increase this voltage when the a.g.c. gate diode V6A conducts, i.e. when the a.g.c. voltage (obtained from V9 anode) on the cathode of V6A is in excess of the voltage set by the RF GAIN control on the anode.

31. The muting diode V10A, when switched ON, is connected between the grid input of the audio amplifier stage V1 in the amplifier unit (AF) Type 7113 (*para* 35) and earth. A bias voltage from the anode of the a.g.c. amplifier V9 is placed on the anode of V10A. This potential is positive with no signal input (*para* 28), and the diode will conduct and reduce the noise input to the audio-amplifier by approximately 20 dB. During the reception of a signal, however, the anode bias on the diode changes to negative and the diode then has no effect on the audio input to the audio amplifier.

32. From the foregoing it will be apparent that the control RV1 considerably affects the operation of the receiver. The a.g.c. delay and the muting is affected, since RV1 varies the bias on the a.g.c. amplifier V9, and the detector current is also affected, since RV1 controls the current through R41 which provides the positive bias for the detector.

33. In order to obtain the correct setting for RV1, a strong signal input should be obtained and the meter switch set to measure detector current (position 2). The RF GAIN control should be set to maximum and then RV1 set so that the meter reads 67. No definite signal strength is specified here provided it is sufficient for a.g.c. to be produced; the receiver a.g.c. is capable of maintaining the i.f. input to the detector within a few volts once the delay has been overcome.

34. The gain of the i.f. stages is set by the RF GAIN control (5RV3). With no signal input, therefore, this control sets the noise level at the detector. Since this noise, if above a certain level, will render the muting circuit inoperative in the

same way as would a signal (*para.* 31), the RF GAIN control should be reduced from its maximum setting until the noise output of the receiver is just muted.

Amplifying unit (AF) Type 7113

35. The audio output of the i.f. amplifying unit is passed to the amplifying unit (AF) Type 7113. From the circuit diagram (*fig.* 4) it can be seen that the audio input is applied to the grid of the cathode follower stage V1A via the high-pass filter C1, C14, C2, C3, R1 and R2. In the cathode circuit of V1A is a low pass filter C4, C6 and L1; thus the overall gain of the stage is confined to frequencies in the range 300 MHz to 3,500 MHz.

36. Connected across the input to the cathode follower stage V1A is the muting diode (2V10A) which is situated in the amplifying unit (IF) Type 7112. A circuit description of this stage is given in *para.* 31.

37. The output of the cathode follower stage V1A is passed to the triode amplifier V1B. This amplifier has two outputs at different levels to feed the monitor amplifier and the line amplifier.

38. The front panel of the receiver carries the LINE GAIN control (5RV7) and MONITOR GAIN control (5RV9). These are independent controls and set the amplitude of the audio input to line and monitor amplifiers, respectively.

39. The monitor amplifier output is transformer-coupled, via a link panel to the telephone jack on the front panel and also to SKT21 at the rear of the receiver unit. The link panel is beneath the main chassis and may be set for an output impedance of 300-ohm or 600-ohm with centre tap to earth. The monitor amplifier can provide 2 W audio power.

40. The line amplifier output is transformer-coupled to feed into 600-ohm via a safety circuit (*para.* 40A). A centre tap to earth may be fitted if required at the link panel (*para.* 39). The chassis assembly carries a resistor network to attenuate the output when operating into GPO lines.

◀ 40A To avoid a fault on T2 causing 270V to be applied to the GPO lines, a safety circuit, of two 60mA fuses FS1, FS2 and four Zeners Z1 to Z4, is introduced into the amplifying unit (A.F.) Type 7113 by Mod.No. A3868/4. If a short circuit occurs between the primary and secondary of T2, 270V is applied to the safety circuit where the diodes conduct to chassis rupturing the fuses. ▶

41. A tertiary winding on T2 provides negative feedback to combat the effects of load variations. If the volume control is set so that 3.5V audio is being developed across 1800-ohms, then it changes by no more than 1.5V if the load changes to 100-ohm.

42. MR1 rectifies the output of the line amplifier for the meter when the meter switch is in position 4, which is used when setting LINE GAIN (5RV7).

Drive unit radio Type 7353

43. The first "local oscillator" signal for the receiver is provided by the drive unit radio Type

7353. The circuit diagram (*fig.* 5) shows that the unit contains four stages, an oscillator multiplier, an amplifier, a doubler, and an output stage.

44. Oscillator multiplier V1 is controlled by a quartz crystal in a temperature-controlled oven, the crystal temperature being within $\pm 1.5^{\circ}$ C. of 75° C., regulated by the panel, electronic circuit (*para.* 62). The grid input circuit is adjusted (C4) during manufacture so that the crystal is operating into a 30 pF circuit. Valve changes may upset the setting of this circuit.

45. The tuned circuit L3, C11 is tuned to a harmonic of the crystal. At the lower end of the frequency band the multiplication factor is three whilst at the upper end it is four. Certain crystals therefore may be used for two channels. It is important to note, however, that only crystals of close tolerance may be used for the higher multiplication factor.

46. The amplifier stage V2 is inductance-capacity coupled to the third stage V3. This is a doubler stage with inductance-capacity coupling to the output stage V4. The output frequency of the drive unit is therefore at six times, or eight times, the frequency of the crystal.

47. The output of the drive unit is taken from a tapping on the inductance L11 which is part of the last tuned circuit. This is taken to the cathode circuit of the mixer stage (*para.* 12) in the amplifying unit (RF) Type 7111. The mixer stage generates and uses the third harmonic of the drive unit output i.e. eighteen or twenty-four times the frequency of the crystal.

48. Since the "local oscillator" signal is 24 MHz above that of the input signal, the crystal frequency, for a given aerial input signal can be calculated as follows:—

$$\text{Crystal Frequency} = \frac{\text{Aerial input frequency} + 24 \text{ MHz}}{\text{Multiplication factor (18 or 24)}}$$

49. Where the aerial input frequency is between 225 MHz and 293.9 MHz the multiplication factor is 18 and for aerial input frequencies between 294 MHz and 399.9 MHz the multiplication factor is 24.

50. The anode current of the output stage may be read on the front panel meter when the meter switch is placed in position 6. Other voltages and currents may be read by using the nine pole test plug (5PL27) (*para.* 61)

51. The h.t. and l.t. supplies to the valves in the drive unit are listed in Tables 1 and 2. The output valve V4 receives a standing negative grid bias which is obtained from the negative 48-volt supply. The crystal oven receives its power via the panel, electronic circuit (*para.* 62) from the 115V tappings on the mains transformer primary in the power unit Type 7352.

Power unit Type 7352

52. The power unit Type 7352 is mounted at the rear of the receiver unit Type 9096 and provides

all h.t., l.t. bias and relay voltages required by the receiver. The circuit diagram of the power unit is given in fig. 6. The power unit contains only one mains transformer, the primary of which can be set (in 10-V steps) to any voltage between 200-V and 250-V and (in 5-V steps) to any voltage between 105-V and 130-V. The frequency of the supply should be between 45 Hz and 65 Hz.

53. Connected to the 230-V tappings on the mains transformer is a bridge rectifier circuit; the d.c. output of this rectifier may be measured by the front panel meter when the meter switch is in position 7. Also taken from the primary of the transformer is a supply of 115-V for the crystal oven heater (*para.* 44 and 51)

54. The mains transformer has four l.t. windings which supply valve heaters in different parts of the receiver; these are listed in Table 1.

55. The main secondary winding has two outputs; 57-0-57-V and 365-0-365-V. The former is rectified by a full wave metal rectifier MR2 and provides the negative 48-V bias and relay supply. The latter is full-wave rectified by the two diodes V1 and V2 and provides h.t. for the receiver.

56. The h.t. circuit is protected by a 250-mA fuse and controlled by the h.t. relay. The h.t. relay is energized by the negative 48-V supply when the h.t. switch on the front panel of the receiver is set to ON and the delay switch S1 has operated. The h.t. smoothing chokes are turned to the 100 Hz ripple voltage to ensure good smoothing.

57. Three different h.t. voltages are obtained from the rectified 365-0-365-V winding, these are listed in Table 2. In addition, when the H.T. switch is set to OFF, an h.t. supply of 180 V nominal derived from resistors R18 and R19 is applied, via relay contacts

TABLE 1

Valve heater supplies

Transformer Winding	Fig. 6 ref.	Supply No.	Supplies to	Unit
1	a - b	-	V1, V2	Power unit
2	c - d	L.T.1	All valves	Drive unit
			All valves	Amplifying unit (AF)
			V1, V2	Amplifying unit (RF)
3	g - h	L.T.2	Thermal delay	Power unit
			LT indicator lamp	Chassis assembly
			All valves	Amplifying unit (IF)
4	e - f	L.T.3	V3	Amplifying unit (RF)

HT2, to the valves in the amplifying unit (RF) Type 7111; this serves to alleviate deterioration of the valves caused by prolonged standby conditions.▶

58. The nine-pole test plug (5PL27) (*para.* 61) may be connected to the socket SKT18, the front panel meter will then read certain currents and voltages in the power unit.

Chassis assembly Type 7354

59. The chassis assembly Type 7354 provides a mounting for those sub-units of the receiver which have been described in the preceding paragraphs. The chassis assembly includes the front panel of the receiver and all the controls mounted thereon. The chassis assembly also contains the electrical interconnections between the sub-units except the r.f. coaxial connections.

60. The circuit diagram of the chassis assembly

TABLE 2

Receiver h.t. supplies

Supply No.	Voltage	Supplies to	Unit
H.T.1	270	Anodes V2, V3	Amplifying unit (AF)
H.T.2	255	All valves	Amplifying unit (IF)
		V3, V4	Drive unit radio
		V1 and screens of V2 and V3	Amplifying unit (AF)
◀ H.T.3	{255 180 standby}	All valves	Amplifying unit (RF)▶
H.T. (STAB)	150	V1, V2	Drive unit radio

Type 7354 is given in fig. 7. Parts of the circuitry of the chassis assembly are shown dotted on the circuit diagrams of other sub-units. This has been done for simplicity and reference is made to the circuit description paragraphs of these sub-units.

61. The front panel meter may be connected to certain parts of the circuit by the twelve-position meter switch. The first seven are permanent meter-

ing positions, these are listed in Table 3, while the last five are taken to a nine-pole test plug at the end of an extension lead. This test plug should normally be fitted to the socket 6SKT18 on the power unit Type 7352, but when required it may be fitted to the socket 4SKT14 on the drive unit radio Type 7353. The circuit positions metered in these units are listed in the tables on the appropriate circuit diagrams.

TABLE 3
Receiver unit Type 9096 — permanent metering

Meter switch position	Circuit	Meter F.S.D.
1	First mixer cathode current (drive indication)	5 milliamp
2	Detector current	200 microamp
3	First i.f. cathode current (a.g.c. indication)	10 milliamp
4	Line amplifier output	10-volt
5	Second mixer cathode current	10 milliamp
6	Drive unit output anode current	25 milliamp
7	Mains supply	300-volt

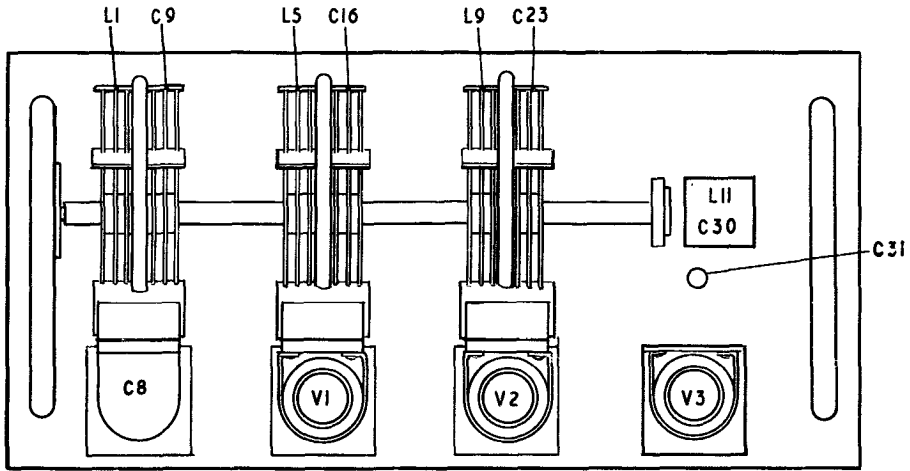
◀ **Panel, electronic circuit (fig. 8)**

62. The panel, electronic circuit (control module) provides control of the temperature within the crystal oven on the drive unit radio Type 7353 (*para. 44*). The module, bolted to a vertical bracket on top of the drive unit chassis, operates from the 115 V a.c. (*para. 51*) and protected by a 250 mA fuse 18FS1 on the module.

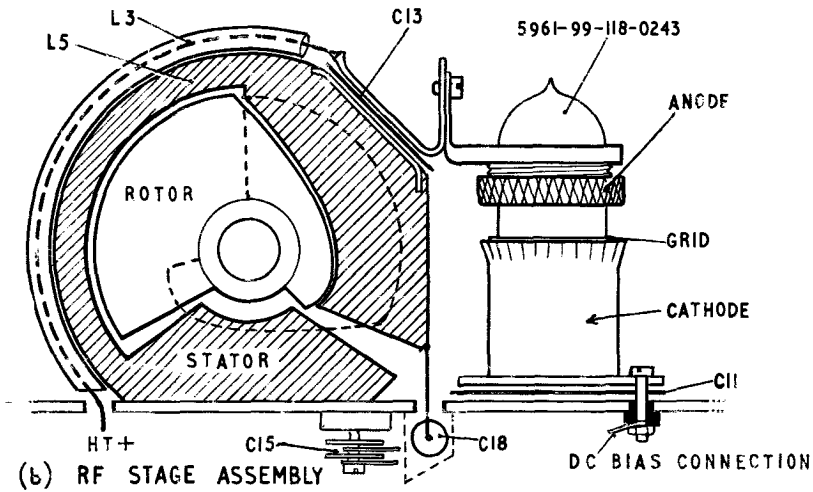
63. The module comprises a thermistor resistance bridge feeding an operational amplifier, the output of which operates the gate of a thyristor. The resistance bridge comprises 18R2, 18R3, 18R4, 18R5, 18RV1 and 4TH1: 18RV1 functions as a temperature presetting control and 4TH1 is a negative temperature co-efficient sensing thermistor fitted inside the crystal oven. When the temperature is below the level preset by 18RV1, the bridge is unbalanced and a voltage fed to the differential input of the oper-

ational amplifier 18IC1. The output from the amplifier causes gate current to flow in thyristor 18CSR1 via 18R6 and 18ZD2. This in turn causes the thyristor to operate, applying 115 V to the heating element of the oven.

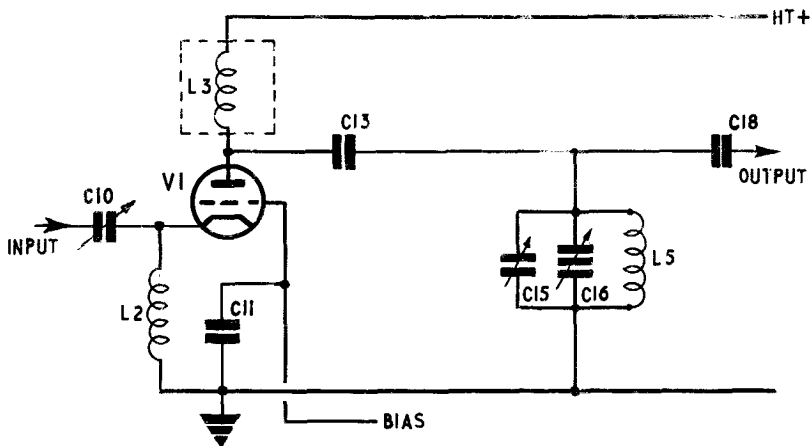
64. As the temperature increases, the resistance of the thermistor decreases, restoring the bridge to a balanced condition. The differential voltage applied to the operational amplifier falls to zero, causing the amplifier output to fall to below the breakdown voltage of 18ZD2 and thus the thyristor returns to its blocking condition. Because the amplifier output never falls completely to zero, ZD2 is included to prevent false switching of the thyristor. 18C2 and 18C3 stabilize the amplifier against h.f. oscillation due to stray coupling from output to input. 18D5 limits the differential voltage applied to the amplifier when the oven is cold.▶



(a) PLAN OF CHASSIS



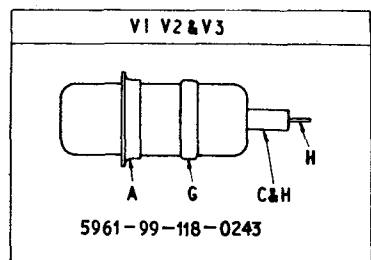
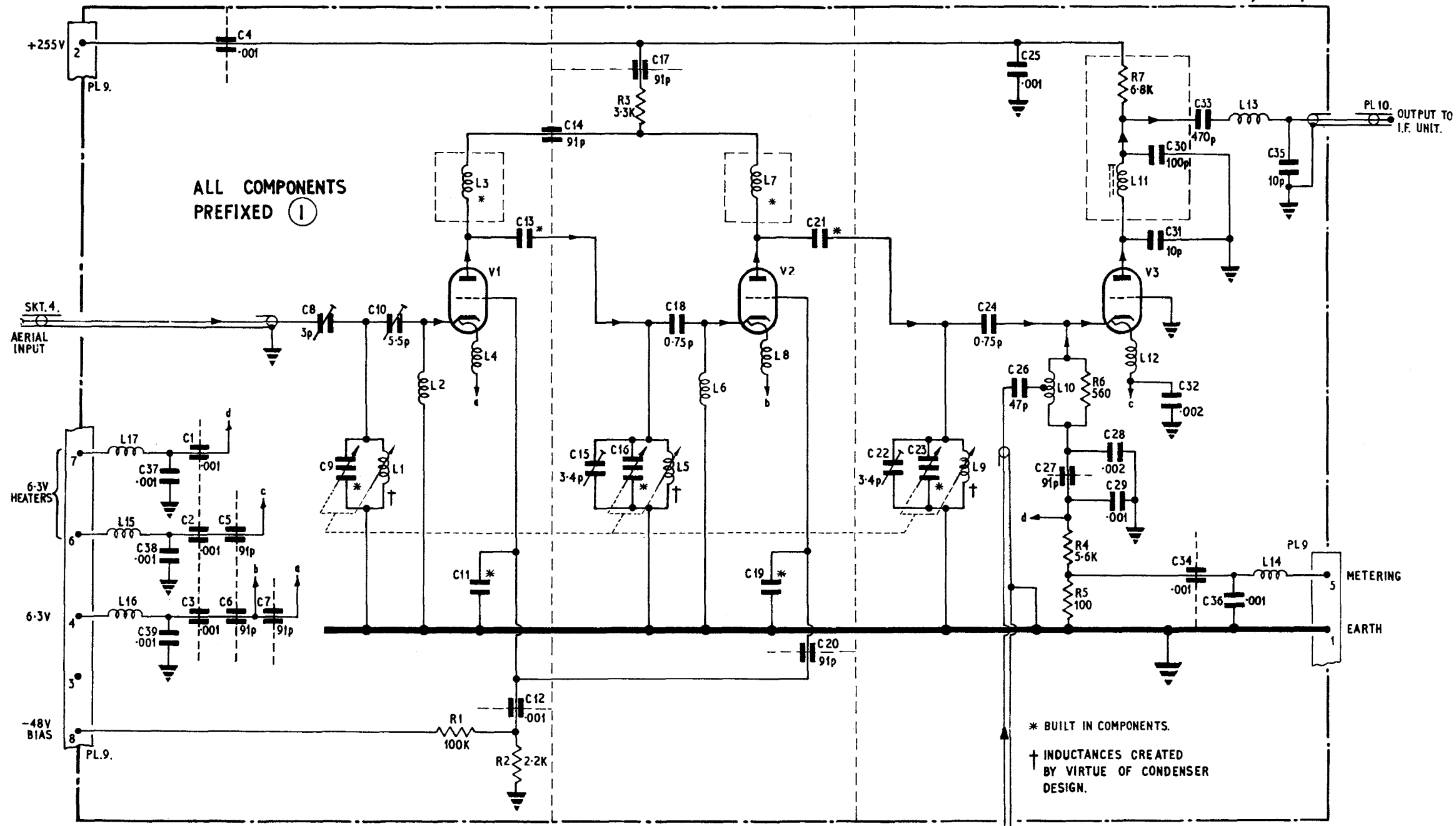
(b) RF STAGE ASSEMBLY



(c) CIRCUIT

Fig. 1. Amplifying unit (RF) Type 7111-construction

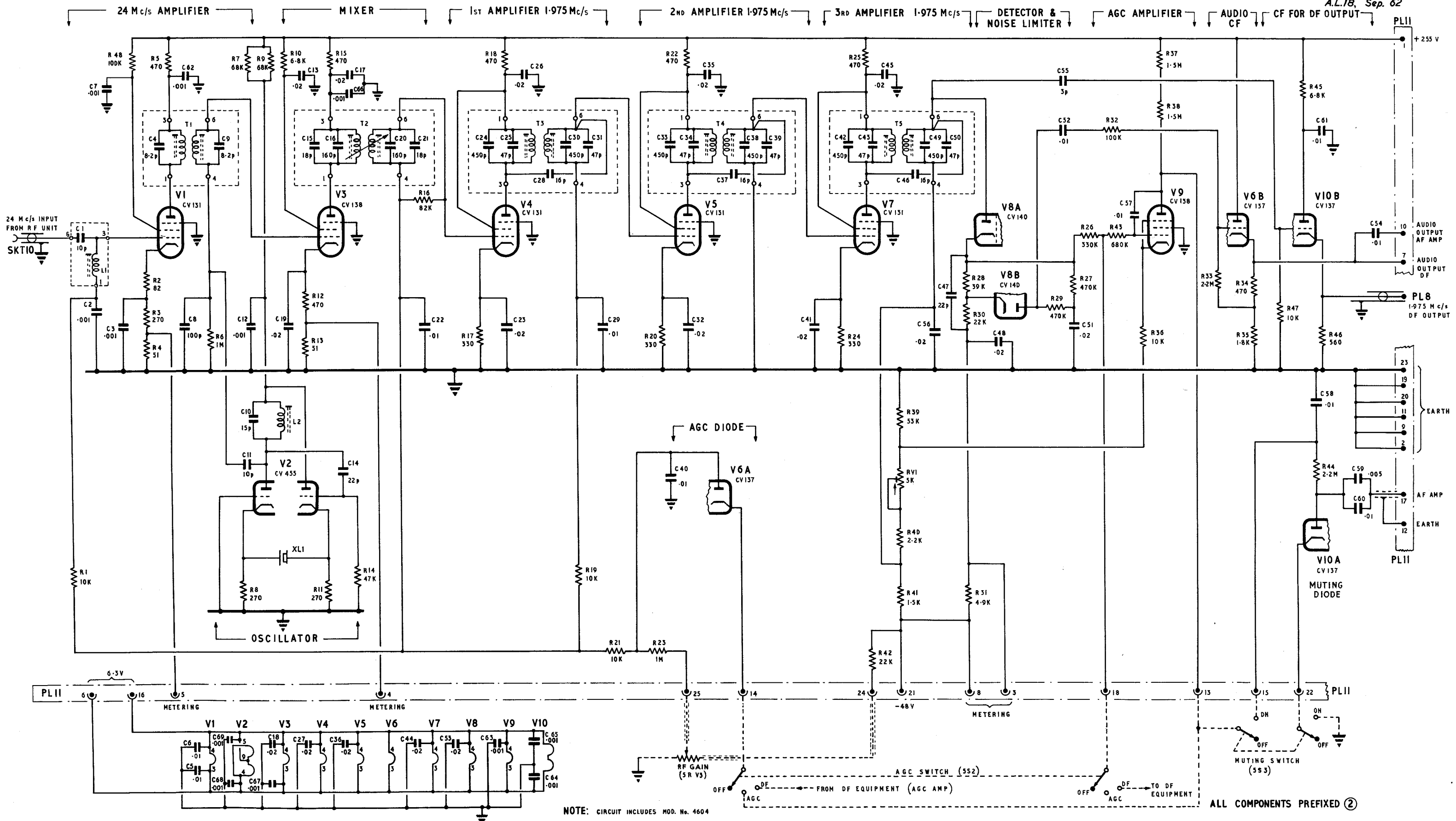
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Amplifying unit (RF) Type 7111 - circuit

Fig. 2



NOTE: CIRCUIT INCLUDES MOD. No. 4604

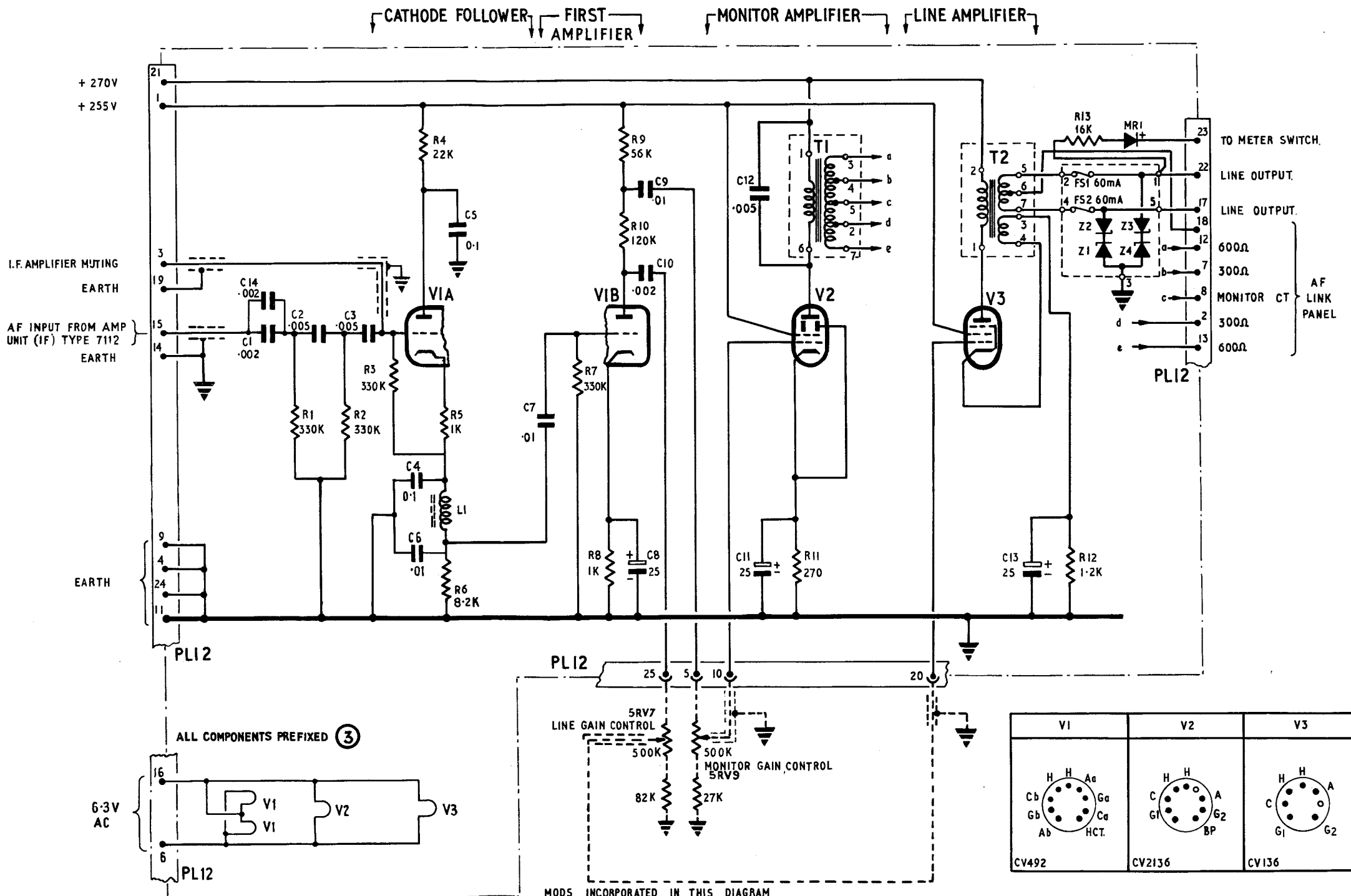
ALL COMPONENTS PREFIXED ②

Amplifying unit (IF) Type 7112 - circuit

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 D. 6862. Wt. 28701. 288688. 10/62.

