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TEST SETS TYPE 740 AND 740A

6625-99-957-5060 AND 10S/16824

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

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Ministry of Defence

FOR USE IN THE
ROYAL AIR FORCE

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Introduction

1. Test set Type 740 is a portable self-contained unit consisting of a performance tester, Type 9170 and its ancillary equipment contained in a canvas case. Test set Type 740A is similar in all respects to the Type 740 but is supplied without a case for the ancillaries and is primarily intended for Naval use.

2. Performance tester Type 9170 provides the facility for checking the performance of vhf airborne transmitter-receivers operating within the range 100-150MHz and may be used with the installation insitu or in the workshop. The facility provided permits ten specific tests to be carried out on the installation in alphabetical sequence by the operation of a rotary switch. A list of the switch positions and their respective functions is given on a label fixed to the front panel (para. 37).

3. The supply required for operation of the instrument is 28V dc ± 2V.

4. The dimensions and weight of the instrument and ancillaries are:

	Height (mm)	Width (mm)	Length (mm)	Weight (kg)
Performance tester	276	362	181	7.25
Ancillaries	-	-	-	1.81

GENERAL DESCRIPTION

Performance tester Type 9170

Physical

5. Performance tester Type 9170 (fig. 1) is housed in a rectangular case of aluminium alloy with a guard-rail fitted to each end of the case by steel cross members. These rails are provided to safeguard the equipment as well as to enable the operator to manipulate the controls whilst sitting with the instrument on his knees in the aircraft.

6. The front and back panels of the case are hinged along their upper edges and are held in the closed position by two captive screws. These panels provide access to the sub-assemblies of the instrument and to individual components, including the various presets which are not normally required during operation. Holes drilled in the back panel provide an outlet for any moisture that might result from condensation, especially under tropical conditions.

7. Operating controls are fitted on the side faces of the case (fig. 1). The PRESS FOR HIGH LEVEL button (switch SWE) and the ADJUST FREQUENCY control are on the left-hand side whilst the ten-bank ten-position SERVICE SELECTOR (switch SWA) and the SET RF Potentiometer (RV6) are on the right-hand side.

8. The TRANS REC MIC/TEL plug (PL8) the 28V MAINS plug (PL7), AERIAL plug (PL6) mic/tel jacks (JK1 and JK2) and the telescopic aerial are mounted on the top face of the case.

9. The telescopic aerial is a unipole element and has three sections with a total length of 0.61m when extended. The base of the aerial is fixed to one side of a small triangular strip of synthetic-resin-bonded paper. Connection is made from the aerial via a strip of tinned-dipped brass to the inner of a socket, specially constructed for use with the triangular strip. This triangular strip is, in turn, mounted on a rotatable spring-loaded spindle that can be rotated from the stowed position (fig. 1) to enable the socket to be engaged in PL6, electrical contact being maintained by the action of the spring.

10. A metal cam fixed on the lower end of the spring-loaded spindle operates a micro-switch, SWC, when the aerial is connected to PL6. The microswitch is mounted on a bracket on the inside of the case (fig. 5).

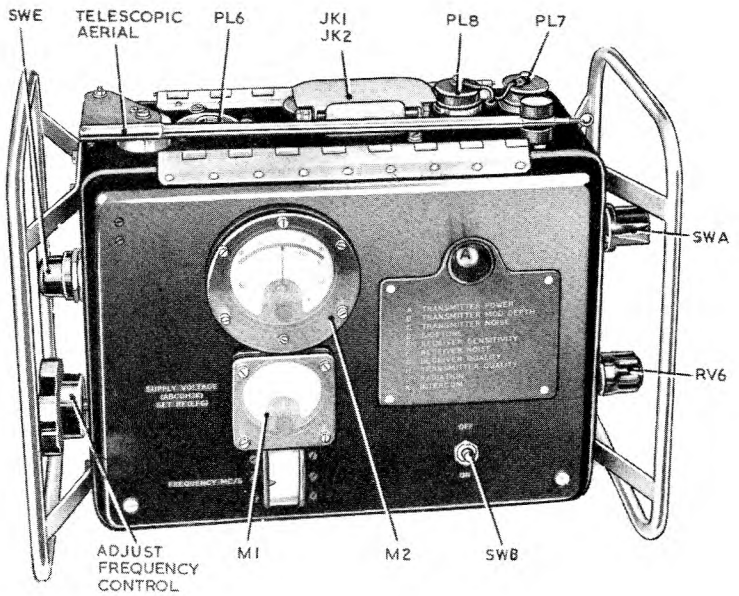


Fig. 1. Performance tester Type 9170

11. The SUPPLY VOLTAGE/SET RF meter (M1) the PASS-REJECT meter (M2) and the ON/OFF switch (SWB) are mounted on the front panel. Perspex covers are fitted over the meter faces.

12. The FREQUENCY MC/S drum (calibrated 100-160MHz) is visible through a slot below the meter M1 and a second drum (driven by the shaft of the SERVICE SELECTOR switch (SWA) alphabetically engraved A to K, can be seen through a circular hole to the right of M2. Perspex windows are provided for both apertures.

13. Fitted to the front panel (below the circular hole for the drum of the SERVICE SELECTOR switch) is a label on which the various facilities are engraved.

Main sub-assemblies

14. Mounted in the instrument case are the following sub-assemblies:

(1) Attenuator unit Type 7868
(2) Dummy load Type 7866
(3) Oscillator unit Type 7865
(4) Amplifier unit Type 7867

15. Dummy load RF Type 7866. The dummy load Type 7866 (fig. 5, detail A) has seven resistors R1A to R1G in a series-parallel arrangement capable of dissipating 10 watts. Four of these resistors (R1D to R1G) are mounted between two circular silver-plated copper discs separated by insulating pillars. The upper of these discs is connected to the centre conductor of the coaxial plug, PL6, which is mounted on a flange supported by insulating pillars.

16. A separate small silver-plated chassis mounted on the side of the flange carries the remainder of the components including miniature coaxial plug PL5 and two feed-through capacitors C4 and C5.

17. The whole assembly is housed in a cylinder perforated to provide for dissipation of the heat generated by the four resistors (para. 15) which together with the brass cylinder form a correctly-matched rf load of 50ohms.

18. The flange on which PL6 is mounted is attached to the underside of the top of the instrument case with the plug protruding through a circular hole in the case.