Fig. 3



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116E-0730-MD7

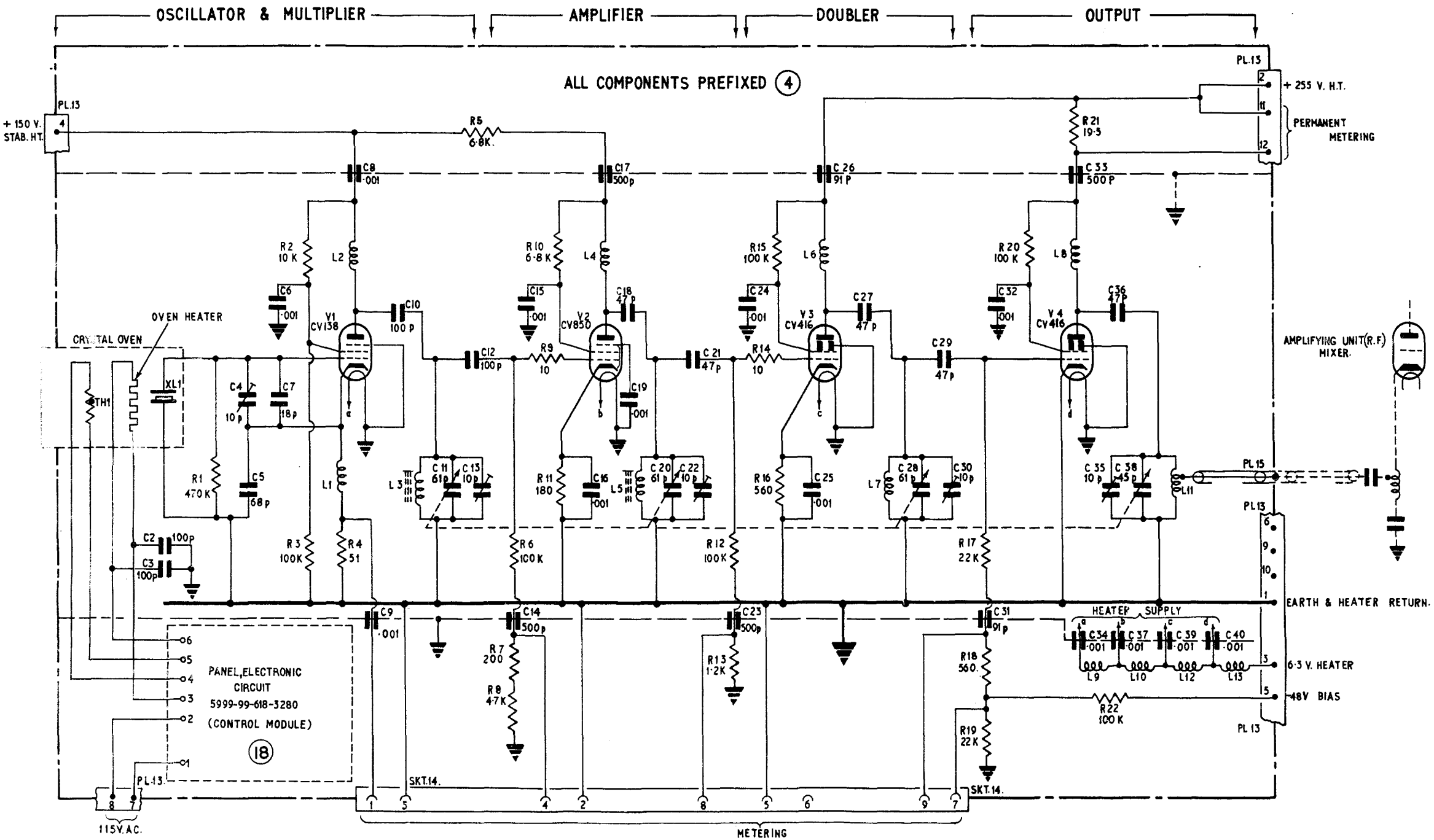
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ISSUE 5 Prepared by the Ministry of Technology

FORMERLY 6127B/MIN

Amplifying unit (AF) Type 7113 : circuit.

Fig. 4



MODS INCORPORATED IN THIS DIAGRAM

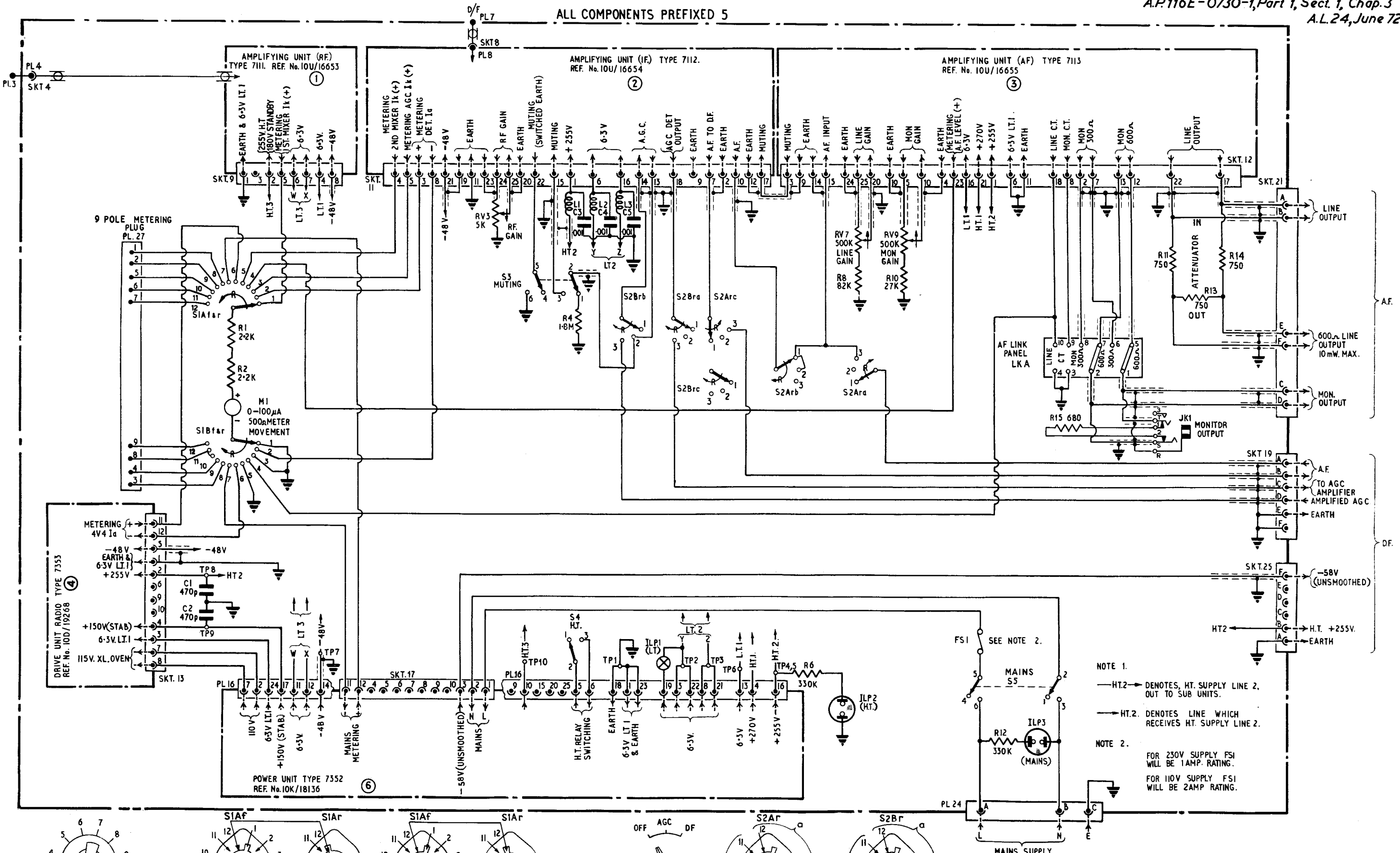
MOD. NO.	A2572	A3197
STRIKE OFF	4	5

AIR DIAGRAM MIN
116E-0730-MD4
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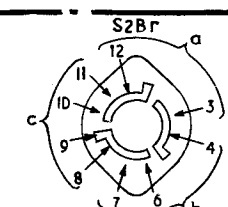
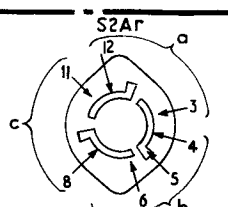
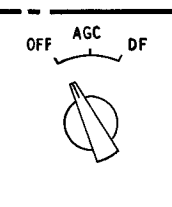
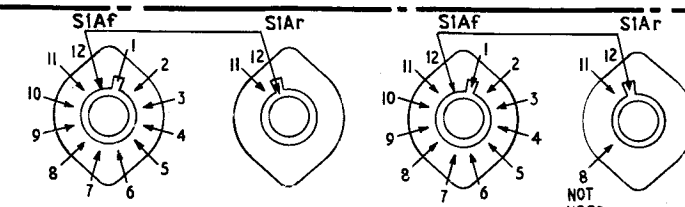
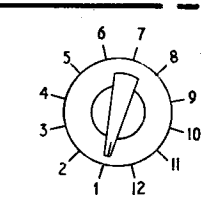
Drive unit radio Type 7353: circuit

Fig. 5

ALL COMPONENTS PREFIXED 5



- NOTE 1.
HT.2 → DENOTES, HT. SUPPLY LINE 2, OUT TO SUB UNITS.
HT.2. DENOTES LINE WHICH RECEIVES HT. SUPPLY LINE 2.
- NOTE 2.
FOR 230V SUPPLY FS1 WILL BE 1AMP. RATING.
FOR 110V SUPPLY FS1 WILL BE 2AMP. RATING.



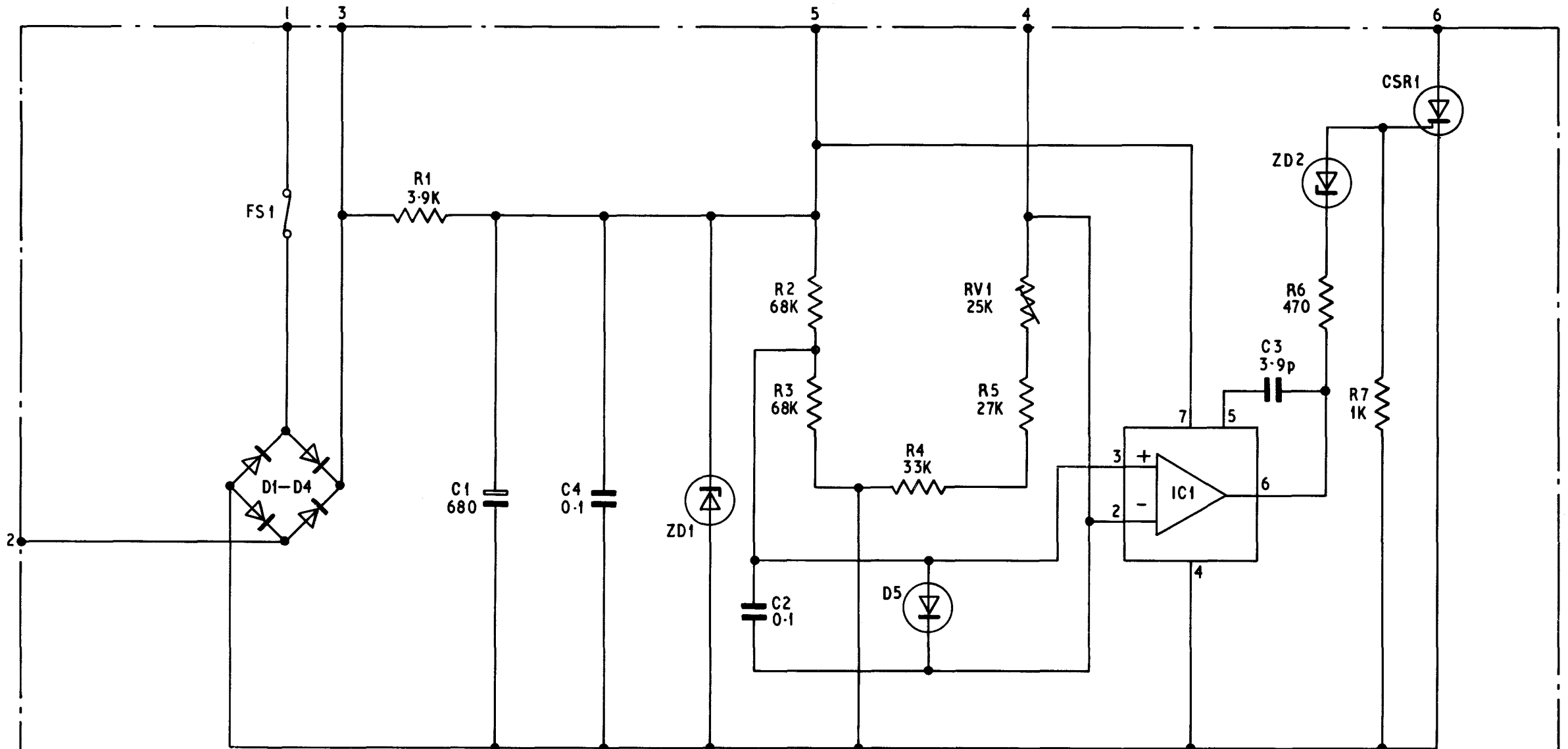
MODS. INCORPORATED IN THIS DIAGRAM

MOD NO.	4947	6970	A2981
STRIKE OFF	2	3	5

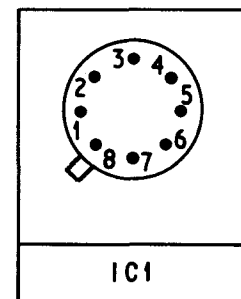
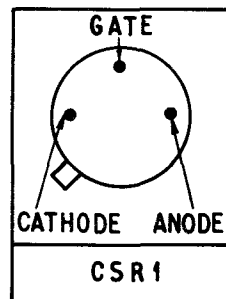
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Chassis assembly Type 7354 - circuit

Fig. 7



ALL COMPONENTS PREFIXED (18)



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Panel, electronic circuit 5999-99-618-3280 : circuit

Fig. 8

Chapter 4.—CONSTRUCTION

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General

1. The receiver Type R.7351 consists of the following items:—

- (1) Receiver unit Type 9096
- (2) Cover assembly
- (3) Cable assembly Type 9097

- (4) Front cover Type 1068
- (5) Two external connectors.

2. The receiver unit and the cable assembly fit inside the cover assembly; the front cover then fits over the front panel of the receiver unit and provides protection for it (fig. 1). The front cover

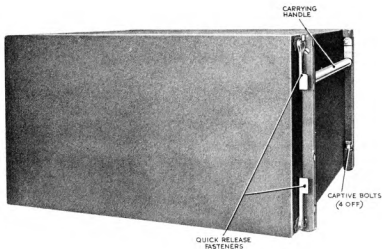


Fig. 1. R.7351 with front cover fitted

is held in place by four quick release fasteners. The external connectors are used for the mains input and audio output connections to the receiver.

3. The receiver unit Type 9096 is held in the cover assembly by the locks of the side runners. These locks may be released by turning the handles (fig. 2) on the front panel outwards; the receiver unit can then be pulled forward on its runners. Four latches are also fitted as an additional fastening (para. 6 and 7).

WARNING . . .

Unless the cover assembly is securely bolted down, the weight of the receiver unit when it is pulled forward on the runners will cause the equipment to fall forwards.

COVER ASSEMBLY

4. The cover assembly (fig. 3) is an open-fronted steel case with two telescopic runners inside. The receiver unit fits on to these runners, it will then slide in and out of the cover assembly as required. The cover assembly, which measures 23½ in. wide by 24½ in. deep by 13½ in. high and (with runners fitted) weighs approximately 51 lb, is common to all major units of the u.h.f. ground equipment with the exception of the air blower Type 7344.

5. Since it is normal practice to mount up to five cover assemblies in one vertical stack of equipment, each must be capable of supporting four further cover assemblies with their units fitted. This is possible since each cover assembly is fitted with four external vertical bars each with captive bolts. The bars of each equipment abut on those of the upper and lower equipments, and with the

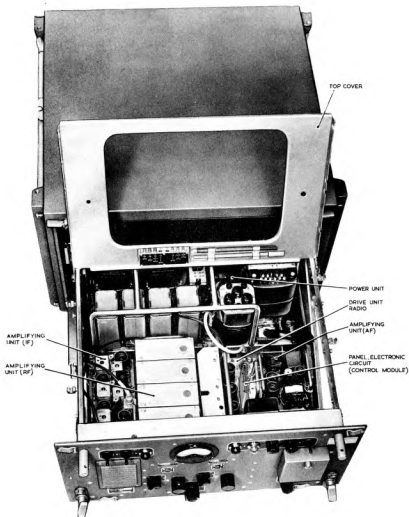


Fig. 2. R.7351 in open position

captive bolts tightened, a robust and stable stack of equipment is formed. A complete stack should be mounted on a plinth Type 7872 which in turn must be bolted to the floor.

6. At each corner of the front frame of the cover assembly is fitted a latch which, with the receiver unit fitted in the cover assembly, engages with a plate on the receiver unit front panel to form a locking device. The latches of the earlier production equipments were spring loaded in the fore-aft direction; it was found, however, that this allowed the unit a degree of "float" inside the cover assembly which in transit could cause damage. Latches of an improved design were fitted to later production equipments. These latches could be tightened by screwing up the hexagon-shaped head of the swivel bolt. For normal use, these should be slackened sufficiently to enable the latches to be operated by normal finger pressure.

7. The rear of the cover assembly has an aperture which receives a recessed panel forming part of the cable assembly (para. 15). Tapped holes are provided on the inside left hand wall of the mains indicator lamp and gate switch bracket, which also forms part of the cable assembly.

8. Carrying handles are fitted between the vertical bars at either side of the cover assembly. A cover front Type 1068, which is provided for use during transit or storage, may be fitted to the cover

assembly by four quick release fasteners. The front covers, which are made of steel, measure 21½ in. by 13 in. by 2 in. deep; when not in use they may be stacked with other front covers and placed on the top of the completed stack of equipments.

Runners

9. The telescopic side runners (fig. 4) permit the receiver unit to be withdrawn to its full length from the cover assembly (para. 4). Each runner comprises three main members; the inner and outer members have small wheels fitted, while the centre member has channels in which the wheels run. The outer members of the mechanism are bolted to the inside of the cover assembly, and the receiver unit fastens to the inner members by four captive bolts which pass through the front panel of the receiver unit.

10. The holes for the bolts which hold the runners in the cover assembly are elongated, this allows a fore and aft adjustment of the mechanism to obtain a good fit for the receiver unit into the cover assembly. This adjustment is a coarse one and is set when the equipment leaves the manufacturer; a fine adjustment is provided at the ends of each runner (para. 14).

11. Mounted on each of the inner runners is a spring-loaded rod which controls a locking device. At the forward end of the rod is an eccentric pin which engages with a steel-lined groove in the rear

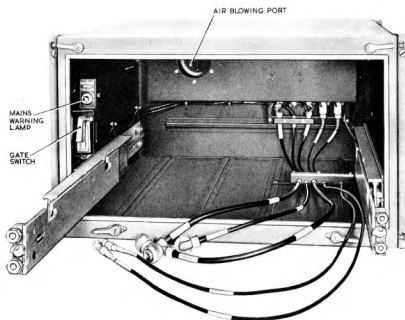


Fig. 3. Cover assembly with cable assembly fitted

of the locking handle (in the receiver unit front panel) so that angular rotation of the handle performs the locking and unlocking operations. The handle is turned outwards through 90 degrees to free the unit; releasing the handle results in the unit being held in the closed, half way, or fully open positions as required.

12. The two bolts which lock the receiver unit to the runners, at each side, pass through the front panel and locate in tapped bushes which are screwed to a projecting block at the end of the runner assembly. External threads on these bushes support hexagon adjusting nuts which may be positioned along the bushes to adjust the position of the front panel, relative to the cabinet, when the unit is pushed home. In this way, the front panel may be closely fitted to the sealing strip around the cabinet thus providing a moisture-proof seal at the panel edge.

Removing and refitting the receiver unit

13. To remove the receiver unit completely from the cover assembly, release the four bolts, two by each handle, and allow the receiver unit to slide forward to the extent of the slots in the runners (fig. 4). This additional movement allows access for the hand to remove the Mk. 4 plugs at the rear of the receiver unit. Remove also the coaxial aerial and DF plugs from the sockets on the frame of the chassis assembly and the cables from the clip at the rear of the chassis assembly. The receiver unit can then be lifted complete from the cover assembly.

14. When refitting a receiver unit to a cover assembly it may be found necessary to readjust the runner adjusting nuts and also the striker bolt which actuates the gate switch. Details of these adjustments are given in the Servicing Chapter (Part 2, Sect. 1, Chap. 2).

Cable assembly Type 9097

15. The cable assembly Type 9097 (fig. 5) fits inside the cover assembly (fig. 3). The cable assembly is mounted on the rear panel of the cover assembly, and carries the fixed plugs and sockets, the air blowing port, the cables, the gate switch and the neon warning lamp. A rear view of the cover assembly and circuit of the cable assembly is given in Part 1, Sect. 1, Chap. 5 of this publication.

16. The gate switch, part of the cable assembly, removes the a.c. supply from the receiver unit when the receiver unit is pulled forward on its runners; the switch is operated by an adjustable striker bolt on the chassis assembly. The gate switch may be locked to the "on" position with the receiver unit out of the cabinet by pressing the spring-loaded knob at the top right hand side of the switch (fig. 3) whilst holding the switch in the 'on' position. If the striker bolt is correctly adjusted the lock will automatically release when the receiver unit is again fitted into the cover assembly.

17. A number of accessories, nuts, bolts, etc., are required when fitting a cable assembly to a cover assembly; these accessories are contained in a small bag which is supplied with the cable assembly (fig. 5). Among the accessories are the components of the clamp which will hold the cables to the bottom of the cover assembly (fig. 3). When fitting, it is important to ensure that the cables are clamped at the rubber sleeves and the word TOP, which is printed on the sleeve, is uppermost. These sleeves have been carefully positioned on the cables to ensure that the length of each cable and the orientation of the free plugs or sockets is such that when these plugs and sockets are correctly fitted to the sockets and plugs of the chassis assembly the cables will not be damaged by the movement, in and out, of the receiver unit on the runners.

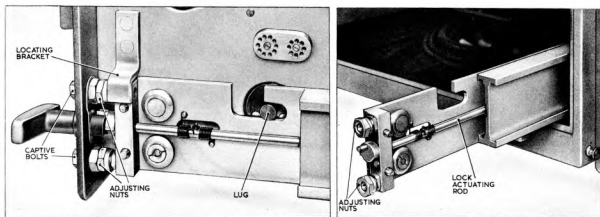


Fig. 4. Side runner of cover assembly

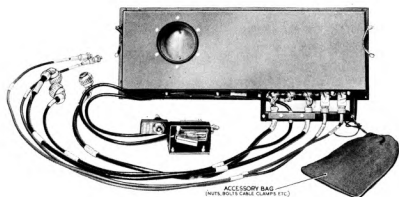


Fig. 5. Cable assembly Type 9097

RECEIVER UNIT TYPE 9096

18. The receiver unit is of sub-unit construction; the sub-units are :—

- (1) Chassis assembly Type 7354.
- (2) Amplifying unit (RF) Type 7111.
- (3) Amplifying unit (IF) Type 7112.
- (4) Amplifying unit (AF) Type 7113.
- (6) Panel, electronic circuit 5999-99-618-3280.
- (7) Power unit Type 7352.

Chassis assembly Type 7354

19. The chassis assembly (fig. 6 and 7) forms a mounting for the other sub-units of the receiver unit. It also carries the electrical connections between the sub-units except certain direct coaxial connections.

20. The chassis assembly has a hinged top cover (fig. 2) which must be lifted in order to remove any sub-unit. The cover may be completely removed by removing the hinging screws at the rear. This top cover plays an important part in strengthening the equipment and should always be refitted, and the screws tightened, when servicing is completed. A number of spare fuses and three adjusting tools are held in clips inside the cover.

21. The sub-units may be removed from the chassis assembly after releasing the green-ringed screws associated with each sub-unit. Care should be taken, when removing the amplifying unit (RF) Type 7111 and the drive unit radio Type 7353 from the chassis assembly, to ensure that the tuning drive is undamaged where it couples to the slow motion drive. The two tuning controls should first be set so that the forked portion of the drive (fig. 8 and 15) is pointing downwards, the sub-unit can then be lifted out of the chassis assembly without damaging the drive. When fitting either of these two sub-units set the front panel tuning

control so that the coupling pin is at its lowest point and set the fork of the tuning drive so that it is pointing downwards. Lower the sub-unit slowly on to the chassis assembly and ensure that the fork engages with the pin of the tuning drive.

22. The chassis assembly is constructed from cadmium-plated steel with a base, two side frames and a rear panel. The base is stencilled to identify the locations of the various sub-units and is fitted with rivetted anchor nuts to receive the fixing screws of these sub-units.

23. The front panel of the receiver, which is part of the chassis assembly, is bolted to the base and side frames. On the front panel are mounted the receiver controls, indicator lamps, meter, etc. The RF GAIN, LINE GAIN, controls and the OFF-AGC-DF switch are shielded by a hinged cover which locks by a single knurled screw. A list of meter readings associated with the built-in metering system is rivetted to the inside of the cover. Projecting pillars, in conjunction with the locking handles, prevent damage to the front panel components when the panel is placed face downwards on the test bench.

24. The top side of the chassis assembly Type 7354 is shown with all sub-units removed in fig. 6. The plugs and sockets on the chassis assembly which mate with the sockets and plugs respectively on the various sub-units are spring-loaded to prevent damage to the pins due to misalignment when fitting a sub-unit into the chassis assembly.

25. On the underside of the chassis assembly (fig. 7) is mounted the a.f. output link panel (SLKA). By means of the soldered links on this link panel, the output impedance of the monitor

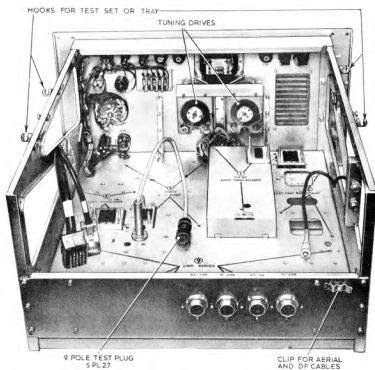


Fig. 6. Chassis assembly Type 7354 — top view



Fig. 7. Chassis assembly Type 7354 — underside view

amplifier may be set to 300-ohm or 600-ohm and the transformer centre-tap of both the line and monitor amplifiers may be earthed.

26. Also mounted on the underside of the chassis assembly are the resistors R11, R13 and R14 which form the attenuator network for the attenuated line output of the receiver. The inductances L1, L2 and L3 and the capacitors C3, C4 and C5 are connected in the power supplies to the amplifying unit (IF) Type 7112.

27. Access is provided, through a hole in the chassis assembly (*fig. 7*) to the inductance L11 of the amplifying unit (RF) Type 7111.

28. Fitted to both sides, on the framework of the chassis assembly, are hooks by which the test set Type 7618 and/or a tray may be hung. The test set Type 7618 and the tray are described in Part 2, Sect. 1, Chap. 1.

Amplifying unit (RF) Type 7111

29. A general view of the r.f. amplifying unit is given in *fig. 8*. This unit has four detachable covers fitted, three of these protect the butterfly tuning assemblies; these three covers have swivelling patch plates to permit insertion of a tuning wand during alignment procedure. The whole unit is finished in silver plating. Three green-ringed screws on the chassis hold the unit to the chassis assembly.

WARNING . . .

Care should be taken when handling the amplifying unit (RF) Type 7111 to ensure that the wiring of the unit and the settings of the stator and rotor plates is not disturbed. It

should also be noted that removal of the covers over the butterfly tuning assemblies will entail re-alignment of the circuits.

30. The amplifying unit (RF) Type 7111 (*fig. 9*) contains three valves, all type CV354 disc sealed triodes, which are operating in "grounded grid" r.f. amplifying circuits. These valves are specially constructed for operation at u.h.f.; the internal capacitances, electron transit time and noise factor have all been reduced to a minimum. The external contacts to the electrodes of the valve are made over a wide area in order to reduce the self-inductance of the leads.

31. The valve holders (*fig. 1 of Chap. 3*) are in three main portions; at the base are the heater and cathode connections, around the valve is a tube carrying the grid contact, while the anode connection is made by means of a screwed clamp. The grid connection is at r.f. earth potential due to the capacitance existing between the base plate and the chassis, a d.c. connection is made for the bias supply to the valve. The anode connection is capacitively coupled to the tuned circuit, the capacity being formed by the support plates separated by a mica sheet, and d.c. coupled by a wire, which passes through the tube attached to the butterfly assembly, to the h.t. positive potential. At these frequencies the wire behaves as an r.f. choke.

32. The method to be adopted for changing the valves and the precautions necessary are given in Volume 6 of this publication.

33. The r.f. tuned circuits (*fig. 1(a), Chap. 3*) of this unit are of the semi-butterfly type. These circuits have integral inductance and capacitance

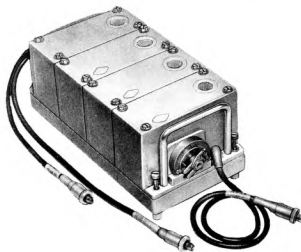


Fig. 8. Amplifying unit (RF) Type 7111 — general view

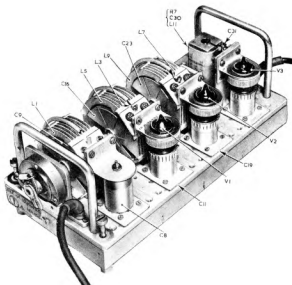


Fig. 9. Amplifying unit (RF) Type 7111 — top covers removed

which vary together, their main advantage being the wide frequency range which this type of circuit covers whilst maintaining a high L/C ratio. The spindle coupling the rotors is of ceramic material which is liable to fracture if subjected to a sudden shock and, since the alignment of the r.f. tuned circuits (which is very critical) is effected by bending the rotor plates, extreme care should be exercised when handling the r.f. unit.

34. The underside of the r.f. amplifying unit is shown with its screening cover removed in fig. 11. The chassis cross-members add to the rigidity of the structure as well as providing screened compartments for the different stages. The coupling capacitors C18 and C24 are separately screened by covers which are fastened by 6 B.A. screws to the longitudinal cross member. It is important that these covers make a good electrical contact with the chassis base, otherwise the amplifier may

be unstable. The unit contains a number of ceramic feed-through type decoupling capacitors which are liable to fracture if the unit is not handled with care.

Amplifying unit (IF) Type 7112

35. The IF amplifying unit chassis is illustrated in fig. 11 and 12. The chassis contains the valves, transformers, etc., associated with the i.f. stages, together with the a.g.c. delay setting potentiometer 2RVI. Apertures in the tops of the screening cans allow insertion of the trimming tool, when aligning the i.f. stages. Tubes, with bayonet-end fittings, are soldered to the chassis and accommodate the various decoupling and bypass capacitors. A plug-mounting crystal XL1 controls the frequency of the receiver second local oscillator.