19. Attenuator unit Type 7868. This unit is fixed to the left-hand side of the instrument case. The PRESS FOR HIGH LEVEL switch, SWE, projects through the side of the case and is fitted with a rubber cap to prevent the ingress of moisture.

20. The case of the attenuator is a circular casting of aluminium alloy with compartments for the elements (fig. 5, detail F), for screening purposes.

21. A circular contact plate fitted over the attenuator case carries the contacts of SWE and is clamped in position by the top plate in which the plunger of SWE is fitted.

22. A 1000 pF feed-through capacitor C16 is fitted in the back of the case to enable the modulation to be introduced. The double screened coaxial cables for external connection to the dummy load RF Type 7866 and the oscillator unit Type 7865 are fed through glands in the attenuator case and are directly connected to the input and output elements.

23. Oscillator unit Type 7865. This unit is supported by a side bracket and a frame which fits through the centre of the case. Components of the unit are mounted on both sides of an aluminium-alloy chassis (fig. 5 and fig. 6, detail E). On top of the chassis (fig. 5) are two compartments housing the oscillator output and the decoupling components. A lead sheet is fitted over the oscillator output compartment to reduce rf leakage and each compartment is then covered by an aluminium alloy plate held in position by four screws.

24. The triode valve V4 and components directly associated with the oscillator are mounted on the other side of the chassis (fig. 6, detail E). Another casting fits over this and is held in position by eleven screws. Drain holes are provided to allow an outlet for moisture caused by condensation.

25. The drive for the tuning capacitor in the oscillator unit and the associated calibrated dial are mounted on the outer side of the main casting. The drive (fig. 5, detail E) is transmitted by a worm on the main shaft via a 25:1 gear. A 2:1 bevel gear coupling at the top end of the capacitor shaft drives the frequency-calibrated tuning dial mounted on a platform supported on four pillars. A stop block running on a threaded portion of the main drive shaft limits the rotation of the capacitor shaft to 354 degrees.

26. Amplifying unit Type 7867. This unit (fig. 5 and Fig. 6 detail C), has a C-shaped chassis which is supported on one side by a bracket attached to the case and on the other by the centre frame of the case. The three valves, V1, V2 and V6, two hermetically-sealed transformers (TR1 and TR2) and two preset potentiometers (RV8 and RV11) are mounted on top of the chassis.

27. The remainder of the components are either connected directly to the valve bases on the underside of the chassis, or on bakelite panels which enclose the remaining two sides of the chassis. Plug PL3 (18-pole unitor) provides the external connections.

Power unit

28. The power unit consists of a rotary transformer Type 123 (fig. 5) together with the associated filter components housed in a metal box attached to the underside (fig. 6, detail B). The unit is supported by a metal frame across the centre of the instrument case. External connection of the supplies is made via a 4-pole unitor plug (PL1) fitted to the side of the filter component box. A fan on the end of the transformer shaft supplies an intake of air through a circular hole in the bottom of the case, and a hole in the top of the case between the two jacks provides the exit for the air.

29. A stabilizer valve (V5) is mounted on a small platform on the frame which supports the transformer.

30. There are two control panels, one (fig. 5, detail D) is mounted on the internal frame at one end and to the side of the case at the other. This panel carries the preset potentiometers RV3, RV4 and RV13, a single-pole 3-way switch (SWD) and fuses FS1 and FS2. Potentiometers RV3 (SET WATTS) and RV4 (SET MOD PERCENT) are fitted with calibrated dials and the correct settings for these dials are indicated on a chart on the inside of the front panel. Locks are provided on all three potentiometers. Electrical connections to this panel are made via the 12-pole unitor socket SK2 mounted on the end of the panel.

31. The other control panel (fig. 6) carries eight preset potentiometers and three test points,(TP1 to TP3) with polythene collars. One side of this panel is pivoted to provide access to the components but it is normally fixed in the lowered position.

32. The FREQUENCY MC/S and the SERVICE SELECTOR drums (fig. 5) are made of translucent plastic and are each illuminated by a lamp.

33. Extensive use is made in the instrument of miniature ceramic terminal posts for making ht connections.

Connector set

34. The ancillary equipment (para. 1) consists of a connector set of four cables and details of these are given below:

(1) Connector Type B2/50F/12 is a 6.1m. length of dumetvinsmall sixteen, terminated at one end in a 2-pole Plessey Mk. 4 plug. The other end of the cable has the polythene insulation removed to facilitate mains connection.

(2) Connector Type B8/50F/7 is a 1.8m. length of sextometvinsmall 2.5 terminated at one end in a 6-pole Plessey Mk.4 socket and a MIC/TEL plug at the other.

(3) Connector Type B8/50F/8 is also a 1.8m. length of sextometvinsmall 2.5 but is terminated in a 6-pole Plessey Mk.4 socket at one end and a 6-pole W socket at the other.

(4) Connector Type D243/50F/1 is a 6.1m, length of uniradio 43 terminated in coaxial sockets (Type 629) at each end.

Serviceability check and adjustment

35. The following check of the serviceability of the test set should be made before use:

(1) Check that the meter pointer is mechanically centred before the test set is switched on.

(2) Switch on the test set and check that the supply voltage is between 26V and 30V. Check the meter indication on all positions of the SELECTOR SWITCH before making any external connections. The indications should be within the following limits:

Selector Switch Position	Meter Indication (Divisions)
A	Reject 50 ± 4
B	Central ± 2
C	Central ± 0.5
D	Reject 50 ± 4
E	Reject 50 ± 4
F	Pass 50 ± 4
G	Central ± 0.5
H	Central ± 0.5
J	Reject 50 ± 4
K	Reject 50 ± 4

36. If the above readings cannot be obtained the test set should be adjusted as follows:

(1) Set SELECTOR SWITCH to position H and adjust RV8 until the pointer of meter (M2) centres on zero ± 0.5 division.

(2) Set SELECTOR SWITCH to position A and adjust RV1 until meter (M2) indicates REJECT 50 ± 4 divisions. Should it be necessary to adjust RV1, check that after adjustment the dc voltage between the wiper of RV1 and chassis is not less than 0.35V dc ; if the voltage is less the test set should be rejected for servicing.

(3) Set SELECTOR SWITCH to position J and adjust RV11 until the meter indicates REJECT 50 ± 4.

(4) Set SELECTOR SWITCH to position F and ensure that the meter is indicating PASS 50 ± 4.