36. The chassis is folded from cadmium-plated

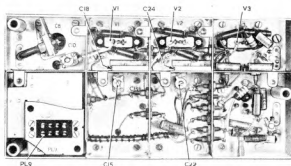


Fig. 10. Amplifying unit (RF) Type 7111 underside view — cover removed

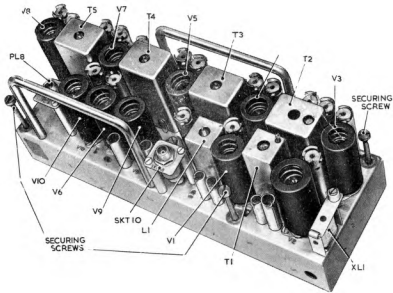


Fig. 11. Amplifying unit (IF) Type 7112 — general view

steel and contains fibre-glass tag panels (fig. 12) which support the various components. A multi-pole plug 2PL11 is mounted on a bracket in the corner of the chassis and completes the electrical connections to the main chassis assembly. Four green-painted captive screws are used to fit the unit in position.

Amplifying unit (AF) Type 7113

37. The (AF) amplifying unit (fig. 13 and 14) is a square-shaped chassis with the valves and transformers of the a.f. amplifier circuit mounted on the top side. The underside contains fibre-glass tag panels on which are mounted the smaller com-

ponents. Connections to the main chassis assembly circuits are made via a multi-pole plug assembly (3PL12).

38. The chassis is constructed of cadmium-plated steel and is fitted with lifting handles, which also protect the components when the chassis is inverted on the test bench. Four green-ringed captive screws secure the unit when in position on the main chassis assembly.

Drive unit radio Type 7353

39. The drive unit radio Type 7353 (fig. 15) is

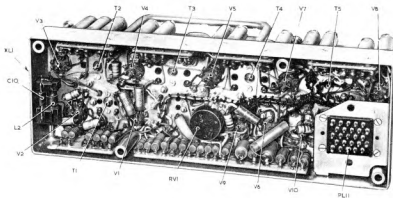


Fig. 12. Amplifying unit (IF) Type 7112 — underside view

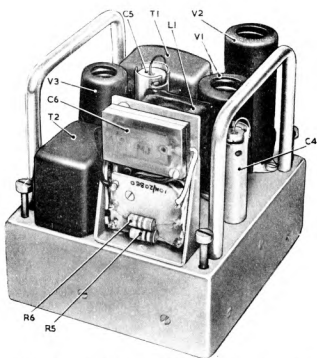


Fig. 13. Amplifying unit (AF) Type 7113 — general view

the "local oscillator" of the receiver. The tuning capacitors are mounted along one side of the top of the unit; a metal cover fits over them and acts as an electro-static screen. Two crystals may be fitted into the crystal oven which is shown open in fig. 17. One crystal is WORKING and the other (SPARE) is kept at operating temperature ready for any subsequent frequency change. The crystals are held in place by a phosphor bronze clip; the inner aluminium cover of the oven has the heater winding wound around it; the electrical connections

are made by a two-pole plug on one side of the cover. The outer cover, which is made of durestos and cork, acts as a heat insulator. The covers are held in place by a clip which is tightened in position by a knurled screw.

40. The special orange-coloured 9-pole test socket (4SKT14) is fitted to the drive unit (fig. 16). By plugging into this socket the test plug (5PL27) a

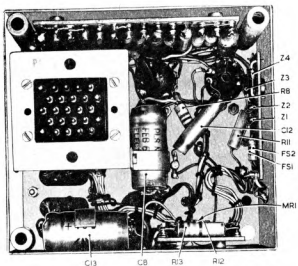


Fig. 14. Amplifying unit (AF) Type 7113 — underside view

number of voltage and current readings may be taken using the meter and METER SWITCH on the front panel of the receiver.

◀41. The panel, electronic circuit (*para.* 43) is secured by three 6 BA cheesehead screws and washers to a vertical bracket on the top of the drive unit chassis (*fig.* 16). Before removing the panel, the wiring connections must be unsoldered from the six panel terminations.▶

42. A view of the underside of the drive unit is given in *fig.* 17. The chassis of this unit is rather deep, but the walls, which are held in place by 6 B.A. screws, may be completely removed to allow access to the components under the chassis.

◀ Panel, electronic circuit

43. The panel, electronic circuit, 5999-99-618-3280 (control module), which controls the temperature within the crystal oven on the drive unit radio Type 7353, comprises a printed circuit board on which a resistance bridge, amplifier and thyristor circuit are mounted (*fig.* 18). This panel is fitted on the top of the drive unit chassis (*para.* 41).▶

Power unit Type 7352

44. The power unit Type 7352 (*fig.* 19) operates from the a.c. mains and provides all h.t., l.t., bias and relay voltages for the receiver. The valves, rectifiers, transformers, chokes and large capacitors are mounted on the top of the chassis and the smaller components underneath.

45. The mains tapping panel is on the top side of the power unit; the appropriate taps may be selected by positioning two plugs; a wire clip holds the plugs in position.

46. A fuse panel is mounted on the top of the inductor (6L2). These fuses are in the l.t., h.t., and negative 48V supply to the receiver. An orange-coloured 9-pole test socket (6SKT18) is provided for the same purpose as in the drive unit (*para.* 40).

47. The underside of the power unit is shown in *fig.* 20. A number of components are mounted on the inside of a hinged flap which may be opened after releasing seven green-ringed screws.

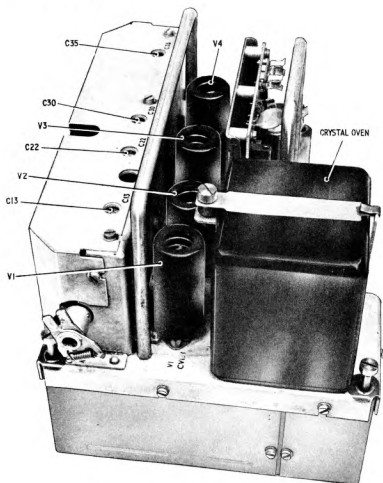


Fig. 15. Drive unit radio Type 7353—general view

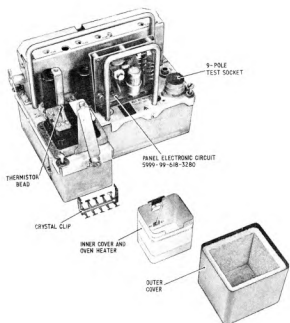


Fig. 16. Drive unit radio Type 7353—crystal oven

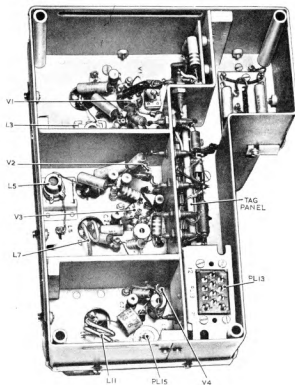


Fig. 17. Drive unit radio Type 7353—underside view

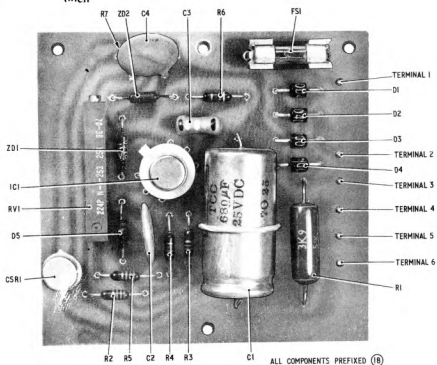


Fig. 18. Panel, electronic circuit 5999-99-618-3280

Chapter 5

INSTALLATION

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GENERAL

1. The receiver Type R.7351 may be installed singly or with a number of other u.h.f. receivers Type R.7351 or Type R.7109. Although a single receiver may be operated while mounted on a table or bench, it is recommended that where two or more receivers are to be operated they should be installed as detailed in para. 3. With either method

of mounting, the receivers should be securely bolted down to prevent them falling forward when withdrawn from the cover assembly.

2. Two connectors are supplied with receiver Type R.7351. One of these connectors is for the a.c. mains input and the other is for the audio output of the receiver. Further details of the connectors are given in Table 1.

TABLE 1
Connector details

Connector Type	Ref. No.	Pole	Core	Function
B4/50F/R7	10HG/89	A	Red	AC line
		B	Blue	AC neutral
		C	Green	Earth
B23/40F/R2	10HG/101	A	Red	600-ohm line
		B	Blue	
		C	Black	300/600-ohm monitor
		D	Green	
		E	White	600-ohm line (attenuated)
		F	Yellow	

3. The cover assembly of the ground u.h.t. equipments has been specially designed so that the equipments may be mounted one upon the other. The equipments may be bolted together using the captive bolts at the sides, and the complete stack should be mounted on, and bolted to, a mounting plinth Type 7872 (*para.* 5).

4. When choosing the position in a building for installing a stack, or a number of stacks of receivers, it is necessary to take into account the safe weight that the floor of the building will support. The weights of the items involved are as follows:—

Receiver Type R.7351	130 lb.
Receiver Type R.7109	160 lb.
Mounting plinth Type 7872	40 lb.
Blower, air, Type 7344	110 lb.
12-24 channel remote control	170 lb.

The weights given include the cover assemblies but exclude the connectors.

Mounting plinth Type 7872

5. The mounting plinth Type 7872 (Ref. No. 10AJ/250) is illustrated in fig. 1. The mounting plinth should be securely bolted to the floor using

$\frac{1}{2}$ in. diameter rag bolts or similar; the dimensions of the fixing centres is given in fig. 2. A spirit level should be used to ensure that the stack will stand vertical on the mounting plinth; suitable packing pieces may be fitted over the bolts so that the mounting plinth is levelled.

6. The mounting plinth contains a number of terminals and fuses which are accessible through the door at the front of the mounting plinth (*fig.* 1). The enclosed terminals on the extreme left-hand side are for the a.c. mains input. These terminals are connected via one of the two fuses to the mains output terminals; six mains outputs may be taken from each mounting plinth. The second fuse is carried as a spare. The soldering tags in the mounting plinth are for the audio connections to the receivers in the stack.

7. The number of receivers in each stack is limited to four by the number of audio soldering tags in the mounting plinth. The two additional mains outputs may be used for the blower, air, Type 7344 (*para.* 8) and for the remote control equipment where these are required. The remote control equipment is described in A.P.116M-0501-1 and is only required by the multi-channel receiver R.7109.

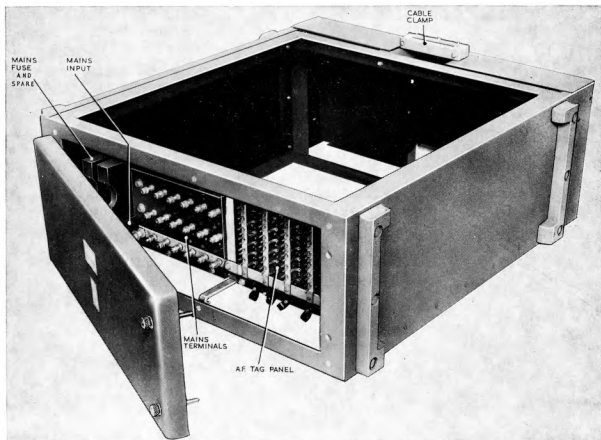


Fig. 1. Mounting plinth Type 7872—general view

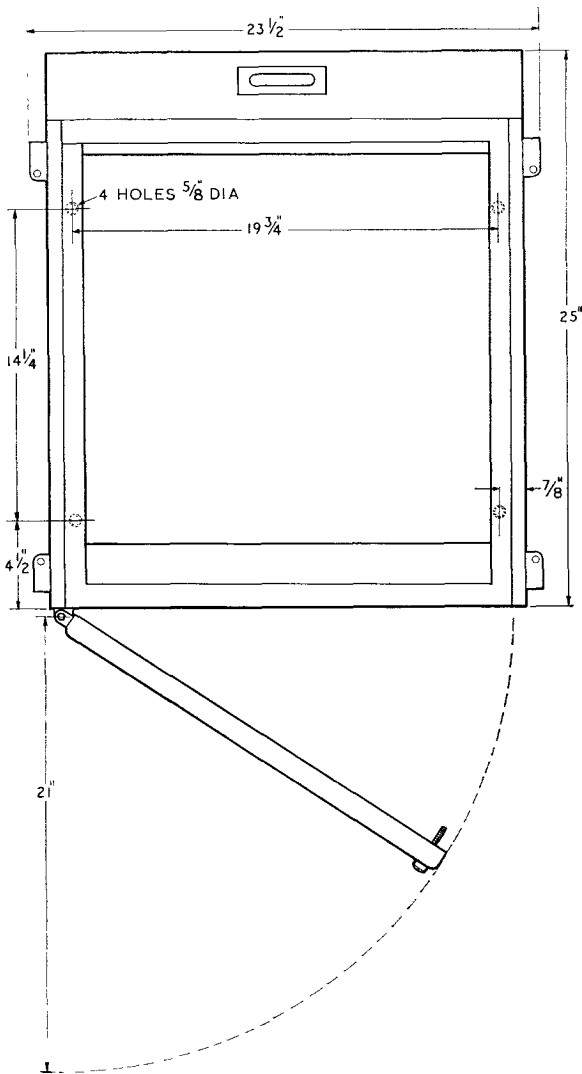


Fig. 2. Mounting plinth fixing centres

Cooling

◀8. The receiver Type R.7351 is capable of operation in ambient temperatures up to +10°C (50°F) without forced air cooling. When it is required to operate the receiver in temperatures exceeding +10°C, cooling must be provided from an external blower, air, Type 7344.

9. The blower, air, Type 7344 has its own cover assembly which incorporates four captive bolts for mounting it on top of the stack of equipment. The cooling air flow from the blower is routed via a pipe to a port on the rear of the cover assembly of the receiver Type R.7351 (fig. 4). In order to ensure adequate cooling of the stack, there are certain accessories which must be employed. Descriptions of the blower and accessories, together with installation details, are given in Part 1, Sect. 2, Chap. 2. ▶

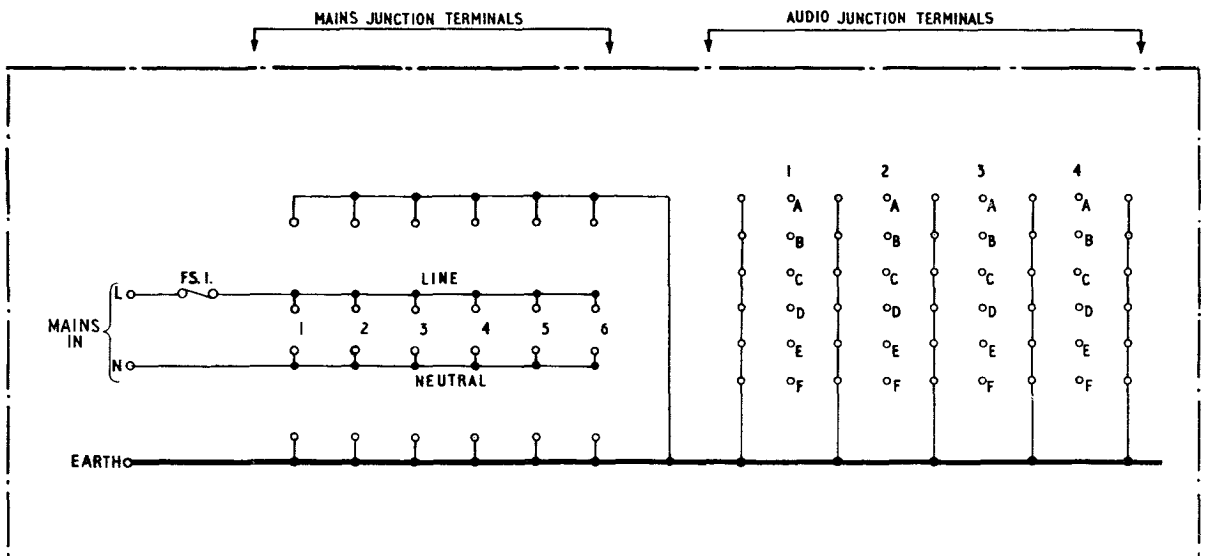
Power supplies

10. The power consumption of the single channel receiver Type R.7351 is 160 watts and of the multi-channel receiver Type R.7109 is 250 watts. The blower, air, Type 7344 (para. 8) requires 150 watts and the remote control equipment approx. 100 watts. For each normal stack of any combination of receivers with a blower, all operating from the nominal 230-volt a.c. supply, one 15-amp power point will suffice.

11. It is recommended that a second power point of 5-amp rating be available close to the u.h.f. equipment for such ancillary equipment as soldering irons, air blowers (for cleaning) and test equipment.

Aerials

12. A description of the aerials and feeders to be used with the u.h.f. receivers is given in Part 1,



NOTE CIRCUIT INCLUDE MOD.No. 4953

Fig. 3. Mounting plinth Type 7872 — circuit

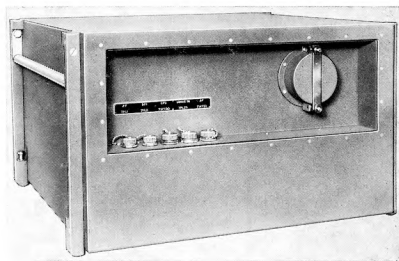


Fig. 4. Cover assembly — rear view

Sect. 2, Chap. 1 of this publication. Uniradio 74 cable should be used from the aerial to an aerial plug board mounted close to the stack. Uniradio 67 should be used from the plug board to the receiver; the length of this cable should be kept to a minimum.

13. The aerial plug board is essential in all installations since the noise generator, which is used for testing the receiver, makes connections at this point. The aerial plug board should be mounted no more than 6 ft. from the front panel of the receiver since one of the two leads of the noise generator connects to the aerial input lead and the other to the telephone output socket of the receiver.

14. The types of plugs and sockets to be used

on the uniradio 74 and 67 cable are given in Part 1, Sect. 2, Chap. 1 of this publication.

PRELIMINARY SETTINGS

15. Before making any connections to the receiver it is advisable to give the equipment a cursory inspection to ensure that all sub-units are undamaged, and that they are correctly fitted. Ensure that all material used for packing is removed and that all inter-unit connections are made; the nine-pole test plug should be fitted to the socket on the power unit.

16. Should it be found necessary, the receiver unit Type 9096 may be removed completely from the cover assembly. Details regarding the removal and refitting the receiver unit are given in Part 1, Sect. 1, Chap. 4 of this publication.

RECEIVER TYPE R. 7351

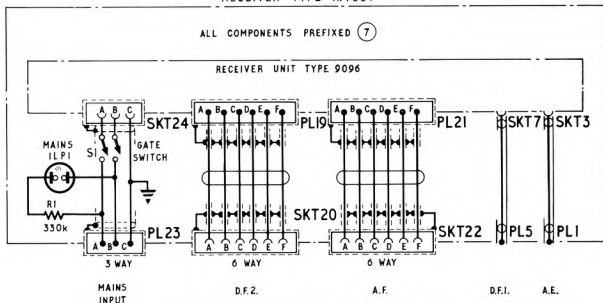


Fig. 5. Cable assembly Type 9097 — circuit

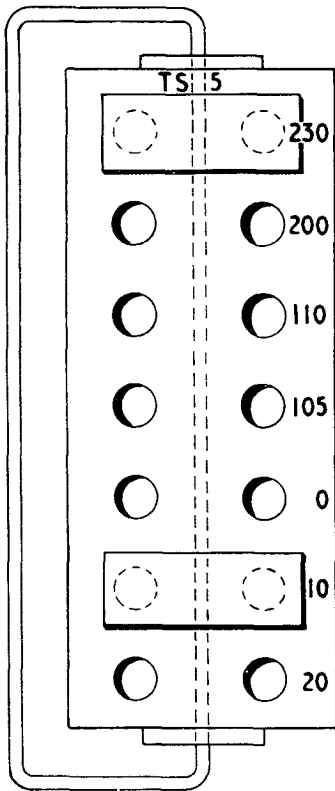


Fig. 6. Mains link panel (6LKA)

17. A cable assembly Type 9097 is fitted into the cover assembly; this cable assembly comprises part of the rear panel of the cover assembly and the plugs, sockets, connectors, gate switch and warning lamp which are all attached to it. A circuit diagram of the cable assembly is given in fig. 5.

18. The input voltage tapplings for the mains transformer should be set to correspond with the voltage of the a.c. supply. The mains tapping panel (6LKA) is located on the power unit Type 7352 at the rear of the receiver unit. This panel, which is illustrated in fig. 6, has two removable links: the links should be fitted to those sockets whose markings add up to the voltage of the supply. In the illustration the links are fitted for a supply of 240-volt. A wire clip fits over the two links to hold them in place.

19. Fuses for the power outputs are on a panel on the power unit while the MAIN input fuse is on the front panel of the receiver. Check all fuses for correct rating. The MAINS fuse should be 1A where the supply is between 200 and 250V and 2A between 105 and 130V.

19A Check that the safety fuses 3FS1, 3FS2 in the amplifying unit (A.F.) Type 7113 are rated at 60mA, denoted by a black spot on the body. ▶

20. Underneath the chassis assembly of the receiver is audio output link panel 5LKA (fig.7). By connecting tinned copper wire between tags the output of the

monitor amplifier can be set to match into 300 or 600-ohm. For a 300-ohm link 1 to 6 and 2 to 8; for a 600-ohm, link 1 to 5 and 2 to 7. ◀The centre tap of the line amplifier output can be earthed by a similar link soldered between tags 4 and 10 of the link panel; this centre tap is not normally required where the receiver is to feed into GPO lines. The centre tap of the monitor amplifier output must be permanently earthed by soldering a link between tags 3 and 9 of the link panel. ▶

CONNECTING UP

21. The mounting plinth should be bolted into position (*para.* 5) and the rear panel removed to provide access. Remove the fuses and fit wire having a fusing value of 15-amp, i.e. 30 s.w.g. tinned copper wire; do not refit the fuses at this stage. The mains and audio cables for the equipments which will form the stack should be passed through the cable clamp on the mounting plinth (*fig.* 1). The length of cable required outside the mounting plinth should be estimated and the spare cable coiled inside the plinth, do not tighten the cable clamp at this stage as it may be necessary to alter the lengths slightly.

22. Pass the open ends of the mains cables under the terminal panel and make connections to the mains terminals in the mounting plinth (*fig.* 1). The bottom row of terminals should be used for the earth core (*green*), the middle row for the neutral core (*blue*) and the top row for the line core (*red*).

23. Pass the audio cables under the tag panel and through the cleats. Strip sufficient of the outer coverings from the cables and connect the cores to the tags on the tag panel. The earth braiding on each of the cores should be soldered to the appropriate earth tag, i.e. the one adjacent. The braiding pigtail should be kept as short as possible to avoid the risk of the live audio tags being shorted to earth.

24. To ease servicing, and for the sake of uniformity, the cores of the audio connector should be

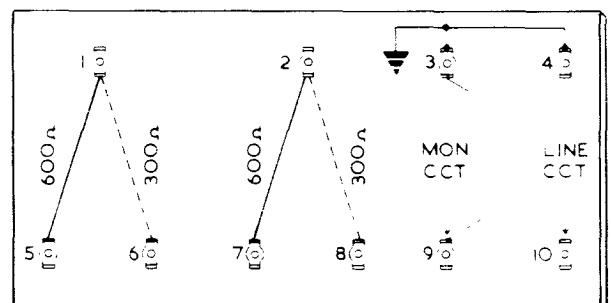


Fig. 7. AF output link panel (5LKA)

soldered to the tags having the same code letters as the poles of the plug at the other end of the connector; these are given in Table 1. Every core should be soldered to a tag even though it may not be required for use, since all cores are live.

25. Complete all connections for the equipments to be placed in the stack and make the external mains and audio connections for the equipment. If the audio output of a receiver is to feed into GPO lines, then the attenuated 600-ohm output (E and F) should be used. For local operation into a loud-speaker the monitor output (C and D) should be used. For feeding a large number of telephones the line output (A and B) should be used.

26. Make a connection from the extra earth terminal on the terminal panel to the combined earth system of the station; use heavy gauge copper wire. Fit the rear panel to the mounting plinth but do not tighten the screws at this stage.

STACKING THE EQUIPMENTS

27. It is to be recommended that each piece of equipment is individually tested either immediately before or as it is mounted in the stack, this will obviate the necessity of removing serviceable equipment in order to change an unserviceable piece. In climates where an external air blower is normally necessary, the testing time should be kept to a minimum.

28. A multi-channel receiver Type R.7109 together with its remote control equipment may be mounted in the same stack with single channel receivers Type R.7351. The remote control equipment should be mounted immediately beneath the receiver it is to control. The blower, air, Type 7344, where required, should be fitted at the top of a stack; details of the capabilities of the blower are given in Part 1, Sect. 2, Chap. 2 of this publication.

29. Mount the equipments on to the mounting plinth and bolt them securely together using the four captive bolts at the sides of the cover assemblies. Ensure that the MAINS switch on the front panel of the equipment is set to OFF and also that the mains input to the mounting plinth is off, then fit the mains and audio connectors to the rear of the equipments and the fuses to the mounting plinth.

30. After the mounting and stacking is completed, the cables at the rear of the stack should be grouped together at the left-hand side of the equipment viewed from the rear and laced with plastic cord. The length should be adjusted correctly and the cable clamp at the rear of the mounting plinth tightened. The screws holding the rear panel of the mounting plinth and the front door should also be tightened.

THE PRE-SET CONTROLS

31. Pull the receiver unit forward on its runners and ensure that the mains indicator lamp inside the cover assembly is illuminated. Set the gate

switch to "on" and lock it in position by pressing the small round knob on the side of the switch.

WARNING . . .

Care should be taken when operating the receiver while it is not locked within the cover assembly to ensure that personal contact is not made with any of the high voltage points on the chassis.

32. Ensure that the MAINS lamp on the front of the receiver is illuminated and set the MAINS switch to ON; the LT indicator lamp should become illuminated.

33. Set the METER SWITCH to position 7 (mains metering) and ensure that the meter reading is between 72 and 80. If the meter reading is outside these limits, switch off the MAINS switch immediately, check the settings of the transformerappings (*para.* 18) and, if necessary, the voltage of the supply.

34. Set the HT switch, on the front panel of the receiver, to ON. The power unit contains a h.t. delay circuit which is set in operation by the MAINS switch, the h.t. will not be present until the delay time has expired; the HT indicator lamp will only be illuminated when the h.t. is on.

35. Ensure that the nine-pole test plug is fitted to the power unit and set the METER SWITCH to position 9 (negative 48-volt); a meter reading of 48 should be obtained. If this reading is not obtained, locate and unlock the screwdriver control 6RV7 on the top of the power unit, and adjust it for a reading of 48 on the front panel meter. Lock the control.

36. Tune the receiver to a frequency about the middle of the range, i.e., 310 MHz instructions for tuning the receiver are given in Part 1, Sect. 1, Chap. 2 of this publication.

37. Obtain a strong signal input to the receiver, i.e., a signal sufficient to produce a dip of 20 divisions with the METER SWITCH in position 3. Set the METER SWITCH to position 2, a meter reading of 66 should be obtained. If this reading is not obtained, locate the screwdriver adjusted control 2RV1 on the amplifying unit (IF) Type 7112 and adjust it to obtain a meter reading of 66. Lock the control.

38. Tone modulate the incoming signal to a depth of 90 per cent and ensure that the receiver is feeding into its normal a.f. load. With the METER SWITCH at position 4 a meter reading of 40 should be obtained. If this reading is not obtained unlock the LINE GAIN control on the front panel of the receiver and adjust it to obtain a meter reading of 40. Lock the control.

39. Set up the receiver to the frequency on which it is required to operate.

◀ Metering

40. Having verified the correct overall functioning of the receiver, a full metering check should be implemented using the internal metering system of the receiver; all readings obtained should be recorded in order that comparison can be made with any subsequent readings when it is required to establish serviceability. A metering label is provided in the cover over the LINE GAIN, RF GAIN and

AGC-OFF-DF controls on the receiver front panel; this label has a blank column in which the readings obtained should be entered. It should be appreciated that certain readings will vary according to the frequency of the receiver; it is advisable to record the frequency in order that subsequent comparisons of readings can be made at the same frequency. Further details of metering are given in Part 2, Sect. 1, Chap. 2. ▶

SECTION 2

ANCILLARY EQUIPMENT

Chapter 1

AERIALS AND FEEDERS

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<i>Aerial installations</i>	6	<i>Mounting the aerial</i>	20
<i>Aerial plug board</i>	7	<i>Double mounting of aeriels</i>	25
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<i>Methods of mounting aerial on mast</i>	2	<i>Additional items to be manufactured for double aerial mounting</i>	7
<i>Aerial plug board</i>	3	<i>American and British ground u.h.f. aerial systems</i>	8
<i>Method of fitting socket 9116893 to uniradio 74</i>	4		
<i>Method of fitting Type C plugs and sockets to coaxial cable</i>	5		

Aerial unit design 41

1. The aerial unit design 41 (used in aerial Outfit AJE) (*fig. 1*) is a u.h.f. aerial suitable for either ship or shore installations. It covers the complete u.h.f. band, 225 Mc/s to 400 Mc/s, and may be used with either one receiver, one transmitter, one transmitter-receiver, or a number of transmitters or receivers grouped for a common aerial working system.

2. The main design features of the aerial are: operation over a wide frequency band, omnidirectional radiation in the horizontal plane, good impedance match into a coaxial line without the need for any matching or balun arrangement, and light weight. The aerial unit weighs only 8¼ lb.

3. Electrically the aerial may be described as a bi-conical monopole with a counter-poise skirt arrangement. The semi-perimeter length of the aerial is approximately one wavelength at the mid-band frequency: the semi-perimeter length includes the horizontal free length between the skirt and the adjacent point on the vertical axis. This

configuration was found, after extensive experimental investigation, to be the most suitable for the features outlined in para. 2.

4. The aerial may be mounted upright (*as in fig. 1*) or it may be completely inverted. In either of these positions it will radiate or receive radio waves which are essentially vertically polarized; and have a free space radiation pattern in the vertical plane consisting of a single lobe with its maximum at right-angles to the axis of the aerial.

5. The aerial may be mounted on the top of a pole mast or on a gibbet or spur projecting from a mast. In exceptional circumstances, two aeriels, one upright and the other inverted beneath it, may be mounted on a single gibbet.

Aerial installations

6. Since lattice masts are usually sited at R.A.F. transmitting and receiving stations, the aerial units will normally be mounted on a gibbet projecting from the mast. *Fig. 2* shows the method of single and double mounting of the aerial. ,

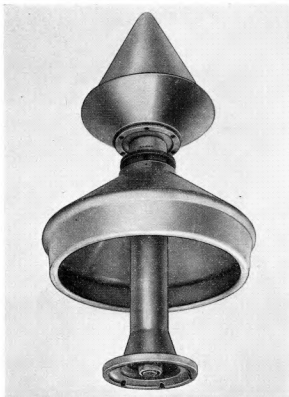


Fig. 1. Aerial unit design 41 — general view

Aerial plug board

7. An aerial plug board (fig. 3) is recommended for use with the u.h.f. ground equipment; it should be mounted near the equipment. The plug board consists of a bracket Type 606 (Ref. No. 10AR/2396) into which the plugs at the end of the aerial cable may be clamped. The main body of the plug board is manufactured from hardwood, it should be screwed to the wall or other suitable support. The plugs UG708/U (*para* 8) fit into the recessed holes in the bracket and are clamped in place by a clamping strip. This clamping strip consists of a strip of mild steel backed by a leather cushion. The clamping strip is held in place by five mild steel coach bolts.

Aerial feeders

8. Cable unradio 74 should be used between the aerial and the aerial plug board. A socket, electrical (Ref. No. 5935-99-911-6893) should be fitted to the aerial end of the unradio 74 to mate with the plug at the base of the aerial. At the plug board end a Type C plug, electrical UG708/U (Ref. No. 5935-99-911-6860) should be fitted to the unradio 74.

9. Cable unradio 67 should be used between the aerial plug board and the receiver; the length of this cable should be kept to a minimum. A Type C socket electrical UG572/U (Ref. No. 5935-99-911-6861) should be fitted to the aerial plug board end of the unradio 67 and a socket electrical SR4G fitted to the receiver end. The socket electrical SR4G consists of:—

- (1) Socket male free — 0560044
- (2) Sleeves inner — 0970145
- (3) Sleeves outer — 0970146
- (4) Nuts union — 0970113

Details regarding the fitting of the plugs and sockets to the coaxial cable are given in para. 10 to 19 and fig. 4 and 5.

Fitting the plugs and sockets to the coaxial cable

10. The socket electrical 5935-99-911-6893 (fig. 4) is designed to fit on to unradio 74 cable and mate with the plug at the base of the aerial unit. The component parts of the socket are shown at (a) of fig. 4. All screw threads of the socket should be greased with G.P. grease spec. CS.881 (Ref. No. 34D/169) before assembly.

11. The end of the unradio 74 cable should be prepared to the dimensions shown in (b) of fig. 4. Loosen the 4 B.A. screws of the clamp then pass the clamp nut, metal washer, rubber sealing washer and taper washer over the cable in that order. The socket should then be soldered to the inner conductor ((c) of fig. 4).

12. Ensure that the "O" ring seal is fitted to the socket body, then fit the socket body on to the cable braid over the taper portion (d) of fig. 4. Fit the two split insulators to the socket, close to the ridge on the socket, then bring up the socket body to clamp them in place.

13. Fit the taper washer over the metal braiding and bring up the rubber sealing washer, the metal washer and the clamp nut. Tighten the clamp nut on to the socket body ensuring that the split insulators remain in place.

14. Fit the plain insulator to the socket, then pass the socket housing through the coupling nut and screw it on to the socket body; tighten, using spanners. Ensure that the clamp nut is quite tight, then screw up the two 4 B.A. screws to clamp the cable.

15. The Type C plugs and sockets used at the aerial plug board (fig. 3) have bayonet type couplings. These plugs and sockets have been chosen since the noise generator CT207 makes connection at this point and quick action, together with mechanical durability is essential. The plug, UG708/U (Ref. No. 10H/9116860) fits on the unradio 74 cable which goes to the aerial, the socket UG572/U (Ref. No. 10H/9116861) fits on the unradio 67 cable which goes to the receiver.

16. The component parts of the Type C plug and socket, and the method of assembly, are shown in fig. 5. The end of the cable should first be prepared as shown at (b) of fig. 5 and the braid of the outer conductor combed out and tapered inwards as at (c) of fig. 5.

17. Place the nut and gasket over the cable ((c) of fig. 5) and fit the clamp portion of the plug or socket over the braid on to the outer covering of the cable ((d) of fig. 5).

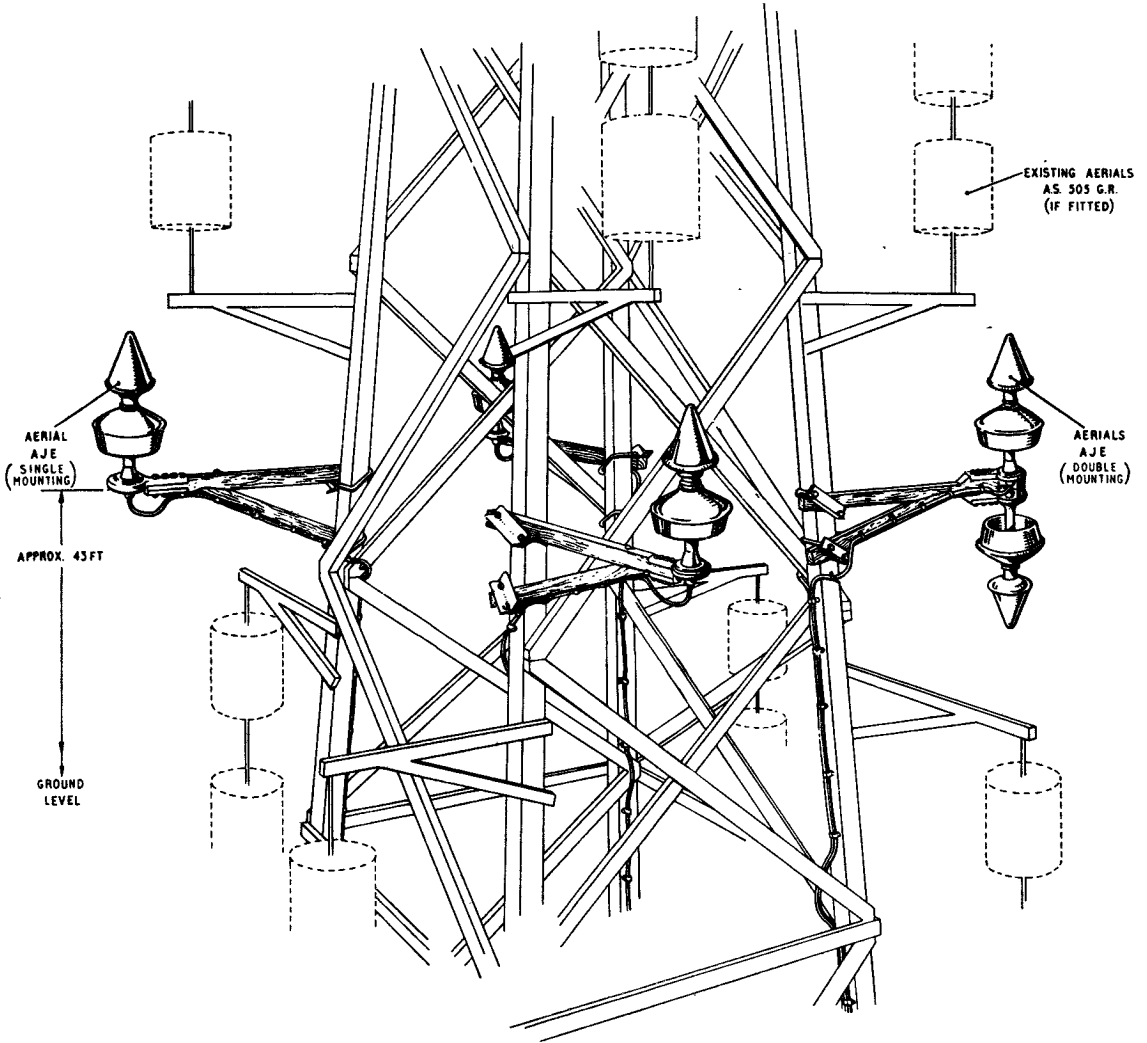


Fig. 2. Methods of mounting aerial on mast

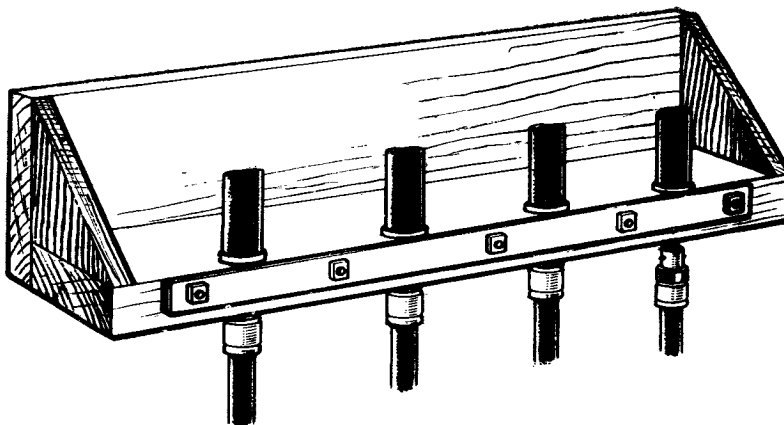


Fig. 3. Aerial plug board

18. When the clamp is in place, fan out the wires of the braid, trim to length and fold them back smoothly on to the clamp ((d) of fig. 5). The exposed portions of the inner conductor and polythene insulator of the cable should then be trimmed to the dimensions shown at ((d) of fig. 5) the contact can then be soldered to the inner conductor.

19. Bring up the gasket and ensure that the sharp edge of the clamp enters the groove of the gasket. Fit the body of the plug (or socket) and screw up the nut. If assembled correctly, the end of the contact in the plug will be flush with the insulator, while the end of the contact in the socket will be recessed approximately 0.010 in. Finally, the nut should be tightened sufficiently to split the gasket and ensure good contact between the nut and the clamp.

Mounting the aerial

20. For ground station installation where a lattice mast is in position, the aerial unit design 41 can be mounted on an aerial support Type 110 (Ref. No. 10B/18587) which may be clamped to the mast (fig. 2). If the mast also carries AS.505 aerials, the aerial units design 41 should be mounted between them at about 43 ft. above ground level.

21. One lattice mast can thus accommodate four upright mounted aerial units design 41. In circumstances where more than four aerials are required, then two can be mounted on a single gibbet, the second inverted beneath the first. It is important, however, that the drain holes in the inverted aerial unit are enlarged as shown in detail in fig. 6.

22. The aerial unit design 41 is secured to the metal plate of the aerial support Type 110 by six $\frac{3}{8}$ in. B.S.W. bolts fitted with nuts and spring washers. The complete assembly is clamped to

the upright of the mast by two U-bolts and clamp angles which are supplied with the aerial support. It should be noted that the two U-bolts and clamp angles are not identical, their widths being slightly different. The reason for this is that the arm and brace do not meet the upright of the mast at the same angle; the wider of the two should be used at the top.

23. In order to prevent the assembly slipping from between the clamps owing to subsequent shrinkage of the wood or otherwise, a double-sided 2 in. Bulldog connector (also supplied with the aerial support) should be fitted between the two pieces of timber at each clamping point. These connectors are circular pieces of metal with serrated faces, when clamped between the pieces of timber they bite in and prevent slipping.

24. After the assembly, the uniradio 74 cable should be fastened to the mast using rubber "P" clips (Ref. No. 28E/14060) and wood screws No. 10 $\times \frac{3}{8}$ in. (Ref. No. 28S/2659). These clips should be spaced at approximately 2 ft. intervals.

Double mounting of aerials

25. In those special circumstances where more aerials are required than can be mounted singly, it will be necessary to mount two aerials on each support bracket Type 110. A number of additional items will be required and these will have to be manufactured locally.

26. The materials required to manufacture the additional items are listed in Table 1. These materials should be manufactured into the items shown in fig. 7 and assembled on to the aerial support Type 110 as shown in fig. 6.

27. The two pieces of timber (item 1 of Table 1) are required to make packing pieces which should be fitted as shown in fig. 6. The timber should be

TABLE 1
Additional materials required for double aerial mounting

Item	Ref. No.	Nomenclature	Quantity
1	31B/99	Timber 4 in. \times 4 in.	2 \times 12 in. Packing pieces (<i>para.</i> 26)
2	30C/2837	14 s.w.g. sheet steel	1 $\left. \begin{array}{l} \text{Aerial} \\ \text{bracket (para. 27)} \end{array} \right\}$
3			1
4			3
5	30A/378	Hexagon steel bar 0.920 in. A/F	4 \times 12 in. To manufacture bolts
6	29A/1249	Nuts steel, plain $\frac{1}{2}$ in. B.S.W.	4
7	29C/3931	Washers, spring steel, $\frac{1}{2}$ in.	4
8	29A/727	Bolts, hexagon head, steel $\frac{3}{8}$ in. B.S.W. \times $1\frac{1}{4}$ in.	6
9	29A/1247	Nuts, hexagon, steel, plain $\frac{3}{8}$ in. B.S.W.	6
10	29C/3929	Washers, spring steel, $\frac{3}{8}$ in.	6
11	29B/3638	Screw, hexagon head, steel $\frac{1}{4}$ in. B.S.W.	6
12	29A/1245	Nuts, hexagon, steel, plain $\frac{1}{4}$ in. B.S.W.	6
13	29C/3875	Washers, spring, single, steel, $\frac{1}{4}$ in.	6

finished to size 3 in. × 3 in. × 12 in. and pressure impregnated with Salts, wood preserving (Celcure) to specification C.S.2584.

28. The aerial mounting bracket consists of two pieces of 14 s.w.g. mild steel (*items 2 and 3 of Table 1*). One piece is for the plate portion, while the other is for the flange; the two should be shaped, drilled and welded together as shown in fig. 7. It will be noticed that the aerial is mounted slightly off centre; this is important for double mounting in order to prevent fouling of the cables and allowing access for fitting the socket.

29. Three straps of mild steel (*item 4 of Table 1*) are required to add strength to the assembly. These should be manufactured to the dimensions shown in fig. 7. The straps are secured in position by the six bolts, nuts and washers (*item 11, 12 and 13 of Table 1*).

30. The four bolts securing the mounting brackets to the wooden support are required to be 1 in. long for double aerial mounting. Since these may not be available directly from stores, it will be

necessary to manufacture them. The material required is steel hexagon bar (*item 5 of Table 1*), these should be manufactured to the dimensions given in fig. 7.

31. All manufactured mild steel items, including the bolts (*para. 30*) must be galvanized to specification B.S. 729 after manufacture.

32. After assembly the four nuts and bolts holding the mounting brackets to the support bracket, and the six nuts and bolts holding the aerial unit design 41 to the mounting bracket should be painted, first with one coat primer to DEF.1035 and then with two coats finishing to CS.2308. Tint 633 (blue grey) on BS.381C should be used.

British/American interconnections

33. Where it is required to operate the British u.h.f. equipment using the American aerials, or vice versa, it will be necessary to make an adapter. The items required and the arrangement is shown in fig. 8.

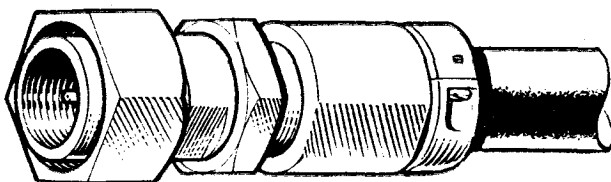
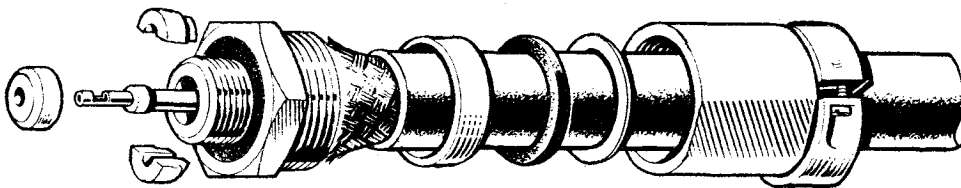
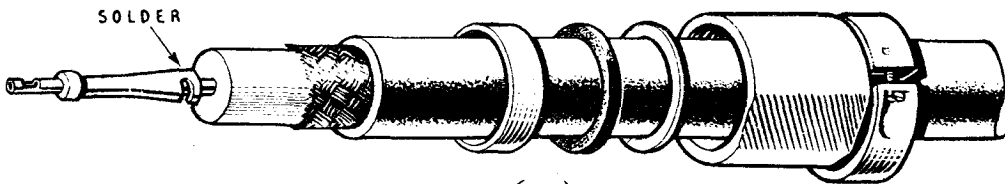
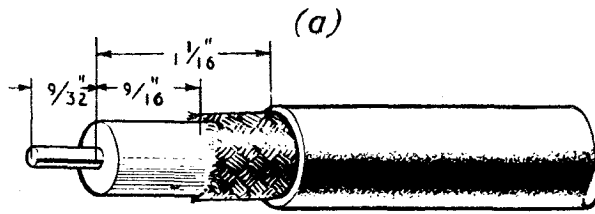
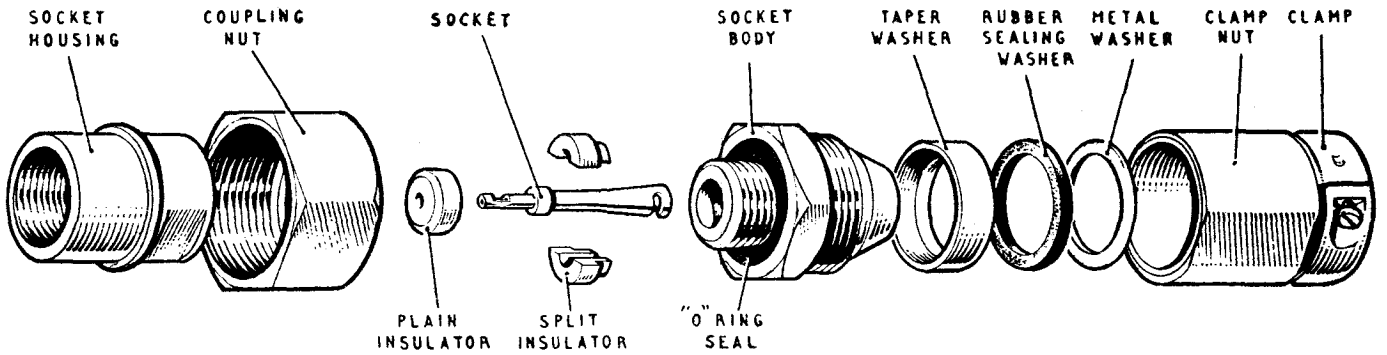
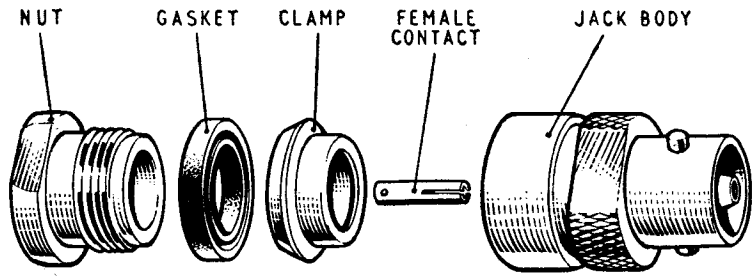
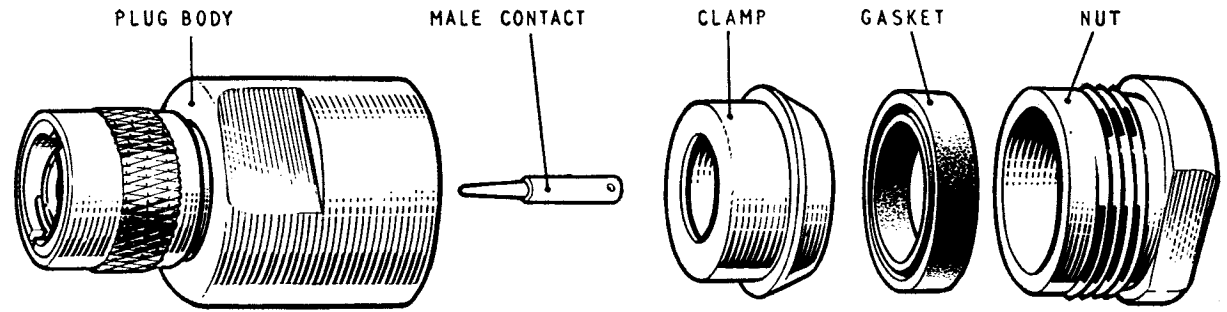


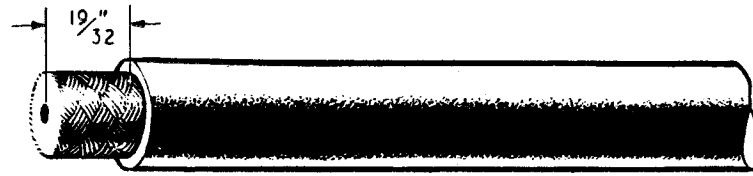
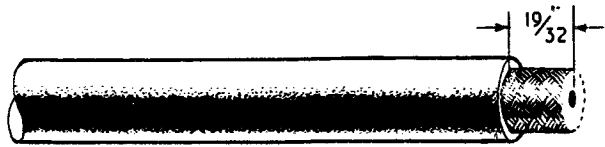
Fig 4 Method of fitting socket 9116893 to uniradio 74 Fig 4



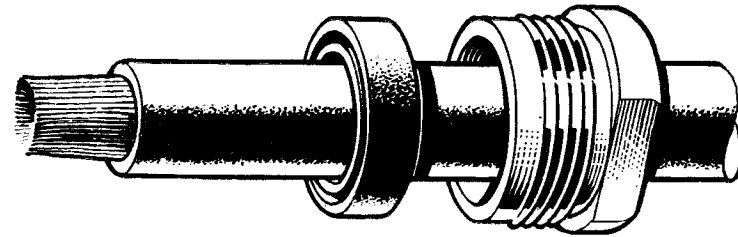
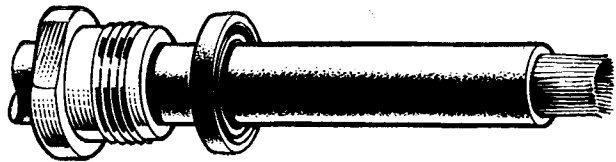
(a)



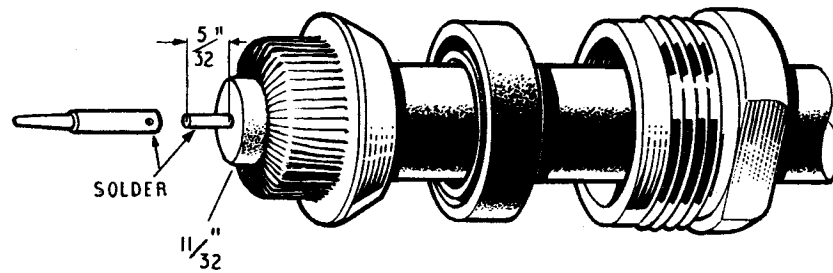
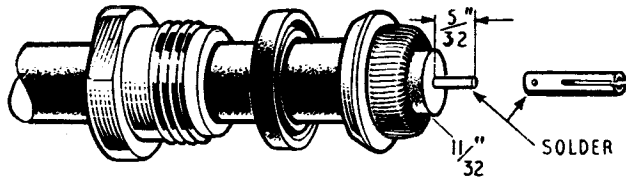
(b)



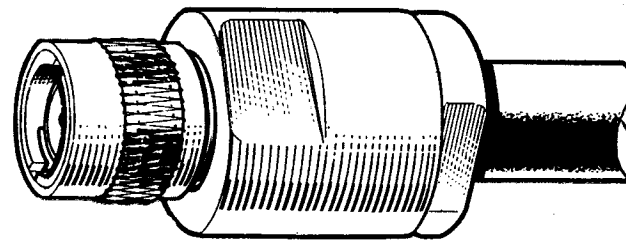
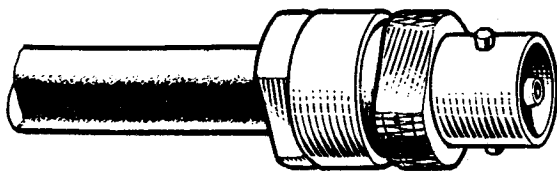
(c)



(d)



(e)

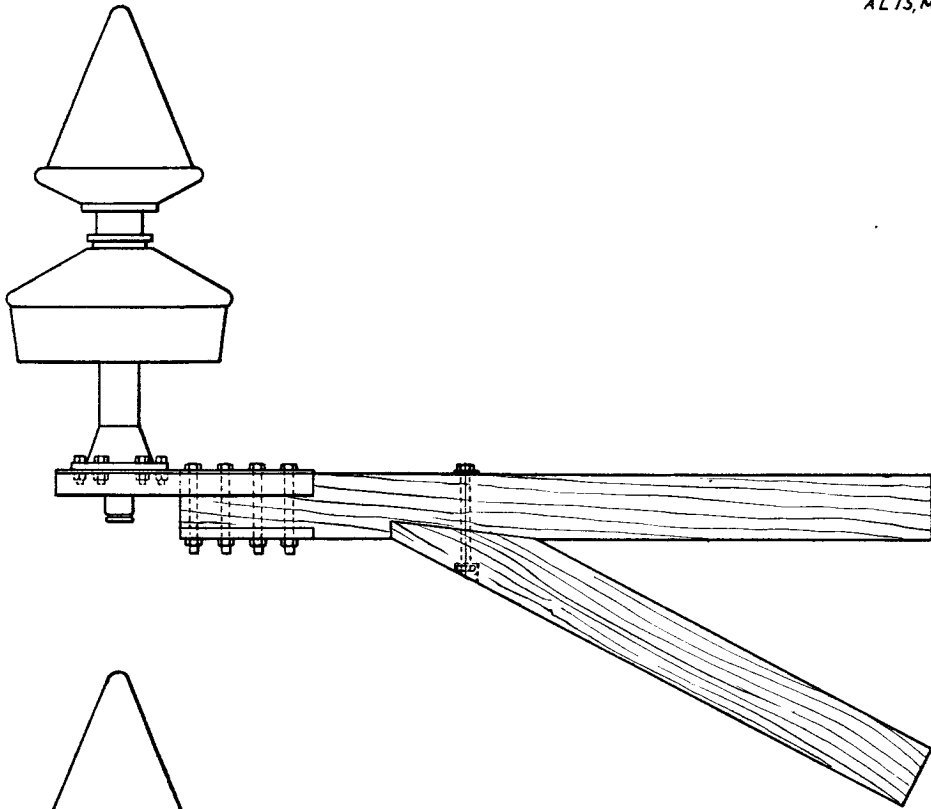


SOCKET UG 572/U

PLUG UG 708/U

Fig. 5 Method of fitting Type C plugs and sockets to coaxial cable

Fig. 5



SINGLE FITTING

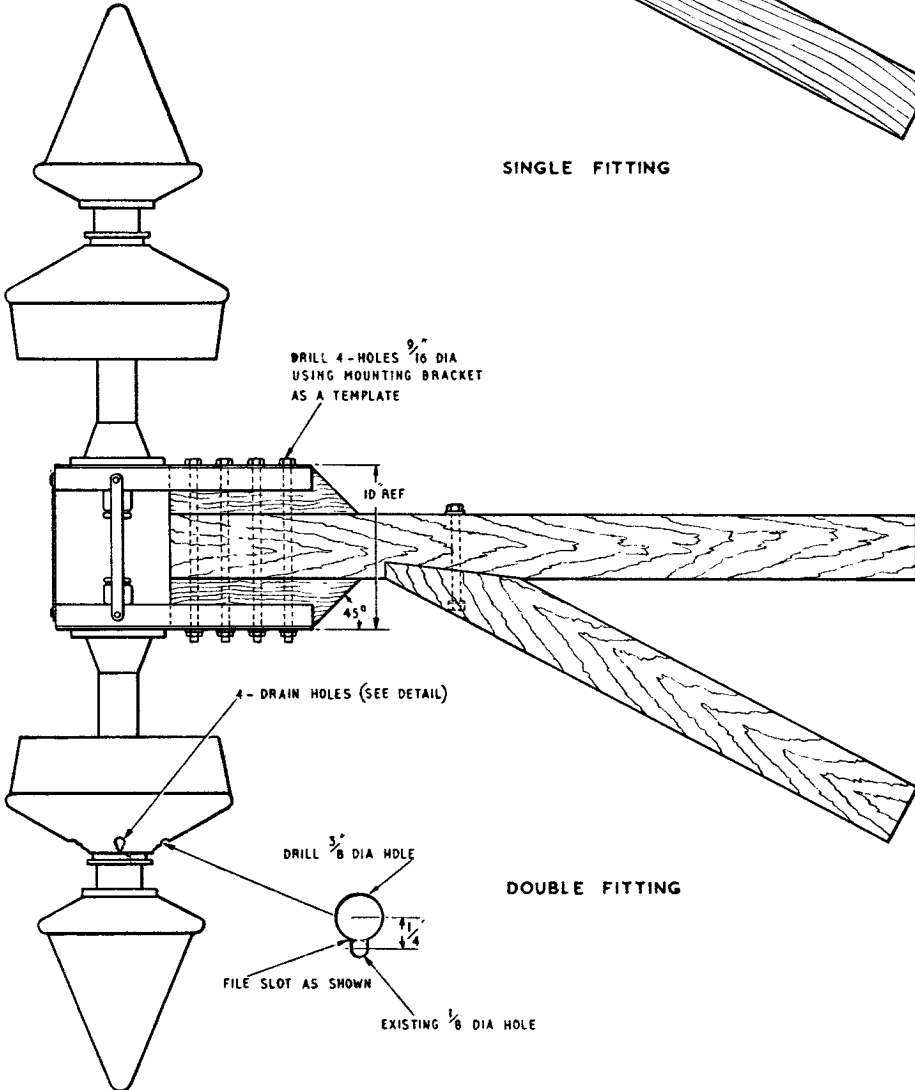


Fig. 6 Single and double aerial mounting — general assembly

Fig. 6.