If necessary the above adjustments should be repeated until correct indications are obtained.

Principles of operation

37. The appropriate functions of the test set are selected by operation of the SERVICE SELECTOR switch (SWA) to suit the requirements of each of the following individual tests:

Switch position	Function
A	Transmitter power
B	Transmitter modulation depth
C	Transmitter noise
D	Sidetone
E	Receiver sensitivity
F	Receiver noise
G	Receiver quality
J	Radiation
K	Intercomm. system

When in some instances groups of these tests employ common circuits they are dealt with under one heading.

Switch positions A, B and C

38. In switch position A (fig. 2), the output of the transmitter under test is introduced into the dummy load Type 7866 which provides correct termination for the transmitter output stage. This unmodulated rf signal voltage is rectified by V3 and the associated network and a fraction of the resultant dc voltage developed across R6, is fed to V6a where it is compared against a preset voltage derived from RV1, such that if the power from the transmitter is at the correct (normal) level a zero indication will be obtained on the centre-zero meter M2 (fig. 1).

39. If the transmitter power is lower than normal the meter will indicate in a red sector marked REJECT, whilst for transmitter outputs greater than the predetermined (normal) level the meter will indicate in a green sector marked PASS.

Note ...

The calibrated preset control RV3 is used to determine the correct fraction of the rectified signal voltage from V3 (para. 38) for rf power outputs of 1 to 10 watts.

40. In switch position B, the transmitter under test is modulated by af voltage from the test set provided by oscillator V1a and amplifier V1b. The modulated rf is then fed back to the dummy load in the test set where it is demodulated. A portion of the resultant af is taken via SWA3 to the buffer and rectifier stage, the output from which is taken to the grid of V6a, whilst a predetermined fraction of the resultant demodulated output developed across R8/RV4 is taken to the grid of V6b via SWA5.

41. The meter M2, directly across the cathodes of V6, is used as a comparator on a pass/reject basis for the modulation depth of the transmitter output. The SET MOD DEPTH potentiometer RV4 has a dial with an arbitrary scale and may be calibrated for modulation depths of 50 to 90 percent modulation of the transmitter.

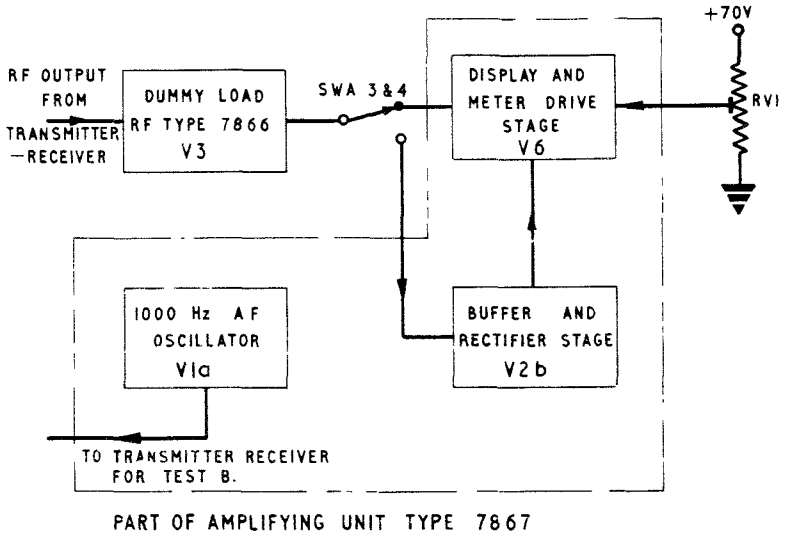


Fig. 2. Block diagram for switch positions A, B and C

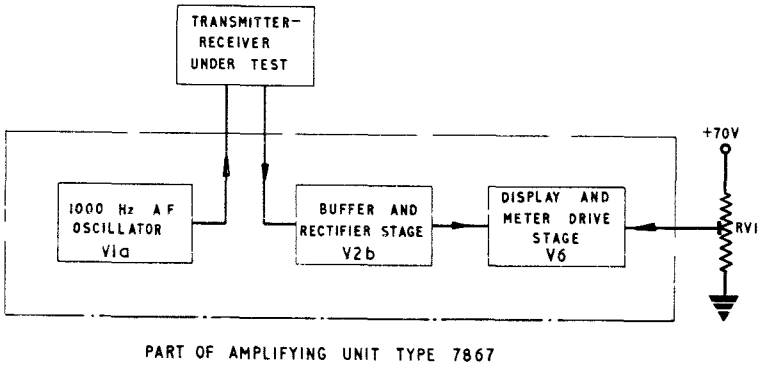


Fig. 3. Block diagram for switch position D

42. In switch position C the modulation voltage to the transmitter under test is open-circuited by switches SWA7 and SWA8. The circuit and tests are otherwise similar to those in switch position B. Noise in the transmitter provides modulation and balance in the meter M2 is obtained when the modulation depth is less than 5 percent.

Switch position D

43. In switch position D, the output of the 1000Hz oscillator is used to provide modulation of the transmitter under test (fig. 3) and the sidetone output is returned to the test set and compared in the display and meter stage, with a voltage representing an af input of 100 mW, the minimum acceptable pass output.

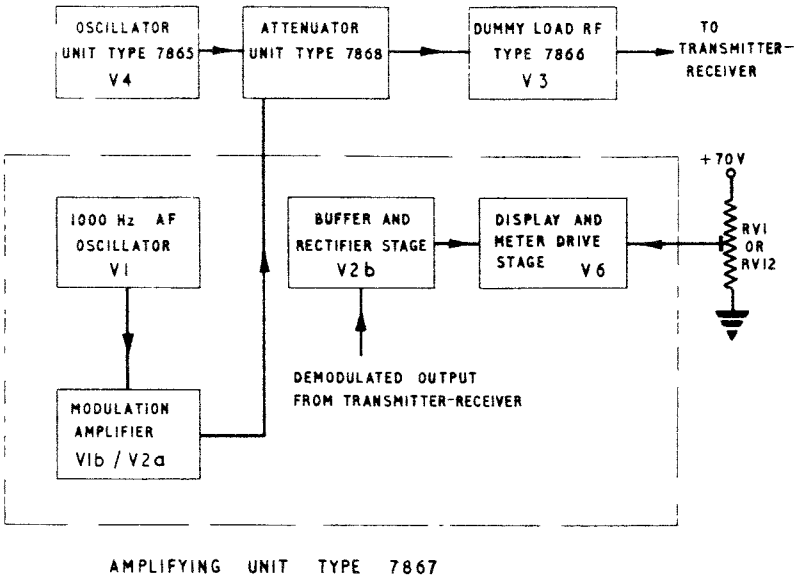


Fig. 4. Block diagram for switch positions E, F and G

Switch positions E, F and G

Note ...