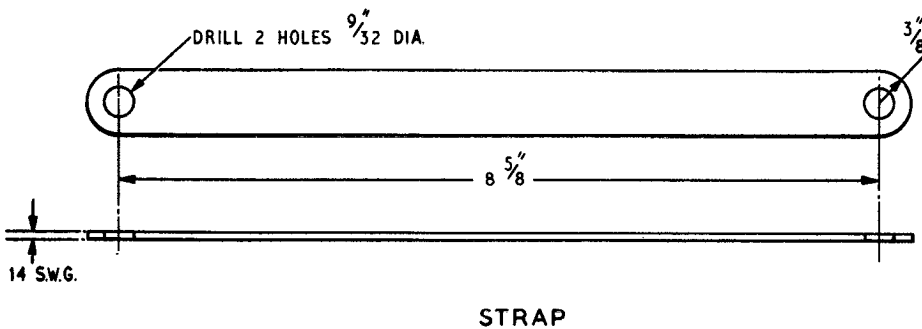
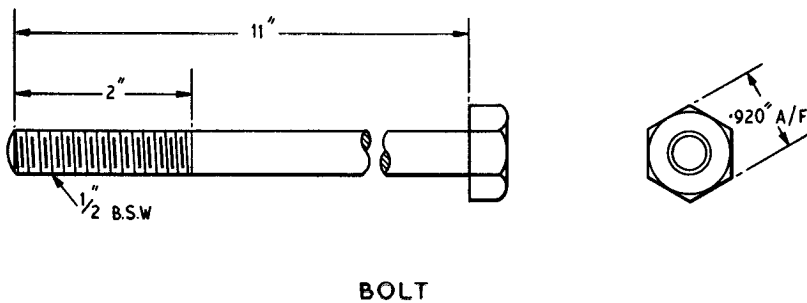
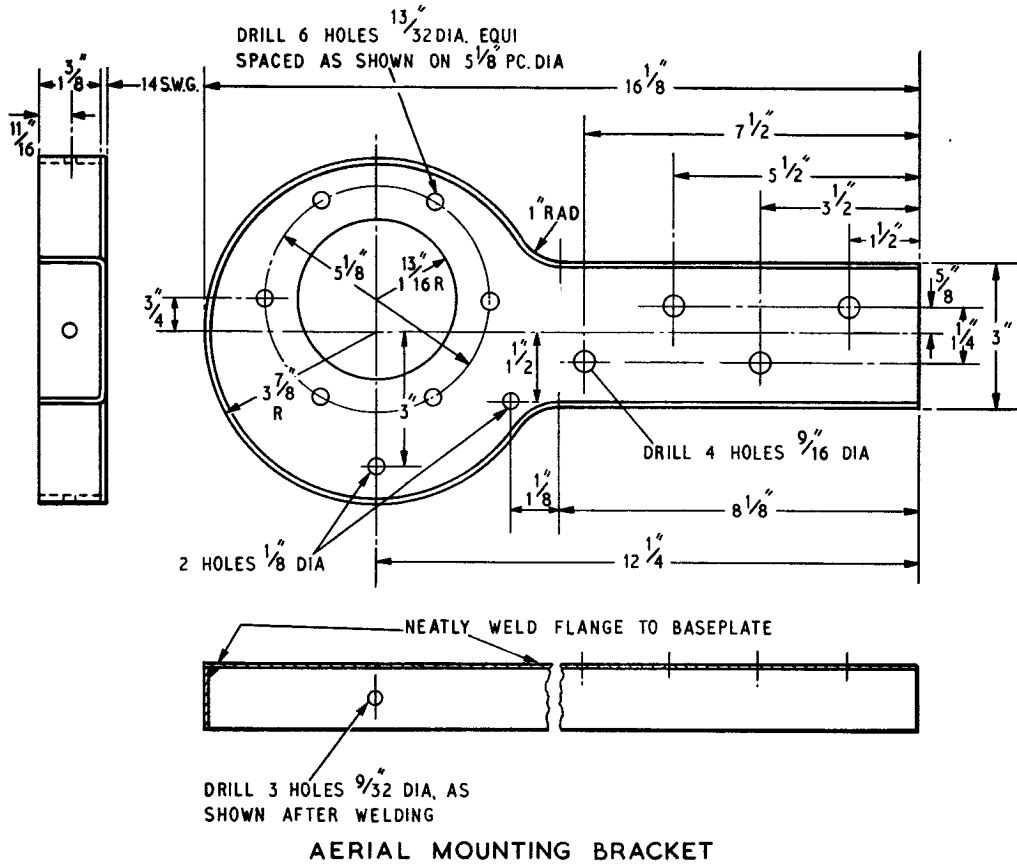
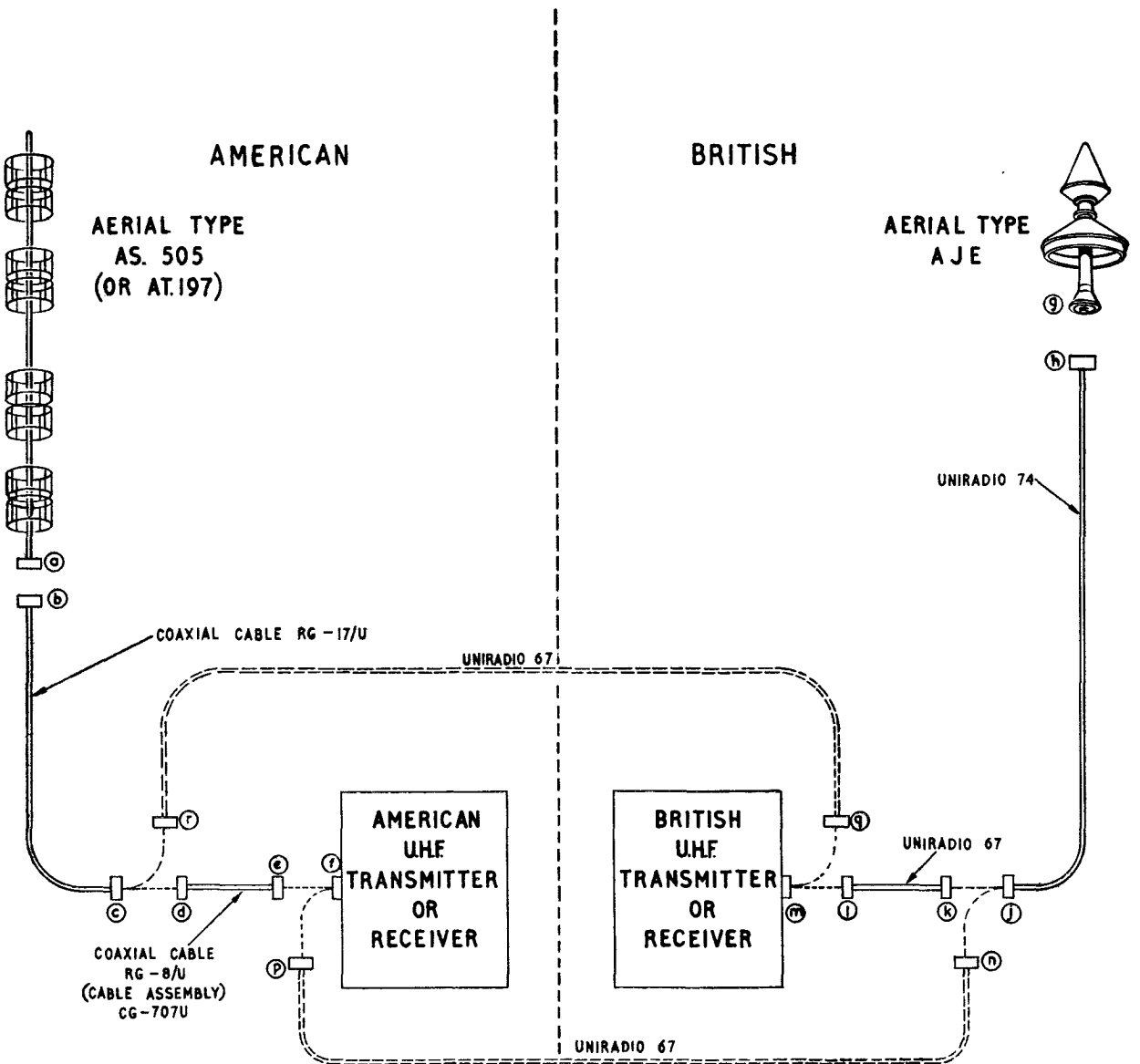


Fig. 7. Additional items to be manufactured for Fig. 7 double aerial mounting



- (a) CONNECTOR REE UG 496/U SOCKET FEMALE FIXED
- (b) " " UG 495/U PLUG MALE FREE
- (c) " " UG 495/U PLUG MALE FREE
- (d) " " UG 60A/U SOCKET FEMALE FREE
- (e) " " UG 59A/U PLUG MALE FREE (STRAIGHT)
- (f) " " UG 496/U SOCKET FEMALE FIXED
- (g) " " UG 59A/U PLUG MALE FREE (STRAIGHT)
- (p) " " UG 60A/U SOCKET FEMALE FREE

- (q) RF PLUG "SPECIAL" (SUPPLIED WITH AERIAL)
- (h) SOCKET ELECTRICAL (REF No. 5935-99-9116893)
- (j) RF PLUG ELECTRICAL UG 708/U (REF No. 5935-99-9116860)
- (k) RF SOCKET ELECTRICAL UG 572/U (REF No. 5935-99-9116861)
- (l) RF SOCKET MALE FREE, STYLE SR4G, (Z560044)
- (m) RF PLUG FEMALE FIXED, STYLE PR4E, (Z560046)
- (n) RF SOCKET ELECTRICAL UG 572/U (REF No. 5935-99-9116861)
- (o) RF SOCKET MALE FREE, STYLE SR4G (Z560044)

AIR DIAGRAM
6127J/MIN.

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FOR PROMULGATION BY AIR MINISTRY

American and British
ground u.h.f. aerial systems

Fig. 8

Chapter 2*(Completely revised)***BLOWER, AIR, TYPE 7344****LIST OF CONTENTS**

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<i>Cover assembly</i>	5	<i>Pipes, air cooling</i>	17
<i>Cover, front, Type 1068</i>	8	<i>Filter, air conditioning</i>	18
<i>Fan assembly, Type 9672</i>	9	<i>Covers, exhaust aperture</i>	19
<i>Accessories</i>	15	<i>Installation</i>	20

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<i>Accessories</i>	1

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<i>Cover assembly and fan assembly Type 9672</i>	2	<i>Filter, air conditioning and covers, exhaust aperture</i>	7
<i>Blower, air Type 7344—rear</i>	3	<i>Typical stack arrangement</i>	8
<i>Fan assembly, Type 9672—rear</i>	4		
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Introduction

I. The blower, air, Type 7344 (fig. 1) provides a flow of air for cooling the receiver Type R.7351

when it is to be operated in ambient temperatures greater than 10°C (50°F) but not exceeding +55°C (131°F)

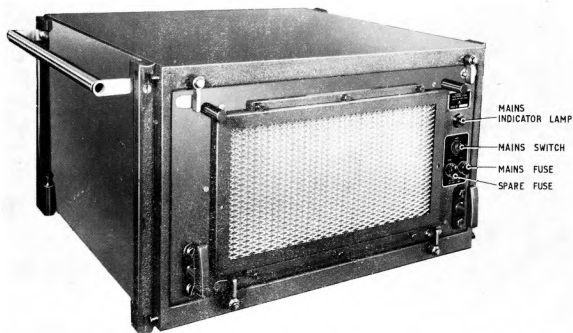


Fig. 1. Blower, air, Type 7344

2. The blower operates from a.c. mains supplies of either 105V to 130V or 200V to 250V at 45 c/s to 65 c/s (single phase); the power consumption is approximately 155 watts.

3. The overall dimensions of the equipment are 23½ in. wide, 24 in. deep and 13¼ in. high; the weight is approximately 110 lb.

4. The blower, air, Type 7344 consists of the following major items:—

- (1) Cover assembly, Ref. No. 10AP/236.
- (2) Cover, front, Type 1068, Ref. No. 10AP/299.
- (3) Fan assembly Type 9672, Ref. No. 10K/19472.
- (4) Connector Type B4/50F/R9, Ref. No. 10HG/103.

Cover assembly

5. The cover assembly (fig. 2) serves as a cabinet and measures (overall) 23½ in. wide, 24 in. deep and 13¼ in. high; a carrying handle is provided at each side. At each of the four lower corners is a captive bolt for securing the cabinet on top

of the uppermost cabinet of a stack of equipment. The interior of the cabinet is fitted with two fixed runners for supporting the fan assembly Type 9672 (para. 9); also included is an internal connector for coupling the fan assembly to the external mains supply via a plug at the rear of the cabinet. The front face of the cabinet incorporates four spring-loaded latches for securing the fan assembly into the cabinet.

6. At the rear of the cabinet (fig. 3) are four outlet apertures for the flow of air from the fan to the equipments which are to be blown. Hinged covers are provided to close the apertures against dust etc. when the equipment is in storage or transit; these covers are secured by captive bolts and associated knurled nuts.

7. To remove the fan assembly Type 9672 from the cabinet (fig. 2) release the four spring-loaded latches on the front of the cabinet and then, by pulling on the fixed front panel handles, withdraw the fan assembly against the spring-loaded runner catches. Uncouple the internal connector from the plug on the right-hand side-frame of the fan assembly. Raise the runner catches and remove the assembly from the cabinet. Fitting the fan assembly is the reverse of the removal procedure except that the runner catches are chamfered so that they lift automatically as the fan assembly is pushed on to the runners.

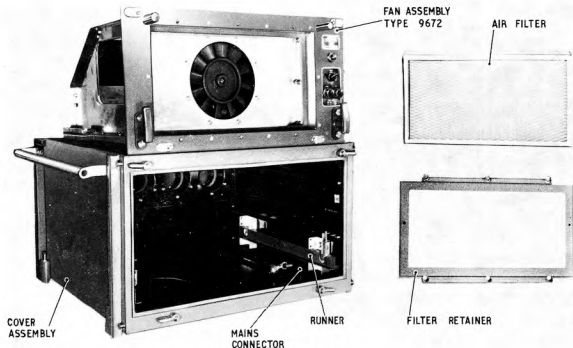


Fig. 2. Cover assembly and fan assembly Type 9672

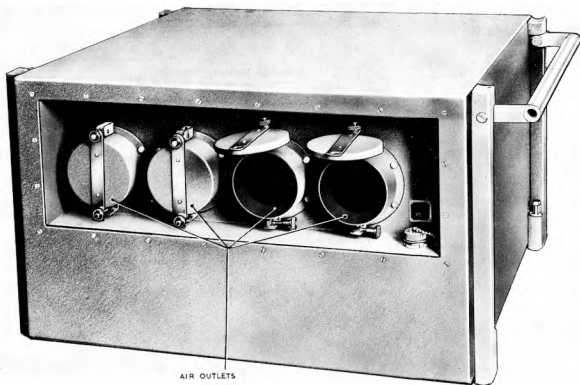


Fig. 3. Blower, air, Type 7344 — rear

Cover, front, Type 1068

8. The cover, front, Type 1068 (Part 1, Sect. 1, Chap. 4, fig. 1) is made of steel and measures (overall) $21\frac{1}{4}$ in. wide, 13 in. high and 2 in. deep; it can be secured to the front of the cabinet by four quick-release fasteners. The purpose of the cover is to protect the equipment from dust or damage during storage or transit. Since the air inlet filter is on the front of the fan assembly Type 9672, it is essential to ensure that the front cover is removed while the blower, air, Type 7344 is in use.

Fan assembly Type 9672

9. The fan assembly Type 9672 incorporates the main chassis, air filter, fan Type 9685 and associated circuit components; the fan assembly is illustrated in fig. 4 while a circuit diagram is included in fig. 5.

10. The fan Type 9685 is an axial flow unit capable of delivering 275 cubic feet of air per minute as measured against the pressure of a one inch static water gauge. The impellers are driven by an induction motor at a nominal speed of 2800 rev/min. The motor operates from 230V a.c. mains at 45 c/s to 65 c/s (single phase). To provide the necessary phase difference for the

currents flowing in the two field windings of the motor, the supply for one winding is fed via capacitor C1.

11. The mains supply is fed from the mounting plinth Type 7872 via the external connector (para. 4(4)) to the plug PL1 at the rear of the blower cabinet and then via the internal connector to PL2 on the right-hand side-frame of the fan assembly Type 9672. From this plug it is fed through the MAINS ON/OFF switch and fuse, on the front panel of the fan assembly, and then via a mains tapping panel to the mains transformer T1. Also located on the front panel is a mains indicating neon lamp ILPI which, with its series limiting resistor R1, is connected across the mains input supply.

12. The mains transformer T1 is an auto-transformer which supplies 230V a.c. to the fan Type 9685 (para. 10). The transformer is tapped to permit operation of the equipment from a.c. mains supplies in the range 105V to 130V in 5V increments, or from 200V to 250V in 10V increments. The appropriate tapplings are selected by means of two link plugs on the mains tapping panel LKA at the rear of the fan assembly. It is essential to ensure that the tapplings are correctly set to the local a.c. mains supply before applying power to the equipment.

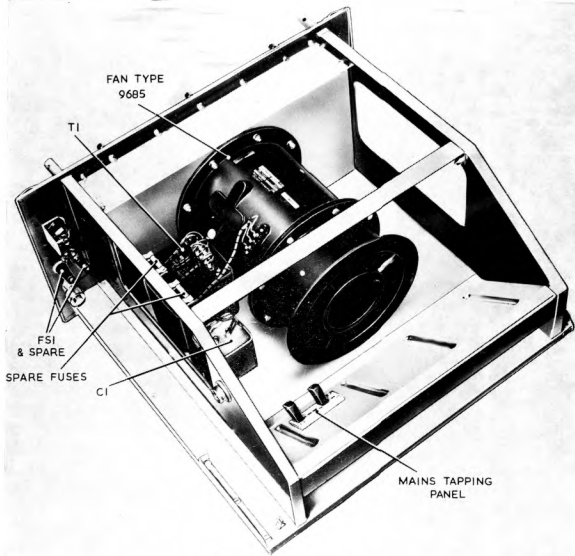
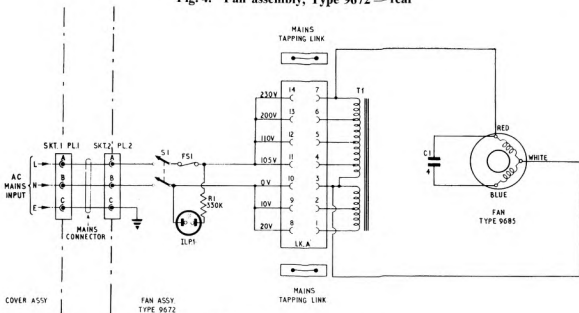


Fig. 4. Fan assembly, Type 9672 — rear



NOTE: CIRCUIT INCLUDES MDD NO. 4944, 5105

Fig. 5. Blower, air, Type 7344 — circuit

13. When the blower, air, Type 7344 is operating from an a.c. mains supply in the range 200V to 250V, the fuse FS1 should be 1A (5920-99-911-8319); when the supply is in the range 105V to 130V the fuse should be 2A (5920-99-911-8320).

14. The air filter is fitted into a recess on the front panel of the fan assembly and is held in position by a retaining frame (fig. 2) which is secured to the front panel by six captive screws.

Accessories

15. A number of accessories are available for use in conjunction with the blower, air, Type 7344; all of these accessories are listed in Table 1 although certain items are not used in connection with the equipments which are the subject of this air publication (see "further details"). The accessories required will depend upon the stack arrangement of the equipment (para. 21); all requirements must be obtained separately.

TABLE 1
Accessories

Ref. No.	Nomenclature	Further details
10D/19818	Panel, blanking, Type 7990	} Para. 16
10D/22505	Panel, blanking, Type 9240	
10AQ/194	Pipe, air cooling (54 in. long)	} Para. 17
10AQ/195	Pipe, air cooling (40½ in. long)	
10AQ/196	Pipe, air cooling (26½ in. long)	
10AQ/197	Pipe, air cooling (12½ in. long)	
4130-99-194-8981	Filter, air conditioning	Para. 18
5820-99-194-8982	Cover, exhaust aperture	} Para. 19
5820-99-194-8983	Cover, exhaust aperture	
5820-99-194-8984	Cover, exhaust aperture	
5820-99-194-8985	Cover, exhaust aperture	

Panels, blanking

16. The panel, blanking, Type 7990 is used on the receiver Type R.7109 and the panel, blanking, Type 9240 is used on the transmitter Type T.7096; these panels are described and illustrated in A.P.116E-0253-1 and in A.P.116E-0731-1.

Pipes, air cooling

17. The air pipes (fig. 6) are manufactured to

four different lengths (Table 1), the quantity and lengths required being determined by the stack arrangement of the equipment with which the blower is to be used (para. 21). Each pipe is a U-shaped tube constructed from a length of wire re-inforced Flexatex with a 3 in. diameter metal outlet secured to each end, by metal circlips, to form the open ends of the U. One end of each tube fits into an air outlet aperture at the rear of the blower, air, Type 7344 and the other end into a similar aperture at the rear of the equipment to be blown.

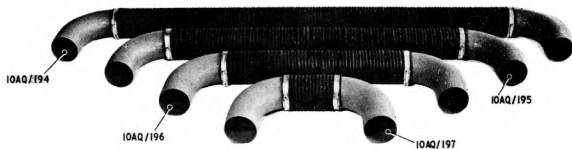


Fig. 6. Pipes, air cooling

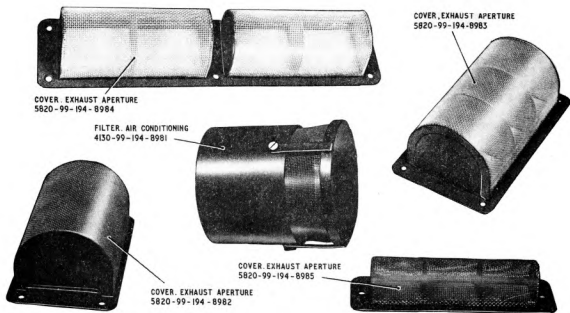


Fig. 7. Filter, air conditioning and covers, exhaust aperture

Filter, air conditioning

18. The filter, air conditioning, 4130-99-194-8981 (fig. 7) comprises a metal gauze tube to which is fitted an end cap; these are coupled to a metal tube by three metal straps to form an assembly which has a diameter of 3in. and is $3\frac{5}{8}$ in. long. Up to three of these filters may be required for fitting to the unused outlet apertures of the blower, air, Type 7344 (para. 25).

Covers, exhaust aperture

19. When an equipment is to be cooled by the blower, air, Type 7344, a special exhaust cover must be fitted to the front panel of that equipment. There are four covers (fig. 7) which are as follows:-

(1) The cover, exhaust aperture, 5820-99-194-8982 comprises a metal frame to which is soldered a U-section metal gauze screen; the latter is internally supported by three metal plates, one at each end and one at the centre. The dimensions are $2\frac{3}{8}$ in. high, $3\frac{1}{16}$ in. long and $1\frac{5}{16}$ in. deep. The cover is designed for fitting to the transmitter unit Type 7703 of transmitter Type T.7096 (A.P.116E-0253-1) and to the receiver Type R.7109 (A.P.116E-0730-1).

(2) The cover, exhaust aperture, 5820-99-194-8983 is similar in construction to that described in sub-para. (1) except that the gauze screen is supported by four plates and the dimensions are 3 in. high, 5 in. wide and $1\frac{7}{8}$ in. deep. The cover is used on the receiver Type R.7351 (para. 24).

(3) The construction of the cover, exhaust aperture, 5820-99-194-8984 is also similar to that described in sub-para. (1) but this cover is fitted with two separate gauze screens, each supported by three plates, and the overall dimensions are $1\frac{13}{16}$ in. high, 8in wide and $1\frac{3}{16}$ in. deep. The cover is used on the transmitter Type T.7355 (A.P.116E-0252-1).

(4) The cover, exhaust aperture, 5820-99-194-8985 is constructed similarly to that described in sub-para. (2) but with dimensions $1\frac{3}{8}$ in. high, $4\frac{5}{8}$ in. wide and $\frac{7}{8}$ in. deep. The cover is designed for fitting to the power unit Type 7097 of the transmitter Type T.7096 (A.P.116E-0253-1) and to the power unit Type 9202 of the amplifier (R.F. power) Type A.7349 (A.P.116E-0253-1) and Type A.9365 (A.P.116E-0252-1). Two of these covers are required for each power unit.

Installation

20. To install the blower, air, Type 7344 with a stack of receivers Type R.7351 see Part 1, Sect.1, Chap. 5.

CAUTION . . .

When the blower bearings have been stationary for long periods, i.e. during storage, the lubricant deteriorates. Before installing, refer to the attached label to determine whether the bearings require cleaning and relubrication as in Part 2, Sect. 2, Chap. 1. ►

21. When used with certain accessories (para. 23) the blower, air, Type 7344 can supply cooling for a maximum of four receivers Type R.7351, or any combination of receivers Type R.7351 and Type R.7109 (A.P.116E-0731-1) up to a maximum of four (see para. 22(2)).

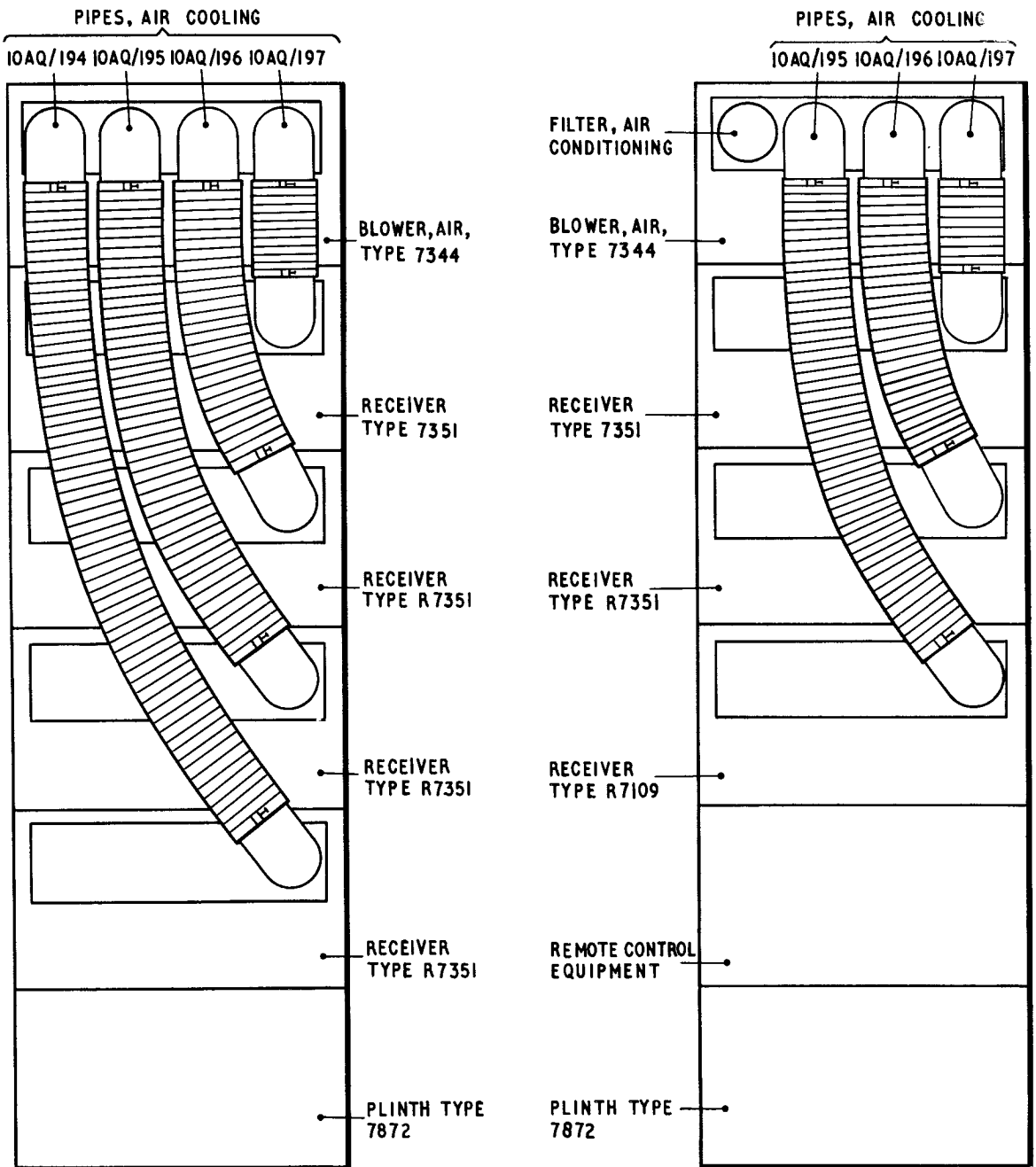


Fig. 8. Typical stack arrangement

22. The subsequent installation details apply only to receivers Type R.7351; where a stack contains receivers Type R.7109, reference must also be made to A.P.116E-0731-1, Part 1, Sect. 2, Chap. 2. In addition, attention should be given to the following points: —

(1) It is important to note that the receiver Type R.7351 requires cooling, from the blower, air, Type 7344, at ambient temperatures from $+10^{\circ}\text{C}$ to $+55^{\circ}\text{C}$ whereas

the receiver Type R.7109 requires this cooling over the ambient temperature range $+37^{\circ}\text{C}$ to $+55^{\circ}\text{C}$.