In switch positions E and F there will be a meter (M2) indication if the receiver muting operates. Whatever the direction of this indication the receiver is to be passed.

44. In switch position E, a 10μV signal from the rf oscillator Type 7865, modulated to a depth of 30 percent by 1000 Hz from the af oscillator is fed to the receiver under test for sensitivity checks (fig. 4). The demodulated output from the receiver is then introduced into the buffer and rectifier stage and the resulting dc output is applied to the display and meter stage where it is compared with a predetermined voltage representing a receiver output of 15 mW, the minimum acceptable pass output.

45. A press button switch SWE is provided in the attenuator unit Type 7868 which, when depressed, increases the signal level at the input plug of the receiver to approximately 100μV and provides a means of determining the effectiveness of the agc circuit in the receiver. A meter indication between 0 and +30 is acceptable.

46. In switch position F, the only difference from that for switch position E is that the rf output from the test set to the receiver under test is not modulated and the af oscillator output is open-circuit. The af output from the receiver is therefore that due to noise generated in that unit and the dc voltage produced is compared with a predetermined voltage representing a receiver output of 1 mW, the maximum acceptable level.

47. In switch position G the rf oscillator output, modulated by voice

signal (via the modulation amplifier in the test set) is used for checking the quality of the receiver output. This is an arbitrary assessment and should not be regarded as conclusive that the receiver is defective.

Switch position H

48. In switch position H the transmitter under test is voice modulated via the test set microphone input and the modulated rf returned to the dummy load, where it is demodulated and used to feed a telephone headset for arbitrary assessment of quality.

Switch position J

49. In switch position J, the test set is used as a receiver. With the transmitter under test radiating normally,a signal is picked up by the test set aerial and the demodulated output from the dummy load is fed to the display and meter drive circuit for comparison with a standard reference level.

Switch position K

50. In switch position K, the test set functions as for switch position D except that the af load can be adjusted by switch SWD to represent 3, 6 or 10 sets of the telephone headsets.

51. Power for the performance test is obtained from a dc source of 28V ±2V. This is applied to a rotary transformer Type 123 which provides a +250V output capable of delivering 40mA. A secondary ht supply of +70V is derived from the main ht supply by use of a CV284 stabilizer valve. The heaters of the valves are fed in a series-parallel arrangement directly from the 28V supply. Protection is provided for the input supply by means of a 7A fuse, and the ht is further protected by a 50mA fuse.

Operating instructions

52. When the performance tester Type 9170 is to be used to check an air-borne transmitter-receiver, the aerial for the installation should be dis-connected at the socket and the 6.1 metre length of coaxial cable connected between this socket and the AERIAL socket on the instrument. The six-pole plug on the mic/tel connector should then be connected to the appropriate socket on the test set and the plug on the other end of the connector inserted in any convenient intercomm. jack on the aircraft.

53. The SET WATTS and the SET MOD. PER CENT presets RV3 and RV4 (situated on the control panel under the front panel) should now be checked and adjusted, if necessary, to accommodate the normal power output percentage modulation expected from the transmitter under test. The correct setting for each is given on the calibration chart on the inside of the front panel. Switch SWD, adjacent to the presets should be set to the appropriate intercomm. load.

54. Test Set Type 740 and the transmitter-receiver to be tested should now be switched on and allowed to warm up for at least ten minutes before proceeding with the tests then:

1. Remove the aerial cable from the test set.

2. Set the SERVICE SELECTOR switch to position H.

3. Check that the lower meter (M1) indication is 28V ± 2V.

4. Check that the upper meter (M2) indication is zero ± 0.5 division.

NOTE 1.

A modified test set will operate on a supply of 28V ± 2V but the supply voltage to the transmitter/receiver under test must be kept within the limits of 28V ± 1V for accurate results. If the indication of meter M2 is outside the limit of 0.5 division, observe the actual indication and providing this is not greater than 2.0 divisions from zero this indication may be used as an ARBITRARY ZERO. Should the indication of M2 be greater than 0.2 divisions from zero, it must either be adjusted to zero by preset RV8 or the test set returned for servicing.

5. If the checks (1) to (4) are satisfactory, reconnect the aerial cable (removed in (1)) and proceed with the test procedure.

NOTE 2.

In all positions of the SERVICE SELECTOR switch, with the exceptions E, F and G, the meter M1 indicates the dc input voltage. Tests made with the input voltage below 26 volts should not be regarded as conclusive evidence that the transmitter-receiver is unsatisfactory.
When using meter M2 to indicate the rating of a transmitter or receiver, the performance is satisfactory when the meter needle is either central or in the pass (green) sector.

Transmitter power

55. Check the unmodulated power output of the transmitter-receiver by setting the switch SWA to position A and the transmit/receive switch on the transmitter-receiver to TRANSMIT. The rating of the transmitter output is then indicated on M2. Repeat this test on all channels.

Transmitter modulation depth

56. Check the modulation depth by setting SWA to position B and note the rating indicated by M2.

Transmitter noise

57. Check the transmitter noise by setting SWA to position C and note the rating indicated by M2.

Sidetone

58. Check the sidetone level in the transmitter by setting SWA to position D and note the rating indicated by M2.

Receiver sensitivity

59. Check the receiver sensitivity by setting SWA to position E and the transmit/receive switch to RECEIVE, when the needle on the meter M1 should move to the position on the dial marked SET RF. Any necessary adjustment to bring the needle to this position can be achieved by operation of the SET RF potentiometer (RV6).

Note ...

Some early test sets 740 may be encountered in which the dial is marked as a standard 0-100 microammeter and in this case the SET RF level is 32 microamps which in some instruments is indicated by a red line.

60. The rf oscillator of the test set should be tuned to the frequency of the channel being tested and carefully adjusted to give a maximum indication on the meter M2. This indication should be noted. Leaving the oscillator so tuned check that the agc performance of the receiver is satisfactory by depressing the button of the PRESS FOR HIGH LEVEL switch SWE when there should be no change of position of the meter needle.
Functioning of any muting controls may also be checked at this stage. Operation of any one of these controls, if satisfactory, will cause the meter indication to fall to zero.