(2) If a receiver Type R.7109 is to be operated with a remote control equipment, the latter must be mounted immediately beneath the receiver it is to control; this, together with the limitations imposed by the lengths of the air pipes (para. 23(2)), will restrict the number of equipments which can be cooled by the blower, air, Type 7344.

23. The types and quantities of accessories required for a stack of equipment will depend upon the equipments contained in the stack. Accessories should be obtained in accordance with the requirements given below: details of fitting these accessories are given in para. 24 and 25.

(1) Each receiver Type R.7351 requires one cover, exhaust aperture, 5820-99-194-8983.

(2) One pipe, air cooling is required for each item of equipment to be cooled by the blower, air, Type 7344, the length of each pipe being selected according to the position of the equipment in the stack. It should be noted that the lengths of the pipes (Table 1) are arranged such that they may only be connected (where required) between the blower and the four equipments immediately underneath the blower.

(3) A filter, air conditioning, 4130-99-194-8981 must be obtained for each unused outlet aperture of the blower, air, Type 7344; it is also advisable to hold one spare filter in case it becomes necessary to disconnect an air pipe (see para. 25 warning).

Note . . .

If an equipment in a stack is to be sent for servicing or returned to stores, the accessories must be removed and the equipment restored to its original condition. For this reason it is important to ensure that items removed from the equipments (para. 24) are retained for subsequent refitting.

24. Where it is required to operate the receiver Type R.7351 in ambient temperatures from +10°C to +55°C, cooling must be supplied from the blower, air, Type 7344; an aperture is provided at the rear of the receiver cabinet for fitting an air pipe. In order to ensure an adequate flow of air through the receiver, remove the louvred plate and gauze at the left-hand side of the front panel tuning controls, and substitute the cover, exhaust aperture, 4130-99-194-8983.

25. To fit the air pipes, first release and raise the covers of all four outlet apertures at the rear of the blower, air, Type 7344 and lock each cover in the horizontal plane by means of the knurled nut at the pivoted end of the cover; similarly release, lower and lock open the aperture covers at the rear of the equipments to be blown. Select the required air pipes (para. 23(2)) and push the ends of the pipes firmly into the appropriate apertures. In order to achieve correct operation of the blower and adequate cooling of the equipments in the stack, a filter, air conditioning, 4130-99-194-8981 must be fitted into each of the unused outlet apertures at the rear of the blower.

WARNING . . .

Should it become necessary to withdraw an equipment from its cabinet for servicing, while other equipments in the stack are required to remain operational, the air pipe of the item being serviced must be disconnected at the rear of the blower, air, Type 7344 and a filter, air conditioning, 4130-99-194-8981 fitted into the vacated aperture. This is necessary in order to maintain an adequate flow of air to the operational equipments.

PART 2

TECHNICAL INFORMATION (SERVICING)

October 1971

U.H.F. SINGLE CHANNEL RECEIVER RADIO 5820-99-932-5694 (R.7351)

GENERAL AND TECHNICAL INFORMATION

ADVANCE INFORMATION LEAFLET No. 1/71

Insert this leaflet in front of Part 2, Sect. 1 marker card

Introduction

1. An improved method of crystal oven temperature control is being introduced by Mod. No. A3107 to the drive unit radio.
2. Temperature is measured by a thermistor inside the oven, forming part of a resistor bridge. The remaining components of the bridge, together with an integrated amplifier and a thyristor circuit, form a control module on the drive unit chassis adjacent to the oven.
3. When the oven temperature is below that preset by 18RV1 (part of the bridge circuit), the bridge is unbalanced, feeding a voltage to the differential input of the amplifier, whose output causes gate current to flow in the thyristor and apply power to the oven heater. As the temperature increases, the thermistor resistance falls, the bridge becomes balanced and no voltage is applied to the amplifier whose output decreases, returning the thyristor to its blocking condition and removing power from the oven heater.

CAUTION ...

- (1) The control module operates from a floating 115V a.c. source and earthing any part of the module can cause irreparable damage, so switch off the receiver mains supply before removing the drive unit radio.
- (2) The heater, crystal oven 5820-99-618-3277 (modified version) and the heater, crystal oven, 5955-99-932-5555 (unmodified version) are NOT interchangeable. Fitting an unmodified heater (which has a thermostat) in a modified equipment can result in erratic temperature excursion while a modified heater (with no thermostat) fitted to an unmodified equipment will become overheated.

Test equipment for testing and adjusting the oven temperature

4. (1) Temperature tester. An electronic device capable of measuring in the range 65°C to 85°C, accurate to $\pm 0.25^\circ\text{C}$, in ambient temperatures from -40°C to +37°C. It must use a thermocouple which can be attached to the side of a crystal (style D to DEF-5271A). The wiring between the thermocouple and the tester must introduce minimum heat loss from the point of contact.

(2) Test oven and cover. A heater, crystal oven, 5820-99-618-3277 and a cover, quartz crystal holder, 5955-99-999-3800, both modified to permit the introduction of a thermocouple and wiring (sub-para.(1)) in such a manner that heat loss from the oven is minimal.

Oven temperature testing and adjustment

5. The temperature must be checked and where necessary adjusted using the equipment of para.4 thus (A thermometer is NOT suitable):

- (1) With the transmitter switched off, remove the crystal oven cover and oven and fit crystals into the WORKING and SPARE sockets. (The frequency of the crystals is immaterial). Ensure that the top of the thermistor bead is level with the top of the crystal cans.
- (2) Attach the thermocouple of the temperature tester to the side of the crystal in the SPARE socket, ensuring that good thermal contact is made, and then securely fit the test oven and cover.
- (3) Switch on the transmitter and the temperature tester and allow the oven temperature to stabilize for 30 minutes.
- (4) Note the temperature excursion of the crystal oven over four complete cycles. The mean shall be $75^{\circ}\text{C} \pm 1^{\circ}$.
- (5) If the mean temperature is outside the limits of sub-para.(4), adjust 18RV1 on the oven control panel on the underside of the transmitter chassis. Rotate control screw clockwise to increase the temperature. A variation of 1°C is provided by 2-3 turns of the screw
- (6) After adjustment check the mean temperature as in sub-para.(4). Repeat procedure until the temperature is satisfactory.
- (7) If difficulty is experienced in adjusting the temperature, check the heater, crystal oven, the thermistor and the control module and, if faulty, replace. Recheck the temperature and adjust as necessary.
- (8) Switch off the transmitter and remove the test cover, oven, thermocouple and crystals.

Note ...

- (1) The information contained in this leaflet will be incorporated by normal amendment action in due course.
- (2) If, after receipt of this leaflet, an amendment list with a prior date and conflicting information is received, the information in this leaflet is to take precedence.

116E-0730-1

~~AP-2531F~~, Vol. 1, Part 2

SECTION I

RECEIVER TYPE R.735I

Chapter 1

TEST EQUIPMENT INCLUDING TEST SET TYPE 7618

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INTRODUCTION

1. This test equipment is required for first and second line servicing of the u.h.f. single channel receiver Type R.7351 and its associated equipment.

Details of the use of the first and second line servicing equipment are given in other chapters of this volume. Third line servicing, see Topic 6.

TABLE 1

Test equipment for first and second line servicing

Item	Ref. No.	Nomenclature	Qty.	Remarks
1	10AH/9	Headset, low impedance	1	—
2	1C/6339	Spanner, D.E. open jaw ½ in. x 9/16 in. A.F.	1	To tighten or release clamping bolts holding equipment in a stack
3	1H/100	Tools, valve extractor	1	
4	4G/5421	Vacuum cleaner (large)	1	A.M.S.E.C. scale 105
5	5QP/17447	Multimeter CT498	1	A.P.120M-0106-1
6	5G/1621 or 5G/203	Tester insulation Type A }	1	A.P.4343
		Tester insulation Type D }		
7	10AG/78	Alignment tool, electronic equipment Type 2	1	Slug adjuster } Supplied Lock nut spanner } with re- Trimmer screwdriver } ceiver
8	10AG/79	Alignment tool, electronic equipment Type 3	1	
9	10AG/83	Alignment tool, electronic equipment Type 4	1	
10	5999-99-932-5595	Tray, electronic equipment	1	(para. 3, fig. 1)
11	10S/AP.63451	Noise generator CT207	1	A.P.2563DT : B.R.1771(15)
12	10HS/119	Connector Type D257/20A/R1	1	To interconnect receiver and item 11
13	10S/16830	Test set Type 7618	1	(para. 4, fig. 2, 3 and 4)
14	ZDM/13833-333	Crystal unit, quartz	1	For checking receiver operation at extreme ends of frequency range
15	ZDR/17662-5	Crystal unit, quartz	1	
16		Temperature tester (para. 13)	1	
17		Test oven (para. 13)	1	For oven temperature adjustment
18		Test cover (para. 13)	1	
19	ZDM/17661-1	Crystal units, quartz	1	
20	6625-99-223-9375	Counter, electronic frequency	1	For testing frequency accuracy
21		Calibrated crystal (para. 14)	1	
22	6625-99-949-0510	Wattmeter, absorption, a.f., CT44	1	B.R.1771(18) } For checking B.R.1771(86) } Signal/noise ratio
23		Signal generator CT584	1	

TEST EQUIPMENT FOR FIRST AND SECOND LINE SERVICING

2. The remarks column of Table 1 contains references to publications which give further information on the items; alternatively, where no such publication exists, a brief description is given of the item. However, two of the items are special

to the equipment and details of these are given in the subsequent paragraphs.

Tray electronic equipment

3. This tray (*Table 1, item 10*) is illustrated in fig. 1. It is designed to hang on the side framework of the receiver unit and can be used as a

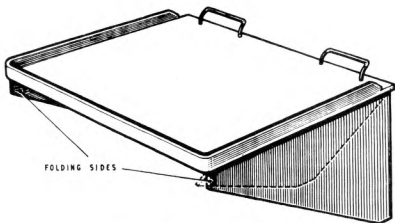


Fig. 1. Tray electronic equipment



Fig. 2. Test set Type 7618 — top view

support for any of the smaller sub-units or the tools in use during servicing.

Test set Type 7618

4. This test set (Table 1, item 13) has been specially designed for use with the u.h.f. equipment. It is built into a steel attache-style case with two hinged covers, rubber feet and a carrying handle. The overall dimensions of the test set are 13 in. x 10 in. x 8 in. and its weight is approximately 17½ lb. The test set requires no power supplies.

5. One of the hinged covers of the test set protects the control panel (fig. 2) while the other fits over the compartment which holds a number of test connectors (fig. 3). The test set can be hung on the side frame of a receiver unit in the same way as the tray electronic equipment (para. 3). The test set is shown in position on a receiver in fig. 4.

6. On the control panel of the test set (fig. 2) is a meter which can be connected, via one of the test connectors (para. 9 (2)) to any of the 9-pole test sockets of the u.h.f. equipment. The meter is similar to the one on the front panel of the u.h.f. equipment, and thus two sub-units can be simultaneously metered. The test set meter can also be used to verify the accuracy of the receiver built-in meter.

7. Inside the cover of the test set (fig. 2) is a list giving the full-scale deflection and normal meter readings to be expected when taking current and voltage measurements with the meter.

8. A total of eight connectors and an adaptor Type 174 are contained in the compartment under the bottom cover (fig. 3). By using the appropriate connector it is possible to interconnect any sub-unit with the main equipment and so have the sub-unit available for close inspection and test with the equipment switched on. Certain of the connectors and the adaptor are not required for use with the single-channel receiver R.7351.

9. The details of the connectors are as follows:—

(1) Connector Type E607/20C/R1 (Ref. No. 10HS/31), 18-way. Not required for use with single-channel receiver.

(2) Connector Type K602/10A/R1 (Ref. No. 10HS/32), 9-way. For use between the special orange-coloured 9-pole test sockets, fitted to certain sub-units and the METER socket on the front panel of the test set (para. 6).

(3) Connector Type K603/20A/R1 (Ref. No. 10HS/33), 37-way. Not required for use with single-channel receiver.

(4) Connector Type E604/20C/R1 (Ref. No. 10HS/34), 25-way. Two of these supplied for use with the following sub-units:—

Amplifying unit (IF) Type 7112
Amplifying unit (AF) Type 7113

(5) Connector Type E605/20C/R1 (Ref. No. 10HS/35), 4-way. Not required for use with single-channel receiver.

(6) Connector Type E671/20C/R1 (Ref. No. 10HS/36), 12-way. For use with the drive unit radio Type 7353.

(7) Connector Type E606/20C/R1 (Ref. No. 10HS/37), 8-way. For use with the amplifying unit (RF) Type 7111.

10. A circuit of the test set Type 7618 is given in fig. 5. Only positions 8, 9, 10, 11 and 12 of the METER SWITCH (S1) are applicable to the single-channel receiver. The others are for the single-channel transmitter, the multi-channel transmitter and receiver, and the remote control equipment.



Fig. 3. Test set Type 7618 — underside

11. The test set Type 7618 also has a number of uses confined to the u.h.f. transmitters, multi-channel receiver and the 12-24 channel remote control equipment. Details of these circuits are in the appropriate publication.

◀ Temperature tester

12. The temperature tester shall be an electronic device capable of measuring temperature from 65°C to 85°C, accurate to $\pm 0.25^\circ\text{C}$, in ambient temperatures from -40°C to $+37^\circ\text{C}$ and employing a thermocouple which can be attached to the side of a crystal (style D to DEF-5271A), the wiring between the thermocouple and the tester being such that there is a minimum of heat loss from the point of contact.

Test oven and test cover

13. The test oven and the test cover shall be, respectively, a heater, crystal oven 5820-99-618-3277 and a cover, quartz crystal holder 5955-99-999-3800 both suitably modified to introduce a thermocouple and wiring (*para.* 12) so that heat loss from the oven is minimal.

Calibrated crystal

14. The calibrated crystal shall be a BT-cut crystal unit, quartz, ZDM/16111-1 to DEF-5271, calibrated for maximum turn-over frequency, between 70°C and 80°C, at 30pF input and with 5mW drive. The turn-over frequency shall be clearly marked on the crystal can. ▶

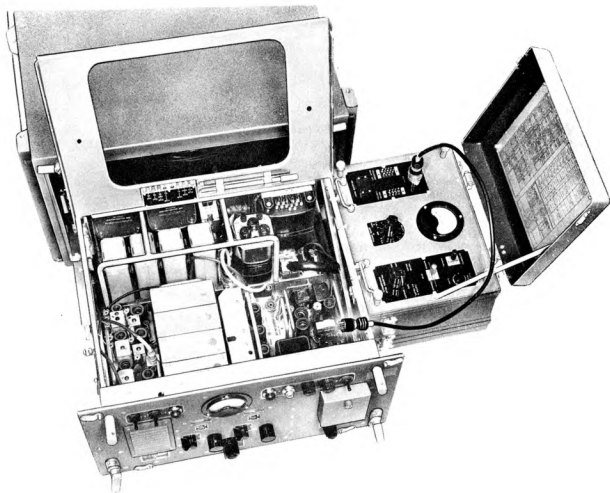


Fig.4 Test set in use on receiver

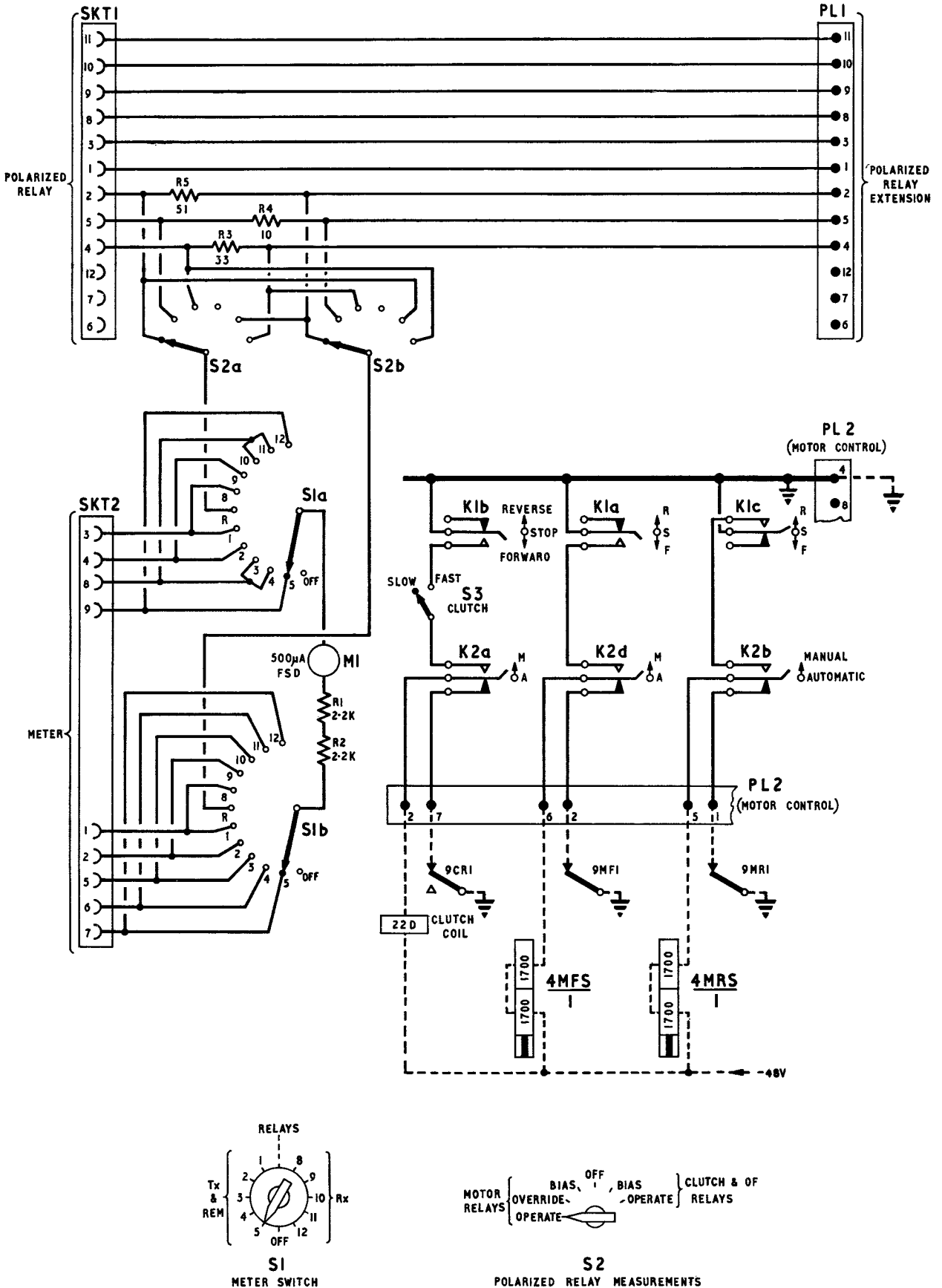


Fig. 5

Test set Type 7618: circuit

Fig. 5

Chapter 2

MINOR SERVICING

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Introduction

1. This chapter concerns periodic testing of receiver Type R.7351; test equipment required is described in Chap.1 of this section. If the receiver fails to pass any tests described, consult the chapter on fault finding (Part 3, Sect.1, Chap.1).

2. Except where absolutely necessary, do not operate the equipment with the receiver unit partially withdrawn from the cover assembly. This preserves the safety factor and limits the ingress of dust and moisture. If the receiver is not to be used for some time, fit a cover, front, Type 1068.

WARNING ...

During servicing do not make personal contact with any of the HIGH VOLTAGE points in the equipment.

3. Since it may be necessary during servicing to disconnect the mains supply to the equipment, it is preferable to test all the equipments in a stack at the same time. If this is not possible, remove the MAINS supply socket, at the rear of the equipment, during the periods when the receiver under test is withdrawn from its cover assembly. Before removing or refitting the MAINS socket ensure that the mains supply is off.

4. Keep the equipment free from dust by use of a vacuum cleaner and, where necessary, a soft camel-hair brush.

WARNING ...

Where an external blower, air, Type 7344 is being used and it is required to operate certain items of equipment in a stack whilst others are serviced, disconnect the air pipe of the item being serviced from the rear of the blower, air, Type 7344 and substitute a filter, air conditioning, 4130-99-194-8981 (Part 1, Sect.2, Chap.2). This is necessary to maintain forced air cooling to the operational equipment. When servicing is completed and the item is pushed back into its cover assembly, remove the filter from the outlet aperture of the blower and reconnect the air pipe.

Mechanical

5. With the mains supply to the equipment off (para.3), operate all switches and controls on the receiver front panel (except tuning controls RF AMP and HG which must not be disturbed) to ensure that they are mechanically serviceable. Return the switches and controls to their correct operational positions.

6. Release the four corner latches, turn the two handles outwards through 90° and withdraw the receiver unit from the cover assembly. Ensure that the equipment moves freely on the runners and that the locks on the runners hold the receiver firmly in each of the three locked positions.

7. While the receiver unit is withdrawn, conduct the following checks:-
- (1) Ensure that all sub-units are in position, secure and undamaged.
 - (2) Ensure that all plug and socket connections, including those at the rear of the receiver unit, are securely and correctly mated. Position the cables inside the cover assembly so that they are not damaged by movement of the receiver unit on the runners. Changing a cable assembly and positioning the cables is described in para.60.
 - (3) Verify that the gate switch in the cover assembly can be manually locked in the "on" position by pressing the knob at the side of the switch; the lock should automatically release when the switch is again pressed. Adjusting the gate switch is described in para.46.
 - (4) Inspect the external connectors at the rear of the receiver and ensure that they are undamaged; renew any frayed connectors. Pay particular attention to the coaxial cable between the receiver and the aerial plug board.
 - (5) Ensure that the orange-ringed 9-pole test plug is fitted to the orange-skirted socket on the power unit.

Electrical

Mains supply

8. Check that the mains tapping links on the power unit are set to the local a.c. mains supply. Reconnect the mains supply to the receiver.
9. Ensure that the amber lamp in the cover assembly above the gate switch is lit. Close the receiver unit into the cover; the front panel MAINS lamp should then light. Ensure that the runner locks engage, i.e. that the handles return to vertical. Secure the four corner latches.

Mains monitoring

10. Set the front panel METER SWITCH to position 7 (mains metering) and the MAINS SWITCH to ON. Ensure that the blue LT lamp lights and that the meter reads between 72 and 80. If the mains tapping links are correctly set, investigate immediately any deviation of the supply outside the specified limits. To check the accuracy of the built-in meter, measure the a.c. mains supply with a meter of known accuracy. If this confirms the accuracy of the front panel meter, inform the officer i/c the section that the mains supply is unsatisfactory so that action can be taken; otherwise the receiver must be serviced at 3rd line.

Delay system

11. The power unit contains a circuit which delays the application of h.t. to the receiver until the valves have heated up. Test as follows:-

(1) Starting from cold (at least 2 minutes after switching off) set the MAINS and HT switches to ON; the blue LT lamp should light.

(2) Ensure that between 30 and 70 seconds elapses before the red HT lamp lights.

Metering

12. The front panel meter and METER SWITCH provide for measuring certain voltages and currents in the equipment. The first seven METER SWITCH positions are permanent while the remaining five depend upon the position of the 9-pole metering plug. This plug may be fitted either to a socket on the drive unit radio or to a socket on the power unit; the latter is the normal stowage position for the plug.

13. The metering limits given in Table 1 are for guidance only; if a reading is outside the limits, check the overall performance of the receiver to establish serviceability. A metering label, in the cover over the LINE GAIN, RF GAIN and OFF-AGC-DF controls on the front panel, has a blank column for recording actual readings obtained (see notes in Table 1). Note that the limits given in the label should be ignored.

Note ...

The readings in Table 1 are taken with the receiver fully tuned and with an input signal of sufficient strength to operate the a.g.c. Note that certain readings are subject to variation with receiver frequency and input signal level.

TABLE 1

Readings taken with built-in meter

Switch position	Measurement	F.S.D.	Limits*	Remarks
PERMANENT METERING				
1	1st mixer I _k (1V3)	5mA	36 min.**	
2	Detector I _k (2V8)	200μA	56-74 **	Set to 66(para. 34) H.T. off: 12-22
3	A.G.C. indication	10mA	- **	
4	Line output	10V	-	
5	2nd mixer I _k (2V3)	10mA	50 min.**	
6	Drive unit output I _a (4V4)	25mA	- **	
7	Mains indication	300V	72-80	

TABLE 1 (contd.)

Switch position	Measurement	F.S.D.	Limits*	Remarks
POWER UNIT TYPE 7352				
8	255V h.t. current	500mA	20-30	
9	-48V bias	100V	46-54	Set to 48 (para. 15)
10	255V h.t. supply	500V	48-54	
11	Not used			
12	150V h.t. current	25mA	30-46	
DRIVE UNIT RADIO TYPE 7353				
8	Osc. Ik (4V1)	10mA	16-30 **	Non osc: 60
9	Amp. Ig (4V2)... ..	200 μ A	- **	Non osc: 0
10	Doubler Ig (4V3)	500 μ A	- **	Non osc: 0
11	Not used			
12	Output Ig (4V4)	1mA	- **	Non osc: 0

* These figures are only a rough guide; record actual figures for each receiver to compare with subsequent readings to establish serviceability. If a sub-unit or valve is changed, re-record the associated readings because the wide range of valve emission may cause differences in the readings.

** These readings will vary with frequency; when recording the readings, also record the frequency so that subsequent comparison of readings can be made at the same frequency.

14. If the receiver metering system is suspect, use the metering facilities of the test set Type 7618 for a comparison test. The test set can also be used with the receiver metering system to monitor two circuits simultaneously. Connect the test set to the metering socket of a sub-unit by an extension connector which is stowed in the base of the test set (Part 2, Sect.1, Chap.1). With its top cover open, suspend the test set from the supporting hooks on the side of the receiver unit by means of the angled rails on the test set front panel.

Adjustment of -48V output

15. An adjustment is provided on the power unit Type 7352 for setting the -48V output. If the meter reading at position 9 of the METER SWITCH is not correct, proceed as follows:-

(1) Withdraw the receiver unit from its cover assembly and manually lock the gate switch in the "on" position.

(2) When the HT lamp lights, loosen the locking screw of potentiometer 6RV7 on the power unit.

(3) Adjust 6RV7 for a reading of 48 on the front panel meter at METER SWITCH position 9; ensuring that the reading remains at the set value, secure the potentiometer locking screw.

16. If difficult to obtain the value in para.15, check that 6R18 (Mod. No.1950) is connected in circuit (See Part 1, Sect.1, Chap.3, fig.6).

Valve changing

General

17. If meter tests (para.13) show a fault on a particular sub-unit, check that all valve heaters are alight. With the equipment switched off, ensure that the valves are not mechanically damaged and are seated firmly in their holders.

Drive unit radio Type 7353

18. If any valves in the drive unit radio require renewal:-

(1) The oscillator valve (4V1) must only be changed where 3rd line facilities exist to carry out re-alignment.

(2) Changing the amplifier, doubler and output valves (4V2, 4V3 and 4V4) may affect alignment. If any of these valves are changed, fully tune the receiver to three frequencies, at top, middle and bottom of the band, and check the drive level at position 1 of the METER SWITCH; if the drive is not satisfactory the drive unit radio must be subjected to 3rd line servicing.

Amplifying unit (I.F.) Type 7112

19. All the valves in this sub-unit, with four exceptions, may be renewed without affecting alignment. The exceptions, and the adjustments required if any are changed, are as follows:-

(1) The 24 MHz amplifier (2V1). Re-adjust the output circuit of the amplifying unit (R.F.) Type 7111 and the input circuit of the amplifying unit (I.F.) Type 7112 (para.51).

(2) The mixer (2V3). Adjust the secondary core of the transformer 2T1 (located at the top of the transformer can) in a similar manner to that given in para. 51.

(3) The detector (2V8) and the a.g.c. amplifier (2V9). Re-adjust potentiometer 2RV1 (para.35 to 39).

Amplifying unit (R.F.) Type 7111

- ◀20. In order to reduce the high consumption of valves, electronic 5960-99-118-0243 used in the amplifying unit, a system of selection of these valves has been evolved; to assist this selection, valves with a noise factor of 9dB or less, during production testing, will be marked with a "red splash" at the seal off pip of the valve.

Note ...

A valve tester must not be used since this does not give a true indication of the suitability of a valve for use in the amplifying unit.

20a. When selecting valves, they must be fitted and tested in the amplifying unit (R.F.) in accordance with para. 20b and 21. The selection procedure is as follows:-

(1) Unmarked valves. These should all be tested in the V1 position, any failures being retained for testing in the V3 position; valves that fail in this position should be retained for testing in the V2 position. Any valve failing in all three positions should be retained for possible use in V2 or V3 positions in other amplifying units (R.F.) Type 7111 or in amplifying units (R.F.) Type 7111A (see A.P.116E-0731-1).

(2) Marked (red splash) valves. These should be suitable for use in V1 position of all amplifying units (R.F.), but, due to individual characteristics of the r.f. stages in some amplifiers, some marked valves may be found to be unsuitable in the V1 position; any such valves should be retained for testing in the V3 or V2 positions in the same manner as unmarked valves (sub-para.(1)).▶

20b. The procedure for renewing a faulty valve in the amplifying unit (R.F.) is as follows:-

(1) Remove the amplifying unit from the chassis assembly Type 7354 (para.50).