Receiver noise

61. Receiver noise is checked by setting SWA to position F and noting the indication on meter M2. If the meter needle moves into the PASS position the noise level is satisfactory.

Receiver quality

62. Check the receiver quality by setting SWA to position G and connecting a mic/tel into each of the mic/tel jacks. With an operator speaking into the microphone of one headset, a second operator can listen to the receiver output and make an arbitrary assessment of the quality.

Transmitter quality

63. Check the transmitter quality by setting SWA to position H and the transmit-receive switch to TRANSMIT. With the two mic/tel headsets connected as for the receiver quality test, the roles of the two operators are reversed and an arbitrary assessment of the transmitter quality made.

Radiation

64. Disconnect the transmitter-receiver from the test set and, with SWA set to position J, move the instrument about in the vicinity of the aircraft aerial until a reading is indicated on M2. It should be noted that this test simply provides an indication that the transmitter aerial is radiating, and the result should not be interpreted on a pass-reject basis.

Intercomm.

65. Check the intercomm. systems by setting switch SWA to position K and noting the reading indicated by M2.

CIRCUIT DESCRIPTION OF PERFORMANCE TESTER TYPE 9170

General

66. The complete circuit diagram of the performance tester Type 9170 is given in fig. 7. It comprises four main sub-assemblies, oscillator unit Type 7865, attenuator unit Type 7868, dummy load RF Type 7866 and amplifying unit Type 7867, together with a power unit and ancillary switching circuits. The functions of the main sub-assemblies will be described in general terms before dealing with the manner in which they are inter-connected for the ten services provided by the SERVICE SELECTOR switch SWA and set out in para. 37.

Oscillator unit Type 7865

67. Oscillator unit Type 7865 associated with triode valve V4 (CV468) has a conventional Colpitt's type circuit. The tuning is continuously variable from 100 to 160 MHz by means of capacitor C12. The correct Oscillator frequency coverage is lined up with the frequency scale by presetting the inductor L1 and capacitor C36.

The rf output is inductively coupled to inductor L2 and delivered to the attenuator unit Type 7868 via PL4, SK4 and a short length of 52 ohms double screened coaxial cable (Telecon K16MYM). A monitoring circuit comprising essentially a crystal diode MR8 (CV442) and meter M1 is connected across the oscillator output. A fraction of the voltage developed across the crystal diode load, that is, the voltage developed across the potentiometer RV14, is applied via switch SWA1 to the meter M1 to enable the oscillator output to be set to the required level, indicated by a red line marked SET RF on the meter scale. Adjustment of this level is achieved by operating SET RF potentiometer RV6.

Attenuator unit Type 7868

68. Attenuator unit Type 7868 is basically of the π - type employing resistors R18, R19, R20, R21 and R22 together with crystal diode MR7 (CV448). A further π - section is provided by R67, R4 and R1 in the dummy load. The combined effect of these attenuators together with the attenuation produced by the coaxial cable, which connects the output of the instrument to the transmitter-receiver to be tested, is to reduce the level of the signal delivered to the plug of the transmitter-receiver to 10μV. This level may be increased to a signal level of approximately 100μV by closing the PRESS FOR HIGH LEVEL switch SWE which reduces the attenuation by about 20dB.

Dummy load RF Type 7866

69. Dummy load RF Type 7866 represents the load of 50 ohms and is capable of dissipating up to 10 watts introduced at PL6 from the transmitter under test. The diode V3 (CV1092) rectifies the input voltage and is cathode-coupled via the feed-through capacitor C4 to the various presets in the amplifying unit Type 7867. In addition, it provides a π - section in the attenuation chain when the oscillator unit is operating as described in para. 68.

Amplifying unit Type 7867

70. Amplifying unit Type 7867 has four stages, consisting of an af oscillator, a modulation amplifier, a buffer and rectifier stage and a display and meter drive.

71. This af oscillator provides a 1000 Hz tone modulation source and is of a parallel-T R-C type, associated with the triode V1A (part of CV455). Positive feedback to the grid is returned through the 0.01 μF capacitor C17, and the necessary phase shift is provided by the parallel-T network comprising resistors R28, R29 and R33 and capacitors C18, C19 and C20. The germanium diode MR1 provides limitation of the output of V1A and tends to square the output waveform. This increases the relative amplitudes of the harmonics but maintains the amplitude of the fundamental at a predetermined level to make it independent of variations in circuit conditions, such as changes in heater volts and ageing of the valve. The harmonics are finally filtered out by the parallel-T network comprising resistors R35, R36 and R37, and capacitors C22, C23, and C24, leaving a 1000 Hz sinusoidal waveform of essentially constant amplitude.

72. The output of V1A is transformer coupled through 1 : 50 windings of TR1 to a two stage modulation amplifier associated with the pair of triodes V1B and V2A.

This amplifier is provided with voltage negative feedback, and the output is cathode-coupled to the attenuator where it is introduced through the feed-through capacitor C16 and rf choke L9, and modulates the rf through the germanium diode MR7. This non-linear element MR7, which forms one arm of the attenuating network is, in the absence of modulation, biased only by the dc voltage introduced through L9. When modulation is applied the diode varies the attenuation introduced by the network, producing the required modulation effect. The percentage modulation is determined by the preset potentiometer RV11 in the grid of V1B. This potentiometer is set on production to provide 30 per cent modulation.

73. A second output, from the 1 : 1 windings of the af transformer TR1, provides, when required, tone modulation of the transmitter under test. The 1 : 1 windings are also used to introduce the output of the microphone which is then amplified by V1B and V2A to provide R/T modulation for one of the tests.

74. The display and meter drive circuit consists essentially of a double triode V6 (CV455) and a centre-zero meter M2. In the appropriate settings of SWA, the voltage representing the output to be measured is applied to one of the grids and is compared with a predetermined voltage representing the acceptable pass level which is applied to the second grid. The degree and the sense of the balance, if any, is then registered on the meter. With the meter needle in the centre or to the right in the pass (green) sector, the result of the test is satisfactory but if it is the reject (red) sector the unit being tested is below standard. Potentiometer RV8 is set on production to provide correct balance in the meter circuit. It will be seen that the connections to the meter are reversed in some positions of SWA6 when a pass level represents a decrease in level to be measured, e.g. when the receiver noise is checked.

75. The buffer and rectifier stage is associated with the triode V2B and the four germanium diodes MR3, MR4, MR5 and MR6. Again, in the appropriate

settings of SWA, the af input signal representing the signal to be measured is applied to the grid of V2B and the output of this valve is cathode-coupled through the 1 : 2 transformer TR2 to the bridge rectifier. The dc voltage developed across the rectifier load, R63, is applied to the appropriate grid of the double-triode V6 (CV455). The output of V2B is also cathode-coupled through capacitor C2 to the mic/tel jacks JK1 and JK2 to allow the signals to be monitored.

76. Dummy load RF type 7866, attenuator unit Type 7868, and oscillator unit Type 7865 are all completely screened and all external supply connections to the units in the rf chain are decoupled by inductors, resistors and feed-through capacitors.

77. A number of components are marked AIC, which indicates that the value of these components is determined during calibration and will therefore vary from instrument to instrument.

78. It is important to note that the following check and adjustment procedure is to be carried out before the test set is used:-

(1) Check that the meter M2 pointer is mechanically centred.

(2) Switch on and check on meter M1, that the supply voltage is between 26 and 30 volts. Before making external connections other than that to the 28V supply, check that the meter (M2) pointer indications on all positions of the selector switch are within the following limits:-

Selector Switch Position	Meter Indication (Divisions)
A	Reject 50 ± 4
B	Central ± 2
C	Central ± 0.5
D	Reject 50 ± 4
E	Reject 50 ± 4
F	Pass 50 ± 4
G	Central ± 0.5
H	Central ± 0.5
J	Reject 50 ± 4
K	Reject 50 ± 4

If the above readings cannot be obtained, the test set should be adjusted as set out below:-

H - Adjust RV8 for central indication of meter pointer

A - Adjust RV1 for Reject 50 indication of meter pointer

J - Adjust RV12 for Reject 50 indication of meter pointer

F - Check the indication is Pass ± 1 division

The above is to be repeated until the correct indications are obtained.

Circuits selected by the SERVICE SELECTOR switch

Transmitter power (switch position A)

79. In this test, the transmitter output power is introduced at the aerial plug PL6 in the dummy load. The dummy load, the impedance of which looks like 50 ohms at vhf provides the correct termination for the long coaxial connector used to deliver the rf power from the transmitter. The diode V3 rectifies the rf signal voltage, and the output is fed through the SET WATTS potentiometer RV3, the junction of R6 and R9 (in the potential divider chain R5, R6 and R9) and SWA4 to the grid of V6A in the display meter drive circuit, and the voltage from the SET M2 preset control RV1 is connected to the grid of V6B through SWA5. When RV3 is set to the normal output to be expected from the transmitter under test, the centre zero REJECT/PASS meter M2 will register zero (or balance) if the power being delivered is correct.

Transmitter modulation depth (switch position B)

80. For this test the output from the transmitter under test is again used as the source of power introduced at PL6. The transmitter is modulated by the output of the 1000 Hz oscillator V1A through the 1 : 1 secondary of transformer TR1, SWA7B and SWA8B, and pins B and F of plug PL8 to modulation input socket at the transmitter. The modulation voltage is adjusted by means of RV7 to be 10mV on open circuit from a source of 200 ohms.

81. In this case, the rectified output of the diode V3 is connected to the grid of the triode V6B through the SET MODULATION potentiometer RV4, (in the potential divider chain R7, RV4 and R8), and SWA5B. Another connection is made from the V3 diode output through the junction of R5 and R9 (in the potential divider chain R5, R9 and R6), SWA3B and C28 to the grid of V2B. The af components of the rectified signal is thus passed to the buffer and bridge rectifier stage and the dc voltage developed across the rectifier load, R63, is applied to the grid of V6A via SWA4B. A dial on control RV4 is calibrated to provide the necessary comparison voltages to represent modulation percentages between 50 and 90 so that for any setting between these limits the potential differences between the adjustable arm of RV4 and chassis is the same as that across R63 if the percentage modulation of the signal is the same as the one selected. If the percentage

is other than that selected by RV4, the appropriate imbalance will be indicated on meter M2. Since the dc voltage applied to the grid of V6b is a function of carrier level, and the voltage applied to the grid of V6a is derived from the modulated signal, then this test is quite independent of power level, provided that the SET WATTS control (RV3) has been correctly adjusted in position A of the SERVICE SELECTOR SWITCH SWA.

Transmitter noise (switch position C)

82. The circuit for this test is similar to that for the transmitter modulation-depth test. The 1000 Hz oscillator is, however not required and is made inoperative by switch section SWA9 which connects the voltage at the primary of output transformer (TR1) back to the grid of V1A. In addition, the transformer secondary is disconnected from the transmitter modulation input stage by SWA7C and SWA8C. In consequence, the only modulation of the transmitter rf output is produced by the noise generated in the transmitter stages. A predetermined fraction of the total output of rectifier V3, determined by the setting of the SET TX NOISE potentiometer RV5 in series with R64, is applied to the grid of V6A and the af component of the rectifier output is applied via V2B, the bridge rectifier and SWA5C to the grid of V6B. The control RV5 is preset on production to provide balance in the meter when the noise is equivalent to 5 per cent modulation. In this instance a pass indication represents a fall in the percentage modulation and vice versa and this is the reason for the reversal of connections to the grids of V6 by SWA4 and SWA5. It will be seen from the circuit that the meter sensitivity is now increased by SWA6, which short-circuits the meter multiplier resistor R60.

Sidetone level test (switch position D)

83. For this test the output of the af oscillator valve is connected via the 1 : 1 secondary of transformer TR1, SWA7D, SWA8D and pins B and F of plug PL8 to the microphone input of the transmitter-receiver. The sidetone output from the transmitter is returned to pins D and A of PL8 and connected across the 51 ohms resistor R58. A fraction of this voltage is taken from the moving arm of RV2 to the potential-divider chain R53 and R57, the junction of which is connected via SWA3D to the grid of the buffer valve V2B. The output is rectified by the bridge rectifier and applied to the grid of V6A via SWA4D. The balancing voltage for V6B is obtained from the preset source RV1 and applied to the grid via SWA5D. RV2, the SET SIDETONE AND INTERCOMM. control, is preset on production to balance the meter drive valve when the input at R58 is the required level, that is, 100mV.