(2) Remove the screening can from the section containing the faulty valve.

(3) Extract two 6 B.A. cheese-head screws which secure the anode connecting bracket to the stator assembly and remove the bracket and valve.

(4) Unscrew the retaining ring which secures the anode flange of the valve to the anode connecting bracket and extract the valve.

(5) Fit the new valve by reversing sub-para.(2) to (4).

21. After renewing a faulty valve, re-align and test the amplifying unit (R.F.) as follows:-

- (1) With the amplifying unit removed from the chassis assembly, couple the r.f. connectors of the unit to their respective mating components in the receiver; to achieve this, support the unit on a suitable insulating board placed across the chassis side-frames.
- (2) Connect 1PL9 of the amplifying unit to 5SKT9 of the chassis assembly using the 8-way connector (Ref.No. 10HS/37) which is stowed in the base of the test set Type 7618 (Part 2, Sect.1, Chap.1).
- (3) With its SUPPLY switch OFF, connect the noise generator CT207 to the a.c. mains supply. Couple the NOISE POWER OUTPUT plug on the noise generator to the receiver aerial connector (para.25).
- (4) Manually operate and lock the gate switch in the receiver cover assembly and set the receiver MAINS and HT switches to ON. When the red HT lamp lights set the receiver to 399.9 MHz, as described in Part 1, Sect.1, Chap.2, para.6, 14 and 16, using a ZDR 17662.5 MHz crystal.
- (5) Set the METER SWITCH to position 2 and turn the tuning capacitor of the amplifying unit, by means of the fork coupling, fully counter-clockwise.
- (6) Slowly turn the tuning capacitor clock-wise until a second peak is indicated on the meter; this peak should occur with the rotor positioned as in fig.1 (remove the first section screening can to verify the rotor position, then refit the can immediately).

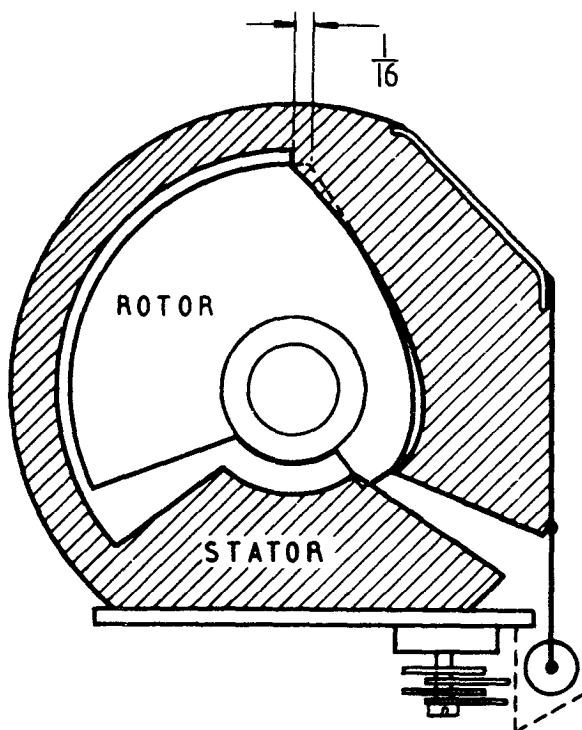


Fig.1. Position of rotor at 399.9 MHz.

(7) Turn the receiver RF GAIN control fully counter-clockwise and then set the noise generator controls as follows:-

SUPPLY switch to ON
DIODE CURRENT switch to +10dB 100mA
SET DIODE CURRENT control to give about half-scale deflection on the DIODE CURRENT meter
TIMER switch to 6 MINUTES

(8) Adjust the receiver RF GAIN control for about half-scale deflection on the meter and then adjust 1C22, 1C15 and 1C10 of the amplifying unit, using an alignment tool Type 4 for peak reading on the meter (re-adjust the RF GAIN control to keep the meter reading at a convenient level). To ensure accuracy of alignment repeat the adjustment of 1C15, 1C22 and 1C10 at least once.

(9) Set the noise generator SUPPLY switch and the receiver MAINS switch to OFF.

(10) Uncouple the r.f. connectors of the amplifying unit from their mating components in the receiver. Disconnect the 8-way connector from 1PL9 and 5SKT9 and stow it in the base of the test set Type 7618.

(11) Refit the amplifying unit into the receiver (para.50).

(12) With the receiver unit closed into its cover assembly and fully operational, check the permanent metering (para.13).

(13) Check the noise factor (para.22 to 33), or the signal to noise ratio (para.34), at 225 MHz, 300 MHz and 399.9 MHz.

Measurement of noise factor

22. Use the noise generator CT207 to measure the noise factor of the receiver; information on the noise generator is given in A.P.2563DT.

23. With the receiver correctly tuned to its operating frequency, or to a frequency at about the middle of the band, set the front panel controls as follows:-

OFF-AGC-DF switch to OFF
MUTING switch to OFF
MONITOR GAIN control fully clockwise (max gain)
RF GAIN control fully counter-clockwise (min gain)

24. With the SUPPLY switch of the noise generator CT207 at OFF, connect the noise generator to the a.c. mains supply and interconnect the MONITOR OUTPUT jack of the receiver and the AUDIO POWER INPUT jack of the noise generator, using the appropriate connector supplied.

25. Disconnect the aerial lead to the receiver at the aerial plug board and couple it to the connector Type D257/20A/RI (Chap.1); fit the other end of this connector to the NOISE POWER OUTPUT plug on the noise generator.

26. Set the noise generator controls as follows:-

AUDIO POWER switch to +0dB 5mW
SET DIODE CURRENT control fully counter-clockwise
DIODE CURRENT switch to OFF
SUPPLY switch to ON

27. Slowly increase the receiver RF GAIN control until a reading of 2mW is obtained on the AUDIO POWER METER of the noise generator.

28. Reset the noise generator controls as follows:-

DIODE CURRENT switch to +10dB 100mA
TIMER switch to 6 MINUTES
SET DIODE CURRENT control to obtain a 4mW reading
on the AUDIO POWER METER

29. Check the settings of the receiver RF GAIN control and the noise generator SET DIODE CURRENT control by setting the DIODE CURRENT switch to OFF and ensuring that the AUDIO POWER METER reads 2mW, and then resetting the DIODE CURRENT switch to +10dB 100mA and ensuring that the AUDIO POWER METER reading returns to 4mW.

30. Determine the noise factor by adding 10dB to the reading on the DIODE CURRENT METER.

Note ...

When measuring noise factor, start on the high range (+10dB 100mA) to protect the DIODE CURRENT METER from overload. Also, on changing the DIODE CURRENT switch to another range, recheck the settings of the receiver RF GAIN control and the noise generator SET DIODE CURRENT control (para.29).

31. If the total noise factor is between 11dB and 15dB (readings of 1dB and 5dB respectively), greater accuracy can be obtained by using the +4dB 25mA range and adding 4dB to the reading. If the total noise factor is less than 11dB (1dB reading) use the +0dB 10mA range and read the noise factor direct.

32. On completion of the noise factor measurements set the noise generator SUPPLY switch to OFF.

33. A noise factor not exceeding 16dB should be obtained; a higher figure indicates the need for more detailed servicing. Keep a log of noise factor readings for each receiver so that any deterioration can be detected.

◀Signal to noise ratio

34. The measurement of signal to noise ratio may be performed as an alternative test to the noise factor measurement (para.22 to 33) in checking the overall performance of the amplifying unit. The procedure is as follows:-

- (1) Connect the output of the signal generator CT584 to the receiver aerial input and connect the wattmeter CT44 to the receiver MONITOR OUTPUT jack. Set the wattmeter to the 200mW range and the input impedance to 600 ohms.
- (2) Connect the signal generator to the a.c. mains supply, switch on the receiver and signal generator and allow a 15 minute warm up period.
- (3) Set the receiver METER SWITCH to position 2 and the OFF-AGC-DF and MUTING switches to OFF.
- (4) Tune the receiver to 225 MHz for maximum reading on the receiver meter, reducing the R.F. GAIN control setting as necessary.
- (5) Set the signal generator output to 5 μ V, amplitude modulated 30%, and then tune the signal generator and receiver for maximum reading on the wattmeter, adjusting the MONITOR GAIN control as necessary.
- (6) Adjust the R.F. GAIN control to give a reading of 50-60 on the receiver meter and adjust the MONITOR GAIN control for a level of 100mW on the wattmeter.
- (7) Switch off the modulation of the signal generator and note the fall in the wattmeter reading in dB. The fall in audio output shall be not less than 12dB.
- (8) Repeat sub-para.(4) to (7) at 300 MHz and 399.9 MHz.▶

Detector current adjustment

35. The potentiometer 2RV1, on the amplifying unit (I.F.) Type 7112, controls the delay voltage of the a.g.c. amplifier (2V9). This control is adjusted for a meter reading of 66 at METER SWITCH position 2 (detector current) with an input to the receiver sufficient to cause a.g.c. The a.g.c. characteristic of the receiver is such that the input to the detector will remain almost constant once the a.g.c. delay has been overcome.

36. Interconnect the receiver and the noise generator CT207 (para.24 and 25) and tune the receiver to its operational frequency, or to a frequency at about the middle of the band. Detune the RF AMP control and set the receiver front panel controls as follows:-

- OFF-AGC-DF switch to AGC
- MUTING switch to OFF
- MONITOR GAIN control fully counter-clockwise (min gain)

RF GAIN control fully clockwise (max gain)
METER SWITCH to position 3 (a.g.c. indication)

37. Set the noise generator controls as follows:-

AUDIO POWER switch to +20dB 500mW
SET DIODE CURRENT control fully counter-clockwise
DIODE CURRENT switch to +10dB 100mA
SUPPLY switch to ON
TIMER switch to 6 MINUTES

38. Note the reading on the receiver meter. Retune the RF AMP control and increase the SET DIODE CURRENT control on the noise generator until the meter reading decreases by 15.

39. Set the receiver METER SWITCH to position 2; a meter reading of 66 should be obtained. If the meter reading is not correct, locate and unlock the screwdriver control 2RV1 on the amplifying unit (I.F.). Adjust 2RV1 to obtain a meter reading of 66 and then secure the lock. Switch off the noise generator CT207.

I.F. gain

40. Provided that the noise factor (para.22 to 33) is satisfactory, a simple test can be conducted to verify that there is sufficient i.f. gain; the procedure is as follows.

- (1) Detune the RF AMP control and ensure that the RF GAIN control is turned fully clockwise.
- (2) Note the reading on the receiver front panel meter at METER SWITCH position 2.
- (3) Uncouple 1PL10 from 2SKT10 of the amplifying unit (I.F.) Type 7112 the meter reading should decrease by at least 25%. Reconnect 1PL10 to 2SKT10.

Crystal oven temperature

41. Check and where necessary adjust the temperature within the crystal oven using the temperature tester and the test oven and cover (Chap.1). A thermometer is unsuitable. Proceed as follows:

- (1) Switch off the receiver.
- (2) Remove the oven cover and oven and fit crystals (the frequency is immaterial) into the WORKING and SPARE sockets.
- (3) Attach the thermocouple of the temperature tester to the side of the crystal in the SPARE socket, ensuring that good thermal contact is made, then securely fit the test oven and cover.

(4) Switch on the receiver and temperature tester and allow the oven temperature to stabilize for at least 30 minutes.

(5) Note the temperature excursion of the crystal oven over four complete cycles. The mean temperature shall be $75^{\circ}\text{C} \pm \triangle 1.5^{\circ}$. ▶

(6) If the mean temperature is outside the limits of (3) adjust 18RV1 on the oven control module. Rotate clockwise to increase the temperature or vice versa. A variation of 1°C is provided by 2.3 turns of the screw.

(7) After adjusting 18RV1, check the mean temperature as in (3). Repeat this procedure until the temperature is satisfactory.

(8) If difficult to adjust the temperature, there may be a faulty heater, crystal oven, thermistor or control module. After changing a faulty item, recheck and readjust the temperature.

(9) Switch off the receiver and remove the test cover, oven, thermocouple and crystals.

Frequency test

42. Whenever frequency drift is suspected, or if trimmer 4C4 has been inadvertently altered, check the frequency of the drive unit output and, if necessary, 4C4 realigned. Proceed as follows:

(1) Switch off the receiver.

(2) Remove the crystal oven cover and fit the ZDM/17661.1 crystal into the WORKING socket.

(3) Refit the oven and cover.

(4) Set receiver METER SWITCH to position 1 and adjust HG for maximum reading on the front panel meter at 293.9 MHz.

(5) Uncouple 1SKT15 from 4PL15 on the drive unit and couple the frequency counter, via its coaxial connector, to 4PL15. Check that the frequency indicated on the frequency counter is within ± 3.3 kHz of six times the crystal frequency (i.e. 105.966666 MHz).

(6) If the frequency is outside the limits of (3) uncouple the counter from 4PL15 and reconnect 1SKT15 to 4PL15, change the crystal, retune the drive unit as in (2) and repeat the frequency check of (3).

(7) If the frequency is still outside the limits proceed as in (8) to (12).

(8) Switch off the receiver.

(9) Remove the crystal oven cover, oven

and the ZDM/17661.1 crystal and fit the ZDM/16111.1 calibrated crystal into the WORKING socket, noting the turnover frequency marked on the crystal.

(10) Refit the oven and cover, switch on the receiver and allow 15-minute warm-up.

(11) With 1SKT15 connected to 4PL15 and receiver METER SWITCH set to 1, adjust HG for maximum reading on the front panel meter at 266 MHz.

(12) Connect the frequency counter to the drive unit as in (3) and observe the frequency excursion indicated on the counter through four cycles of the crystal oven temperature. Note the maximum frequency.

(13) As the frequency just reaches the maximum noted in (12) adjust 4C4 (adjacent to 4V1) to set the maximum frequency to be within ± 12 Hz of six times the turnover frequency noted in (9).

(14) Switch off the receiver.

(15) Remove the crystal oven cover, oven and calibrated crystal, fit the ZDM/17661.1 crystal and refit the oven and cover.

(16) Switch on the receiver and allow to warm-up for 15 minutes.

(17) With 1SKT15 connected to 4PL15, tune the drive unit as in (2) and check the frequency as in (3). If the frequency is outside the limits check and, where necessary, readjust the oven temperature (para.41) and then repeat the frequency check.

(18) Switch off the receiver, remove the crystal oven cover, oven and crystal and refit the oven and cover.

(19) Disconnect the frequency counter.

Removing and refitting a receiver unit

43. The procedure for removing a receiver unit from its cover assembly is as follows:—

(1) Ensure that the MAINS switch on the receiver front panel is OFF and that the mains supply is disconnected (para. 3).

(2) Fully withdraw the receiver from its cover assembly, release the two captive bolts at each of the two front panel handles and allow the receiver unit to slide forward to the extent of the slots in the runners.

(3) Uncouple the connectors of the cable assembly Type 9097 from the receiver chassis, removing the r.f. cables from the spring clip at the rear of the chassis.

(4) Carefully lift the receiver unit from the runners and clear of the cover assembly by first pivoting the front of the unit upwards through approximately 30°; this ensures that the components at the rear of the receiver chassis are clear of the top of the cover assembly. Due to the weight of the unit, an assistant will be required for the lifting operation.

Note . . .

Before refitting a receiver unit it is important to ensure that the cables of the cable assembly Type 9097 are correctly positioned to receive the unit. They must lie flat in the bottom of the cover assembly and should be completely free from any acute bends, kinks or twists. When positioning the cables, ensure that no cable is rotated through 360 degrees as this will permanently damage the cable. The cables are shown in their correct positions in fig 2 (para. 60); ensure that they are dressed in the sequence illustrated and that they cross only at the points indicated in the illustration.

44. When refitting a receiver unit into a cover assembly, the following procedure should be adopted: —

(1) Ensure that each runner is positioned in the cover assembly so that, when the runner is in its closed position and pulled forward against its latch, the front face of the runner is $\frac{1}{8}$ in. behind the front of the sealing gasket of the cover assembly. Each runner is secured in the cover assembly by two bolts which pass through elongated holes in the runner, allowing a degree of adjustment to achieve correct positioning of the runners.

(2) On each runner, position the top adjusting nut so that it is $\frac{1}{2}$ in. from the runner face; screw up the bottom adjusting nuts against the runner face without using undue pressure.

(3) Release the locking nut on the gate switch operating bolt on the receiver unit and screw the bolt through the front panel until at least $\frac{3}{4}$ in. of the threaded portion projects from the front of the front panel. When the receiver unit has been fitted, this bolt must be reset (para. 46).

(4) With the runners fully extended, lower the receiver unit into place with the rear edge pivoted downward through approximately 30°. The handles on the front panel must be positioned vertically to allow the pins on the runner locking rods to engage the slots at the rear of the handles. Care must be taken to ensure that the brackets on the chassis side-frames fit over the projections at the ends of

the runners, otherwise the runners may spring outwards, allowing the unit to fall between them.

(5) Couple the connectors of the cable assembly to the receiver unit in the sequence shown in fig. 2, ensuring that each is correctly aligned before tightening the clamping ring. Fit the r.f. cables into the spring clip at the rear of the chassis.

(6) On the receiver unit, screw up the top fixing bolt at each handle sufficiently to secure the runner; engage the threads of the bottom bolts but do not tighten.

(7) Close the receiver unit into the cover assembly. The latches of both runners should engage when the front panel is tight against the gasket; re-position the top adjusting nuts on the runners as necessary to achieve this action.

(8) With the receiver unit withdrawn, screw forward the bottom adjusting nuts until they touch lightly on the inside of the front panel, then tighten the bottom securing bolts into the runners.

(9) Reset the gate switch operating bolt (para. 46).

45. The corner latches on the cover assemblies of later production equipments have adjustable hexagon head swivel bolts. For storage and transit purposes the latches should be engaged with the front panel latch plates and the bolts tightened to prevent movement of the receiver unit inside the cover assembly; excessive tightening should be avoided or the bolts may be damaged. For normal use the latch bolts should be slackened just sufficiently to enable the latches to be operated by normal finger pressure.

Gate switch adjustment

46. When the receiver unit Type 9096 is closed into its cover assembly, the gate switch inside the cover should be automatically operated, by a striker bolt which is screwed into the receiver unit front panel, causing the front panel MAINS (amber) lamp to become illuminated. In the event of unsatisfactory operation, the striker bolt must be adjusted in the following manner: —

(1) Ensure that the receiver unit is correctly positioned on its runners (para. 44).

(2) With the receiver unit withdrawn from its cover assembly, release the locking nut of the gate switch striker bolt at the rear of the left-hand side of the front panel and, using a screwdriver, turn the bolt counter-clockwise from the front of the front panel, until the bolt is withdrawn to its fullest extent.

(3) Manually operate and lock the gate switch and close the receiver unit into its cover assembly.

(4) Using a screwdriver, slowly turn the striker bolt clockwise, from the front of the front panel. Until the locking device on the gate switch is heard to release; give the bolt a further turn clockwise. Ensure that the front panel MAINS (amber) lamp is illuminated.

(5) Withdraw the receiver unit from its cover assembly and ensure that the front panel MAINS lamp is extinguished. Tighten the locking nut of the striker bolt and then fully close the receiver unit into its cover assembly and ensure that the MAINS lamp is again illuminated.

47. If the gate switch is found to be unserviceable, the cable assembly Type 9097 must be changed (para. 60).

Removing and refitting sub-units

48. The chassis assembly Type 7354 provides a mounting for all other sub-units of the receiver unit Type 9096. The position and prefix number of each sub-unit is stencilled on the chassis base. The multipole sockets on the base of the chassis are spring-loaded to compensate for mechanical tolerances in the chassis assembly and the sub-units.

49. The chassis assembly has a hinged top cover secured by six cheesehead screws. With the cover hinged upwards all sub-units except the power unit can be removed for the power unit removes the top cover by extracting the two hinge bolts. The top cover strengthens the equipment so must always be refitted after servicing;

Amplifying unit (R.F.) Type 7111

◀ WARNING

When H.T. switch is OFF, 180V d.c. is still applied to the valves in the amplifying unit (R.F.).▶

50. This unit can be removed as follows:—

(1) Uncouple 1SKT4 from 5PL4 on the chassis assembly. 1PL10 from 2SKT10 on the amplifying unit (I.F.) and 1SKT15 from 4PL15 on the drive unit radio.

(2) Turn the RF AMP tuning control so that the pin of the coupling is at its lowest point.

(3) Release the three green-ringed captive screws which secure the amplifying unit (R.F.) to the chassis and lift out the unit.

(4) To refit the unit, reverse the instructions in sub-para. (1) to (3), ensuring that the fork coupling on the amplifying unit (R.F.) engages correctly with the pin on the tuning control.

51. If a replacement amplifying unit (R.F.) is fitted, the following realignment procedure must be carried out using the alignment tools Type 2 and Type 3 (Ref. No. 10AG/78 and 10AG/79)

which are clipped to the inside of the top cover (para. 49).

(1) Fully tune the receiver either to the frequency on which it is to operate, or to a frequency at about the middle of the band.

(2) Set the receiver front panel controls as follows:—

OFF-AGC-DF switch to OFF

MUTING SWITCH to OFF

METER SWITCH to position 2 (detector current)

RF GAIN control fully clockwise (maximum gain)

(3) Adjust the cores of inductors 1L11 and 2L1 for peak meter reading; the core of 1L11, in the amplifying unit (R.F.), is accessible through a hole in the underside of the chassis while the core of the 2L1 is accessible from the top of the amplifying unit (I.F.).

Amplifying unit (I.F.) Type 7112

52. To remove the unit, first disconnect 1PL10 from 2SKT10 and 5SKT8 from 2PL8, then release the four green-ringed captive screws and withdraw the unit. To refit the unit, reverse the above procedure.

53. When a replacement amplifying unit (I.F.) is fitted it will be necessary to carry out the alignment procedure in para. 51 and also to adjust the detector current (para. 35 to 39).

Amplifying unit (A.F.) Type 7113

54. Release the four green-ringed captive screws and withdraw the unit; reverse this procedure for refitting.

Drive unit radio Type 7353

55. The procedure is as follows:—

(1) Uncouple 1SKT15 from 4PL15 on the drive unit radio.

(2) Turn the HG tuning control so that the pin of the coupling is at its lowest point.

Caution . . .

Ensure that the receiver mains supply is switched off before removing the drive unit radio from the chassis because the oven temperature control module operates from a floating 115V a.c. and earthing any part of the circuit can cause irreparable damage.

(3) Release the four green-ringed captive screws and lift out the drive unit radio.

(4) To refit the unit, reverse the instructions in sub-para.(1) to (3), ensuring that the fork coupling on the drive unit radio engages correctly with the pin on the tuning control.

Panel, electronic circuit

56. To remove the panel, electronic circuit (con-

trol module):

- (1) Remove the drive unit radio (*para. 55*).
- (2) Unsolder the wiring connections (using a thermal shunt) from the six terminations on the panel, noting the connections.
- (3) Remove three 6BA cheesehead screws and washers securing the panel to its mounting bracket on the drive unit radio and separate the panel from the bracket.
- (4) Fit a control module by reversing removal.

Power unit Type 7352

57. Proceed in the following manner:—

- (1) Remove the hinged top cover (*para. 49*).
- (2) Uncouple 5PL16 from 6SKT16 and 5SKT17 from 6PL17 and remove the 9-pole metering plug from the power unit socket.
- (3) Release the seven green-ringed captive screws and lift out the power unit.
- (4) Refitting the power unit is achieved by reversing sub-para. (1) to (3). If a replacement power unit is fitted, metering tests (*para. 13*) should be performed to establish serviceability, with particular attention being paid to the - 48V output (*para. 15*).

Chassis assembly Type 7354

58. To remove the chassis assembly it is first necessary to remove the complete receiver from the cover assembly (*para. 43*) and then remove all sub-units from the chassis assembly (*para. 48 to 57*). Refitting the chassis assembly is the reverse.

59. It is essential, after renewing any sub-units detailed in *para. 48 to 58* to carry out metering tests (*para. 13*) to establish the serviceability of the equipment.

Cable assembly Type 9097

60. The procedure for changing a cable assembly is as follows:—

- (1) Remove the receiver unit from its cover assembly (*para. 43*).
- (2) Disconnect the air cooling pipe, if fitted (*para. 4*).
- (3) Uncouple the external connectors from the rear of the cable assembly.
- (4) Supporting the gate switch assembly, remove the two 4 BA screws which secure it to the side of the cover assembly and release the three cable clamps securing the gate switch cable along the side of the cover assembly above the runner.
- (5) Release the earthing braids of

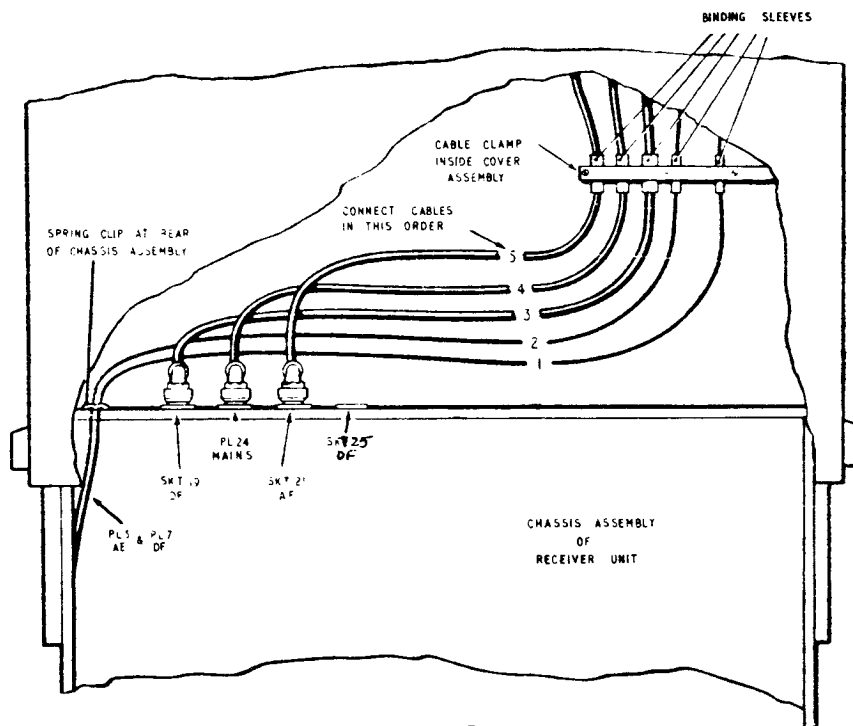


Fig. 2. Arrangement of cables inside cover assembly

cable assembly from their anchoring nuts at the sides of the cover assembly. Release the clamp over the cables on the floor of the cover assembly.

(6) Supporting the cable assembly with one hand, remove the twenty 4 B A countersunk screws which secure it to the cover assembly; withdraw the complete cable assembly, with its gasket, through the front opening of the cover assembly. Place all the fixing screws, cable clamps, gasket, etc., in an accessory bag and tie the bag to the cable clamp bracket on the cable assembly.

(7) When fitting a new cable assembly the procedure given in sub-para. (8) to (13) should be adopted. The necessary screws, cable clamps, gasket, etc., for installing the cable assembly, are contained in an accessory bag which is tied to the cable clamp bracket on the cable assembly.

(8) Pass the cable assembly through the front opening of the cover assembly and, ensuring that the gasket is carefully and correctly positioned between the panel of the cable assembly and the rear wall of the cover assembly, secure the cable assembly panel with the twenty 4 B A countersunk screws.

(9) Carefully secure the cables in the cable clamp in the positions shown in fig. 2. Each cable must be clamped in the centre of its rubber binding with the word TOP uppermost; these bindings must not be re-positioned along the cables. The cables must lie flat in the bottom of the cover assembly and it is essential that they are completely free from acute bends, kinks or twists. When aligning the connectors it is important that no cable should be rotated through 360° as this would permanently damage the cable.

(10) Secure the cable assembly earthing braids to the anchoring nuts in the cover assembly.

(11) Secure the gate switch assembly to the

side of the cover assembly, using the two 4 B A screws, and fasten the gate switch cable to the left-hand side of the cover assembly above the runner, using the three cable clamps.

(12) Couple the external connectors to their mating components at the rear of the cable assembly and fit the air cooling pipe (if required).

(13) Refit the receiver unit into its cover assembly (para. 44).

Cover assembly

61. If a cover assembly becomes unserviceable, it must be renewed as follows:—

(1) Uncouple the external connectors at the rear of the cover assembly to be changed and also of those equipments in the stack above the unserviceable cover assembly.

(2) Remove the receiver unit from the cover assembly (para. 43) and then remove the cable assembly Type 9097 (para. 60(2) to (6)).

(3) Release the securing bolts of the cover assemblies of the equipments above that being changed and remove these upper units from the stack; release the securing bolts of the unserviceable cover assembly and remove it from the stack.

(4) Place the new cover assembly in position on the stack and tighten the securing bolts.

(5) Refit the remaining equipments on to the stack and fully tighten their securing bolts.

(6) Refit the cable assembly (para. 60 (8) to (12)) and then refit the receiver unit (para. 44).

(7) Couple all the external connectors, removed in sub-para. (1), to their respective equipments.

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A.L.13, May 59

SECTION 2

ANCILLARY EQUIPMENT

Chapter 1
(Completely revised)

SERVICING OF ANCILLARY EQUIPMENT

CONTENTS

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Fan assembly Type 9672	1

Introduction

1. Ancillary equipments used with the u.h.f. ground equipments are:-

- (1) Pedestal, cabinet electrical equipment (5820-99-932-5711); originally known as mounting (plinth) Type 7872 and described in Part 1. Sect.1, Chap.5. For some time there will be items of this equipment in use bearing the original title while others will bear the new title.
- (2) External interconnecting cables.
- (3) Test set, Type 7618.
- (4) Blower, air, Type 7344.