Receiver sensitivity (switch position E)

84. When the SERVICE SELECTOR switch is set to position E, the rf oscillator is switched on by SWA2, which completes the ht circuit to V4, and the rf is modulated by the af oscillator output amplified by the modulation amplifier

85. The modulated output of the oscillator valve V4 is delivered at the input socket of the transmitter-receiver at a level of 10μV. The signal is amplified in the receiver in the normal way, and the af output is then returned to the test set at pins A and D of PL8 and connected across the potentiometer RV9 which is in parallel with R58. The slider of RV9 is

connected to the grid of V2B through SWA3E and the amplified signal is rectified by the bridge rectifier and applied to the grid of V6A through SWA4E. This signal is then compared with the potential difference across the preset potentiometer RV1. RV9, the SET RECEIVER SENSITIVITY control, is preset to provide balance when 15mW is being delivered from the receiver.

86. By depressing the PRESS FOR HIGH LEVEL control SWE in the attenuator unit Type 7868 the agc circuit can also be checked. This reduces the rf attenuation by approximately 20dB so that the signal level delivered at the transmitter-receiver aerial plug is approximately 100μV. The agc can be accepted as operating satisfactorily if the meter indication is between 0 and +30.

Receiver noise (switch position F)

87. The circuit for this test is similar to that used for the receiver sensitivity test except that 1000 Hz modulation is not required and af oscillations in the performance tester are isolated by SWA7F and SWA8F.

88. Noise generated in the receiver modulates the rf signal prior to demodulation. The af output of the receiver, representing the noise level, is introduced into the performance tester via pin D of PL8 and applied across RV10, which is in parallel with R58. This output is applied through the slider of RV10 and SWA3F to V2B and the bridge rectifier. The dc output of the rectifier is then applied to the grid of V6B via SWA5, and an arbitrary preset reference-level voltage is applied to the grid of V6A from the slider of the SET M2 control RV12. RV10 is preset in production to provide a balance in the meter with a maximum noise input level of 1mW.

Receiver quality (switch position G)

89. For this test the test set is used as a signal generator. The rf oscillator output is fed through the attenuator unit, the dummy load and plug PL6 to the transmitter-receiver. This output is modulated by the output of the microphone connected to the primary of TR1, through SWA7G and SWA8G and amplified by the modulation amplifier and applied in the attenuator in the same manner as for tone modulation on the modulation depth test (switch position B).

90. The af output of the receiver under test is introduced into the tester at pin D of the plug PL8, and a fraction of this is fed from the preset potentiometer RV10, which is in parallel with R58, to the grid of buffer valve V2B as in the receiver noise test (switch position F). The output from V2B is cathode-coupled through C2 and the mic/tel jacks JK1 and JK2 to a headset, where an arbitrary assessment of the receiver output is made aurally. Both grids of the valve V6 are earthed by SWA4G and SWA5G, rendering the display meter inoperative.

Transmitter quality (switch position H)

91. To carry out this test the test set is now used as a receiver and the transmitter under test feeds in its full output to the dummy load. Modulation for the transmitter is provided by the performance tester. The output from the microphone connected to JK2 is transformer-coupled through the 1 : 1 windings of transformer TR1 and pins F and B of PL8, to the modulation stage of the transmitter. The signal is demodulated in the rf load and the af signal transferred through C4 and RV3 to the potential divider chain R5,

R9 and R6. A fraction of the voltage developed across this chain is taken from the junction of R5 and R9 through SWA3H to the buffer valve V2B. The output of V2B is then cathode-coupled through C2 to the telephone jacks where an arbitrary assessment of the transmitter quality may again be made aurally. The display meter is again made inoperative in the same manner as for the receiver quality test (para. 90).

Radiation test (switch position J)

92. For this test the 6.1 metre coaxial cable is disconnected from the performance tester and the telescopic aerial erected. The instrument is now used as a receiver to check that the transmitter is radiating.

93. A radiated signal from the transmitter is picked up on the instrument aerial and demodulated in the rf load. The output is transferred through C4 to RV13 and a proportion of the voltage developed across RV13 is applied to the grid of V6A through the microswitch SWC, which is closed when the aerial is erected, and SWA4J. It is then compared with the preset voltage from RV12 which is applied to the grid of V6B. This again only represents an arbitrary means of determining that the transmitter is radiating.

94. The purpose of the microswitch SWC is to ensure that the display meter circuit is not damaged if the tester is inadvertently switched to position J while the full transmitter output is being introduced at the aerial socket.

Intercomm. Test (switch position K)

95. To carry out this test the telescopic aerial is returned to its stowed position and the 6.1 metre coaxial connector fitted again between the instrument aerial plug and that on the transmitter-receiver.

96. In this instance the instrument operates as for the sidetone test (switch position D) with the exception that the af load can be varied to represent 3, 6 and 10 headsets as determined by the setting of the selector switch SWD. With SWD in the position shown in Fig. 7 the load is representing three headsets. With SWA10 in position K, SWD may be used to connect R65 (for six headsets) or R65 and R66 (for ten headsets) in parallel with R58. A mid-scale or pass reading represents a satisfactory output.

Power supplies

97. The power supplies for the instrument are derived from a primary source of 28V dc introduced at plug PL7. This is then applied to the motor section of the rotary transformer Type 123X1, by operation of the double-pole single-throw switch SWB and the 7A fuse FS2. The generator section of X1 provides an output of 250V for a load current of 40mA with smoothing provided by the R-C filter represented by the 680 ohm resistor R69 and the 8μF capacitor C31. This represents the main ht supply, and protection by the 50mA fuse FS1. In addition, a 70V stabilised ht supply is provided by the voltage stabiliser V5 (CV284) for the display and meter valve V6, and this supply is also used to bias the limiter diode MR2 as well as to provide fixed bias for V2A via potential chain R44 and R46.

98. Three test points TP1, 2 and 3 are provided to enable the 70V supply, the voltage across RV1 and RV12, and the 250V supply, respectively, to be checked. The voltage between the wiper of RV1 and chassis should be from 0.35V to 0.45V d.c. The nominal 70V supply may be from 65V to 77V d.c.

99. Adequate filtering of the input and output of the rotary transformer is provided by L3 to L6 and C32 to C35, both inclusive.