PEDESTAL OR MOUNTING PLINTH

2. The pedestal or mounting plinth is illustrated in Part 1, Sect.1, Chap.5, fig.1, 2 and 3. The equipment should be examined periodically to ensure that it is not damaged mechanically. The terminals of the power supplies should be tested to ensure that they are tight. The soldered connections of the a.f. leads should be examined for security and serviceability.

EXTERNAL CONNECTORS

3. The external connectors, including any surplus coiled in the base of the pedestal, should be examined to ensure freedom from kinks, fraying or other mechanical damage. Plugs and sockets should be examined to ensure that they are secure and screwed up tightly.

TEST SET TYPE 7618

4. The test set Type 7618 is described and illustrated in Part 2, Sect.1, Chap.1; it should operate for long periods without much attention and, therefore, periodic servicing should be limited to a minimum. The test set and its associated connectors should be visually examined to ensure that they are not damaged mechanically.

5. The switches on the test set (Part 2, Sect.1, Chap.1, fig.2) should be operated to their various positions to ensure mechanical serviceability. It is important that the meter circuit is reliable; this can be tested against either another test set or the built-in metering system of any of the u.h.f. ground equipments.

BLOWER, AIR, TYPE 7344

6. The blower, air, Type 7344 is described in Part 1, Sect.2, Chap.2; it should be examined periodically to ensure that it is not damaged mechanically. The air filter should be cleaned regularly (para.10 and 11).

Fuse

7. Examine the fuse on the blower front panel (Part 1, Sect.2, Chap.2, fig.1) to ensure that it is serviceable and of the correct rating. The ratings are 1A (5920-99-911-8319) for a mains supply of 200 - 250V and 2A (5920-99-911-8320) for a mains supply of 105-130V.

Runners

8. The fan assembly Type 9672 should move smoothly on the runners supporting it in the cover assembly (Part 1, Sect.2, Chap.2, fig.2). The operation of the runners should be tested as follows:-

- (1) Release the four latches at the corners of the cover assembly.
- (2) Move the fan assembly backwards and forwards on its runners to ensure that they are serviceable.
- (3) Withdraw the fan assembly to its fullest extent; the locks on the runners should prevent the complete withdrawal of the assembly.
- (4) Release the locks and close the assembly into its cover; secure the four corner latches.

Fan assembly Type 9672 - removal and refitting

9. The procedure for removing the fan assembly Type 9672 (fig.1) from the cover assembly is as follows:-

- (1) Disconnect the mains supply from the blower, air, Type 7344 by removing the mains input socket at the rear of the cover assembly.
- (2) Release the four corner latches of the cover assembly and ensure that the fan assembly Type 9672 moves freely on its runners. Withdraw the fan assembly to its fullest extent.

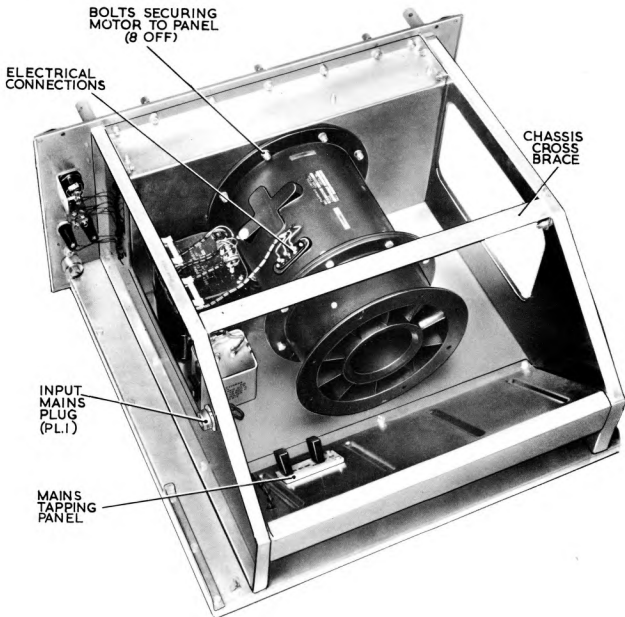


Fig.1. Fan assembly Type 9672

(3) Remove the mains supply socket from the plug on the side panel of the fan assembly (fig.1).

(4) Lift the locks on the side of the runners (Part 1, Sect.2, Chap.2, fig.2) and, with the aid of an assistant, lift the fan assembly clear of the cover assembly.

(5) To fit the fan assembly Type 9672 into the cover assembly, reverse the instructions of sub-para.(1) to (4), ensuring that the runners operate smoothly and that the runner locks operate correctly.

Air filter - cleaning

10. Clean the air filter (4130-99-999-2652) regularly to avoid overheating, every 100 hours or weekly (whichever is the shorter), as follows:-

- (1) Release the six screws securing the cover of the filter to the air blower front panel and withdraw the filter from its housing.
- (2) Place the filter on a flat surface with the air intake side downwards and tap the sides of the filter to dislodge the dirt.
- (3) Refit the filter by reversing the removal, ensuring that the arrow (stencilled on the right-hand side of the top edge of the filter) is pointing towards the equipment; the arrow indicates direction of airflow.

11. In addition the filter must be periodically washed and re-impregnated with oil at three-monthly intervals, except where local climatic and environmental conditions cause excessive contamination when monthly cleaning is essential. Assessment of the degree of contamination shall be by the officer i/c the section. Proceed as follows:-

- (1) After cleaning (para.10) and before refitting, immerse and agitate the filter in a 5% (by weight) tepid solution of "Teepol" in water.

CAUTION ...

Do not clean the filter with very hot water, steam jet or chlorinated solutions (i.e. trichlorethylene etc.) as deterioration of the filter medium will result.

- (2) Thoroughly drain and dry the filter.
- (3) Oil the external surface of the filter medium VERY LIGHTLY by brushing or spraying with oil OM-33 (H-576).

Motor removal and refitting

12. (1) Remove the fan assembly from the cover assembly (para.9(1) to (4)).

(2) Note the colour coding of the three electrical connections to the motor (fig.1); unsolder these connections.

(3) Remove two screws, nuts and washers at each end of the chassis cross brace and remove the brace.

(4) Remove eight screws, nuts and washers securing the motor to the front panel.

(5) Remove four screws, nuts and washers securing the feet of the motor to the chassis and remove the motor. If the motor is in need of repair it must be returned for third line servicing (Topic 6).

(6) To fit the motor reverse the instructions of sub-para. (1) to (5), ensuring that the electrical connections are correct.

Final check

13. With the fan assembly Type 9672 fully closed and secured in its cover assembly, switch on the blower, air Type 7344 and ensure that air is drawn in via the air inlet at the front and expelled via the outlets at the rear. Ensure that the noise level of the blower is not unduly high. Switch off the power.

PART 3

FAULT DIAGNOSIS

SECTION I

RECEIVER TYPE R.735I

Chapter 1

GENERAL FAULT FINDING

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Fig.

Routing of mains supply 1

WARNING . . .

When operating the receiver while it is withdrawn from its cover assembly, care must be taken to avoid personal contact with any of the high voltage points thus exposed.

Introduction

1. The information contained in this chapter is intended as a guide to the location of simple faults

and should be used in conjunction with the minor servicing chapter (Part 2, Sect. 1, Chap. 2). In the subsequent information it is assumed that the mains a.c. supply is present at the wall switch controlling the unserviceable equipment. It is also assumed that the major unit is withdrawn from or closed into its cover assembly as required.

2. Details of the sub-units, together with their prefix numbers and abbreviated titles, which are used in the subsequent tabulated fault finding in-

formation, are as follows:—

Item	Abbreviation	Prefix No.	Part	Reference		fig.
				Sept.	Chap.	
Mounting plinth Type 7872	Plinth	—	1	1	5	3
Amplifying unit (R.F.) Type 7111	R.F. amp. 7111	1	1	1	3	2
Amplifying unit (I.F.) Type 7112	I.F. amp. 7112	2	1	1	3	3
Amplifying unit (A.F.) Type 7113	A.F. amp. 7113	3	1	1	3	4
Drive unit radio Type 7353	D.U.R. 7353	4	1	1	3	5
Chassis assembly Type 7354	Chassis 7354	5	1	1	3	7
Power unit Type 7352	P.U. 7352	6	1	1	3	6
Cable assembly Type 9097	Cable assy. 9097	7	1	1	5	5
Panel, electronic circuit 5999-99-618-3280	P.E.C.	18	1	1	3	8

Note . . .

The voltage readings quoted in this chapter are not mandatory and are intended only as a guide when servicing. It is advocated that the figures for a particular equipment be recorded so that comparison can be made with subsequent readings to establish serviceability. If a valve or sub-unit is changed the associated readings should be recorded; this is because the readings may differ due to the wide range of valve emission.

3. To simplify fault finding it is recommended that efforts should first be made to locate the faulty sub-unit; suspected sub-units should be removed in accordance with the instructions contained in Part 2, Sect. 1, Chap. 2 and known serviceable items substituted. This provides a relatively rapid means

of confirming the serviceability of those sub-units which have not been changed.

4. The receiver incorporates its own metering system (Part 2, Sect. 1, Chap. 2) which should be used to assist in locating a faulty sub-unit and, in some instances, the faulty section of a sub-unit. A number of indicator lamps are included in the equipment and these also serve as an aid to the location of faults. In the event of a complete failure of the receiver Type R7351, all the switches should be set to their OFF positions and then set individually to their ON positions in the sequence given in Table 1 which lists the possible causes of the non-operation of an indicator lamp; in each case it should be first ascertained that the lamp itself is serviceable. Table 1 should also be used in conjunction with fig. 1 which shows a simplified circuit of the routing of the a.c. mains supply to the receiver.

TABLE 1
Faults indicated by non-operation of lamps

Switch operation	Indicator lamp	Possible fault if lamp does not light
A.C. mains wall switch	71LP1 (amber) in cover assembly	(i) Plinth fuse (ii) Connections on mains terminal panel of plinth (iii) External connectors (iv) Cable assy. 9097 (7PL23 or resistor 7R1)
Gate switch (7S1) in cover assembly	MAINS (amber) 51LP3 on receiver front panel	(i) Gate switch (ii) Cable assy. 9097 (7SKT24-7PL23) (iii) Resistor 5R12
MAINS (5S5) on receiver front panel	LT (blue) 51LP1 on receiver front panel	(i) MAINS switch (ii) MAINS fuse 5FS1 (iii) Mains tapping links on P.U.7352 (iv) LT fuse 6FS4 in P.U. 7352
HT (5S4) on receiver front panel	HT (red) 51LP2 on receiver front panel (after approx. 1 min. delay)	(i) HT switch (ii) HT fuse 6FS5 on P.U. 7352 (iii) LT fuse 6FS1 on P.U. 7352 (iv) 48V fuse 6FS6 on P.U. 7352 (v) LT fuse 6FS4 on P.U. 7352 (vi) Delay switch 6S1 on P.U. 7352 (vii) Delay relay 6DR on P.U.7352 (viii) HT relay 6HT on P.U.7352

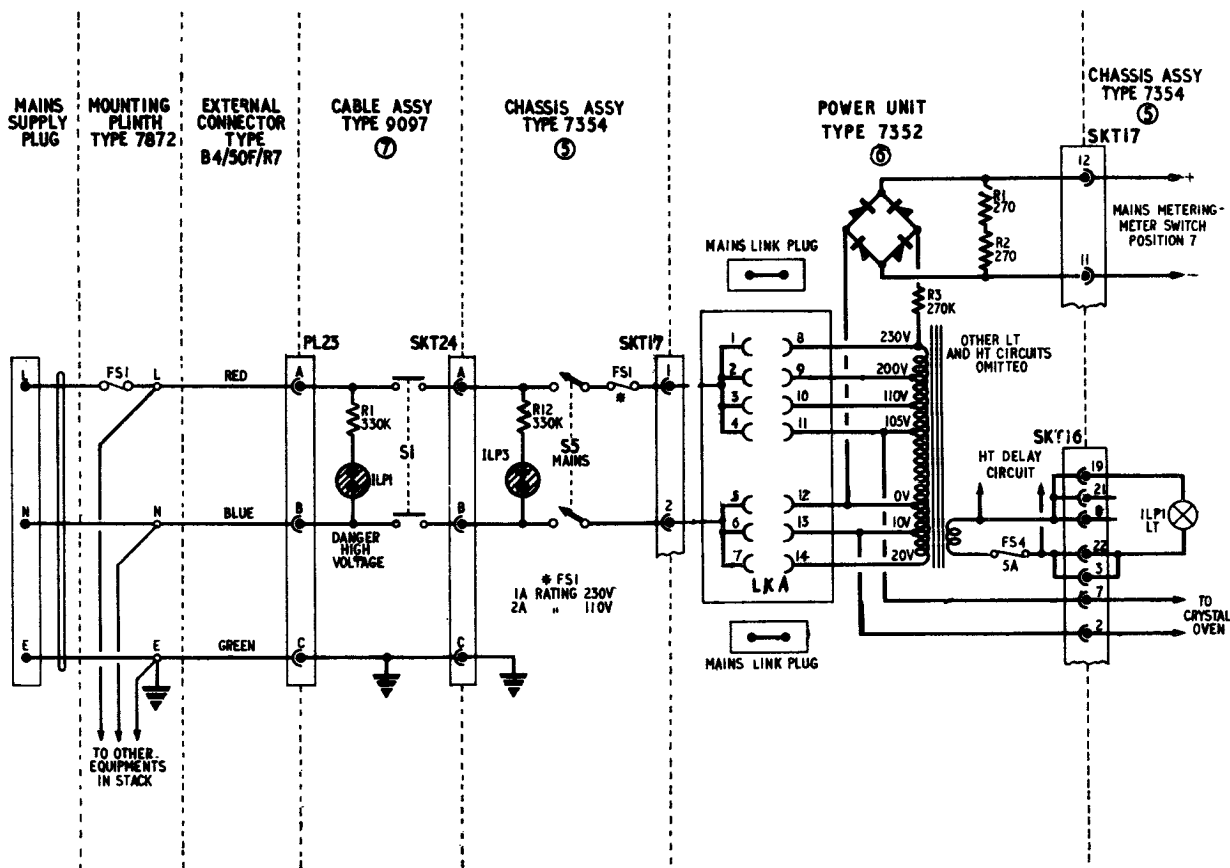


Fig. 1. Routing of mains supply

Metering tests

5. The subsequent voltage and current measurements are made with the sub-units either in their normal positions in the receiver chassis or removed (Part 2, Sect. 1, Chap. 2) and connected to the chassis by means of the extension connectors provided with the test set Type 7618 (Part 2, Sect. 1, Chap. 1). The equipment should be allowed a warming-up period of at least 15 minutes before any measurements are taken. Where measurements are not being made with the built-in metering system, the multimeter CT498 should be employed.

6. Unless otherwise stated, the tests detailed in this chapter should be conducted with the receiver fully operational as follows:

- (1) The receiver shall be fully tuned, either to its operational frequency or to a frequency at about the middle of the band, in accordance with the tuning instructions contained in Part 1, Sect. 1, Chap. 2.
- (2) There shall be no r.f. signal input to the receiver.

(3) The front panel controls shall be adjusted as follows:—

- RF GAIN, LINE GAIN and MONITOR GAIN controls fully clockwise
- MUTING switch set to OFF
- OFF-AGC-DF switch set to AGC

(4) The potentiometer 6RV7 on the power unit Type 7352 shall be correctly set (Part 2, Sect. 1, Chap. 2).

Valve changing

7. Certain valves cannot be changed without either some form of adjustment to the associated circuits or the use of third line test equipment; details are given in Part 2, Sect. 1, Chap. 2 to which reference should be made before changing any valves.

Note . . .

New metering labels, introduced by Modification No. 8209, provide a blank column in which meter readings should be recorded, either upon installation or after servicing, so that comparison can be made with subsequent

readings to establish serviceability. In this chapter the terms "high" and "low" should be related to the previously recorded readings. Where any doubt exists, however, concerning the interpretation of the readings, the overall functioning of the equipment should be considered for guidance.

Power unit Type 7352

8. The outputs of the power unit may be measured using the built-in metering system of the receiver; for these tests the orange-ringed nine-pole test plug must be fitted into the socket on the power unit. An interpretation of these measurements is given in Table 2 as a guide to the location of faults.

TABLE 2
Guide to power unit faults

METER SWITCH positions and readings						
7 MAINS	8 225V (current)	9 - 48V	10 225V	12 150V (current)	Further tests	Possible fault
High or Low	High or Low	High or Low	High or Low	Normal or Low		(i) Mains tapping links (ii) Mains supply
Zero	Zero	Zero	Zero	Zero	See Table 1	
Normal	Zero	Zero	Zero	Zero		(i) 48V fuse 6FS6
Normal	Normal	High or Low	Normal	Normal		(i) 6RV7 requires adjustment
Normal	Normal	Normal	Normal or Low	High	Is stabilizer 6V3 glowing ?	No (i) Faulty stabiliser
Normal	Zero	Normal	Zero	Zero	are 6V1 & 6V2 heaters alight ?	No (i) LT fuse 6FS1 Yes (i) HT fuse 6FS5
Normal	Zero	Normal	Zero	Zero	Is LT (blue) lamp alight ?	No (i) LT fuse 6FS4 Yes (i) HT switch 5S4 (ii) Delay relay 6DR (iii) HT relay 6 HT (iv) Rectifiers 6V1 and/or 6V2
Normal	Low or High	Normal	High	Zero	Are valve heaters alight in D.U.R. 7353, A.F. amp. 7113, R.F. amp. 7111 (1V1 and 1V2) ?	No (i) LT fuse 6FS2 Some (i) Faulty plug and socket connections
Normal	Low	Normal	High	Normal	Are valve heaters alight in I.F. amp. 7112 ?	No (i) Faulty plug and socket connections
Normal	Normal	Normal	Normal or High	Zero	Are valve heaters alight in D.U.R. 7353 ?	No (i) Faulty plug and socket connections
Normal	Low	Normal	Low	Normal or Low	Are 6V1 and 6V2 heaters alight ?	One Only (i) Faulty valve heater Yes (i) Low emission valves

9. A further aid to fault finding is provided by the list of typical voltage readings in Table 3; these should be taken with the RF AMP control detuned. Except where stated in Table 3, the test points are accessible

via two apertures in the floor of the receiver adjacent to the rear panel, when the power unit is in its normal position in the chassis.

TABLE 3

Power unit Type 7352 – typical voltage readings
(with respect to chassis)

Test point	Meter range	Typical voltage (d.c.)
Junction 6C3/6C7 (operate unit on extension connectors (para. 5))	1000V	270
Junction 6R13/6SKT16, pole 16	1000V	260
Junction 6R14/6SKT16, pole 17	250V	150
◀ Junction 6HT2/6SKT16, pole 10	1000V	260
Junction 6HT2/6SKT16, pole 10 (H.T. switch OFF)	250V	180 ▶
Junction 6RV7/6R11	100V	-48
Junction 6L2/6FS6 (located under fuse panel)	100V	-58

Chassis assembly Type 7354

10. The typical voltage readings given in Table 4 should be taken with the RF AMP control detuned; all the test points are located on the underside of the chassis, with the test point 5TP1 connected directly to the chassis. It should be noted that any appreciable deviation from the values given may be due to a fault in one of the other sub-units and further tests should be made.

TABLE 4

Chassis assembly Type 7354 – typical voltage readings (to chassis except where stated)

Test point	Meter range	Typical voltage (d.c. except where shown)
5TP6	10V	6.3 a.c.
5TP2 to 5TP3	10V	6.3 a.c.
5TP7	100V	-48
5TP9	250V	151
5TP4, 5TP5 or 5TP8	1000V	260
◀ 5TP10	1000V	260
5TP10 (H.T. switch OFF)	250V	180 ▶

Amplifying unit (R.F.) Type 7111

11. Very few repairs can be carried out on this unit at first and second line servicing. In the event of a fault, the only remedial action that should be taken is valve changing and associated re-alignment and testing (Part 2, Sect. 1, Chap. 2); care must be taken not to disturb any wiring as this may affect the ganging. If a fault cannot be rectified by changing the valves, the unit must be returned for third line servicing.

12. For the purpose of ascertaining the serviceability of the unit, a list of typical voltage readings is given in Table 5. With the exception of 1V3 anode, the test points are located on the underside of the unit which will necessitate operating the unit on extension connectors (para. 5) and removing the bottom

cover; to gain access to the anode clamp of 1V3 it will be necessary to remove the screening can from the top of the unit. All the tests in Table 5 should be performed with the amplifying unit (R.F.) detuned and with the r.f. connectors 1SKT15 uncoupled from 4PL15 on the drive unit radio. The top can and bottom cover must be refitted after the tests.

TABLE 5

Amplifying unit (R.F.) Type 7111 – typical voltage readings (to chassis except where stated)

Test point	Meter range	Typical voltage (d.c. except where shown)
1C14	250V	190
1C12	2.5V	-1.0
1C1 to 1C5	10V	6.3 a.c.
1V3 anode	1000V	245
◀ 1V3 anode (H.T. switch OFF)	250V	170 ▶

Amplifying unit (I.F.) Type 7112

13. In the amplifying unit (I.F.) are facilities for metering of the detector current 2V1 cathode current (a.g.c. indication) and the second mixer cathode current at positions 2, 3 and 5 respectively of the receiver METER SWITCH.

14. The serviceability of the detector (2V8) and the preceding stages in the amplifying unit (I.F.) may be readily established in the following manner:—

- (1) Detune the RF AMP control.
- (2) Note the reading on the receiver front panel meter at position 2 of the METER SWITCH.
- (3) Uncouple 1PL10 from 2SKT10; the meter reading should decrease by at least 25%. Reconnect 1PL10 to 2SKT10.

15. A meter reading of between 50 and 95 is normally obtained at position 5 of the METER

SWITCH. If the oscillator stage (2V2) is not oscillating, due to a faulty crystal or incorrect alignment of the inductor 2L2, the meter reading will be low. In the event of misalignment of 2L2, this inductor may be adjusted for peak meter reading at position 5 of the METER SWITCH.

16. With the METER SWITCH in position 3, the OFF-AGC-DF switch set to OFF and the RF GAIN control set to maximum (fully clockwise), a meter reading of approximately 52 should be obtained; as the RF GAIN control is reduced from maximum the meter reading will reduce. When the OFF-AGC-DF switch is set to AGC, the RF GAIN control to maximum and an r.f. signal, of sufficient magnitude to overcome the a.g.c. delay (indicated initially by a fall in the meter reading), is applied to the receiver, the meter reading will vary with the strength of the input signal.

17. The typical voltage readings listed in Table 6 should be taken with the RF AMP control detuned and the OFF-AGC-DF switch set to OFF. All the test points are located on the underside of the amplifier chassis and, therefore, the unit must be operated on an extension connector (para. 5). No tests are given in Table 6 for the valve 2V9 due to the high resistance circuits. When performing the measurements on the oscillator valve (2V2), the crystal 2XL1 must be removed; this crystal must be refitted as soon as the tests of 2V2 are completed.

TABLE 6

Amplifying unit (I.F.) Type 7112 — typical voltage readings (to chassis except where stated)

Test point	Meter range	Typical voltage (d.c. except where shown)
Junction 2R5/2R7	1000V	260
Junction 2R41/2R42	100V	-48
2V4 heater (pin 3 to pin 4)	10V	6.3 a.c.
2V1 anode (pin 5)	1000V	256
2V1 screen (pin 7)	250V	145
2V1 cathode (pin 2)	10V	2.1
Junction 2C10/2L2 (2V2 anodes) — 2XL1 removed	100V	87
2V2A cathode (pin 8) — 2XL1 removed	2.5V	0.7
2V2A cathode (pin 3) — 2XL1 removed	2.5	0.7
2V3 anode (pin 5)	1000V	255
2V3 screen (pin 7)	1000V	250
2V3 cathode (pin 2)	10V	3.0
2V4 anode (pin 5)	1000V	252
2V4 screen (pin 7)	1000V	252
2V4 cathode (pin 2)	10V	3.6
2V5 anode (pin 5)	1000V	252
2V5 screen (pin 7)	1000V	252
2V5 cathode (pin 2)	10V	3.6
2V6B anode (pin 7)	1000V	260
2V6B cathode (pin 5)	25V	16.5
2V7 anode (pin 5)	1000V	252
2V7 screen (pin 7)	1000V	252
2V7 cathode (pin 2)	10V	3.4
2V10 anode (pin 7)	1000V	215
2V10 cathode (pin 5)	10V	3.6

Drive unit radio Type 7353

18. The serviceability of the drive unit radio can be easily established since its r.f. output causes an increase in the first mixer cathode current (METER SWITCH position 1) in the amplifying unit (R.F.) Type 7111. It should be noted that there is normally a standing current which increases to a peak as the drive unit radio is brought to its tuning point; the absence of this standing current indicates a fault in the amplifying unit (R.F.) and not in the drive unit radio.

19. If no tuning peak (para. 18) can be found, the crystal should first be suspected. If the crystal is serviceable, a metering check of the drive unit radio should be performed (Part 2, Sect. 1, Chap. 2).

20. It should be noted that changing the oscillator valve (4V1) may affect the frequency; this valve should not, therefore, be changed unless third line test equipment is available for carrying out the re-alignment involved.

21. When taking the typical voltage readings listed in Table 7, the RF AMP control should be detuned. Since the test points are located on the underside of the drive unit chassis, it will be necessary to operate the unit on an extension connector (para. 5); in order to effect correct coupling of 1SKT15, of the amplifying unit (R.F.), to 4PL15 on the drive unit radio, it is recommended that the drive unit be supported on a board, of a suitable insulating material, placed across the chassis side-frames. Operation of the drive unit radio on an extension connector will necessitate tuning it in the following manner:—

- (1) Fit a 13833.333 kHz crystal into the WORKING socket of the crystal oven on the drive unit radio (Part 1, Sect. 1, Chap. 2).
- (2) Ensure that the prongs of the fork coupling are pointing towards the base of the unit (i.e. the required position for removing and re-fitting the drive unit radio).
- (3) with the METER SWITCH set to position 1, slowly turn the fork coupling counter-clockwise until the first peak is observed on the receiver meter; this peak should occur when the coupling is approximately 20 degrees counter-clockwise from the position stated in sub-para. (2).

TABLE 7

Drive unit radio Type 7353 — typical voltage readings (with respect to chassis)

Test point	Meter range	Typical voltage (d.c. except where shown)
4C26	1000V	260
4C8	250V	151
Junction 4R22/4PL13, pole 5	100V	-48
4V1, 4V2, 4V3 and 4V4 heaters (pin 4)	10V	6.3 a.c.
4V1 anode (pin 5)	250V	151
4V1 screen (pin 7)	250V	125 (non osc: 115)

Test point	Meter range	Typical voltage (d.c. except where shown)
4V1 cathode (pin 2)	2.5V	0.45 (non osc: 0.3)
4V2 anode (pin 5)	250V	105
4V2 screen (pin 6)	250V	100
4V2 cathode (pin 2)	2.5V	0.9
4V3 anode (pin 5)	1000V	260
4V3 screen (pin 7)	250V	110
4V3 cathode (pin 2)	10V	6.8
4V4 anode (pin 5)	1000V	260
4V4 screen (pin 7)	250V	100

Amplifying unit (A.F.) Type 7113

22. With the receiver fully tuned, the RF GAIN control set to maximum (fully clockwise) and the OFF-AGC-DF and MUTING switches set to OFF, sufficient noise can be obtained in the receiver to enable a check of the line output from the amplifying unit to be made (METER SWITCH position 4). The monitor output can also be checked by plugging a pair of telephones into the MONITOR OUTPUT socket on the receiver front panel.

23. With no line output from the amplifying unit but the monitor output present and voltage test (Table 8) reveal no faults, the LINE GAIN and is associated wiring is suspect check 3FS1 and 3FS2. If, however, a satisfactory line output is observed but there is no a.f. at the remote receiving point, test the serviceability of attenuator 5R11, 5R13, 5R14 on the under side of the chassis assembly, external connections remote lines and all associated plug and socket connections

24. An aid to fault finding is provided by the list of typical voltage readings in Table 8 which should be conducted with the RF GAIN control detuned. It

will be necessary to operate the unit on an extension connector (para. 5) in order to gain access to the test points which are located under the amplifying unit chassis.

TABLE 8
Amplifying unit (A.F.) Type 7113 — typical voltage readings (to chassis except where stated)

Test point	Meter range	Typical voltage (d.c. except where shown)
3T2, pin 2	1000V	270
Junction 3R4/3R9	1000V	260
3V2 heater (pin 4 to pin 5)	10V	6.3 a.c.
3V1A anode (pin 6)	250V	225
3V1A cathode (pin 8)	25V	13
3V1B anode (pin 1)	250V	130
3V1B cathode (pin 3)	2.5V	0.7
3V2 anode (pin 7)	1000V	255
3V2 screen (pin 8)	1000V	252
3V2 cathode (pin 3)	25V	13
3V3 anode (pin 5)	1000V	255
3V3 screen (pin 7)	1000V	252
3V3 cathode (pin 2)	25V	15

Panel, electronic circuit

25. The panel, electronic circuit (control module) is mounted on the top of the drive unit radio Type 7353 and, while voltage readings on the module can be taken with the drive unit fitted in the receiver chassis, it may be expedient to perform the measurements at the same time as those for the drive unit (para. 21). Typical d.c. voltage readings are listed in Table 9. It is not necessary for the receiver to be tuned for these tests.

Caution . . .

The measurements in Table 9 must be conducted with care because the control module operates from a floating 115V a.c. supply and earthing any part of the circuit can cause irreparable damage.

TABLE 9
Panel, electronic circuit — typical d.c. voltage readings

Meter connections		Meter range	Typical d.c. voltage
Positive	Negative		
Terminal 5	Junction 18C1/18R7	25V	15
Junction 18R6/18C3	Junction 18C1/18R7	25V	12
Junction 18R6/18C3	Junction 18C1/18R7	25V	1.5 max
Terminal 3	Terminal 6	100V	95
Terminal 3	Terminal 6	100 V	0