100. The valve heater circuit is a series-parallel arrangement connected through the dropper R26 across the 28V input. V1, 2 and 6 heaters are connected in series and these in turn, are in series with the parallel-connected heaters of V3 and V4.

101. Meter M1 is only required to indicate rf output level on three positions (E, F & G) of the ten provided on switch SWA1. The remaining seven positions are used to connect the meter to indicate the voltage of the dc supply.

102. Two 12V lamps are used to illuminate the FREQUENCY MC/S and the SERVICE SELECTOR switch drums and are connected in series with the 33-ohms resistor R61 across the 28V supply.

FAULT DIAGNOSIS

General

103. Before any servicing work is done on this equipment, reference must be made to AP3158, wherein the limitations on first and second-line servicing are laid down. The majority of defects which could occur in the performance tester would necessitate recalibrating the equipment. Exceptions to this include blown fuses, defective dial lamps, and absence of the 70V supply. Both fuses may be renewed after a check has been made to ensure that no over-load exists, the lamps may be renewed as necessary and a replacement voltage stabiliser valve V5 may be installed in place of a defective one. Defects necessitating replacements in excess of the above will usually involve calibration checks.

104. This instrument incorporates only two means of identifying faults within itself; these are the supply voltage meter M1 and the pass/reject meter M2. The meter M2 can only be relied upon in this respect if V6 and the associated circuit can be assumed to be functioning correctly, and this should therefore be checked periodically. To check that V6 and M2 operate correctly, it is sufficient, with no signal fed into the test set Type 740, to turn the SERVICE SELECTOR switch to position H and to rotate RV8; the pointer of the meter should indicate at least ± 40 divisions from the central position as the potentiometer is rotated from one end to the other.

105. The meter M1 provides a check on the voltages of the 28V dc input supply with the SERVICE SELECTOR switch SWA in all positions except E, F and G. If the voltage is not within the limits of 28V ± 2V the results obtained with the instrument cannot be relied upon. If no reading is obtained a check should be made to ensure that there is no overload to cause the fuse to blow; the fuse FS2 should, if necessary, be renewed.

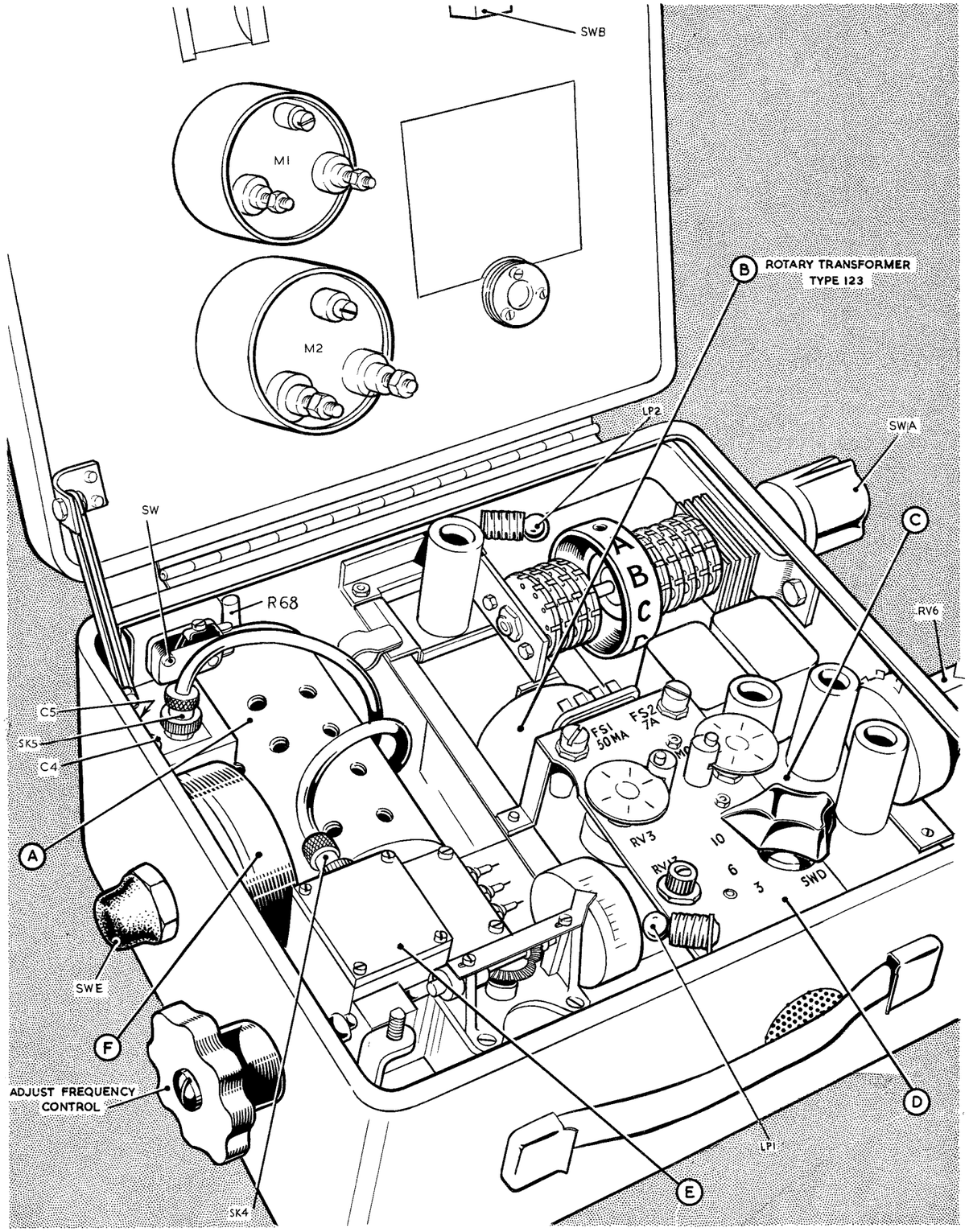
106. In the three remaining positions of the SERVICE SELECTOR switch, M1 indicates the level of the rf output from the oscillator unit Type 7865. If this reading is low and cannot be brought to normal level by means of RV6 the 250V ht supply should be measured at TP3 and the rotary transformer Type 123 checked. If, however, the ht voltage is found to be correct, the components of the oscillator unit Type 7865 and the attenuator unit Type 7868 should be carefully checked, the valve V4 and germanium diodes MR7 and MR8 being dealt with first. If no voltage is available at TP3, a check

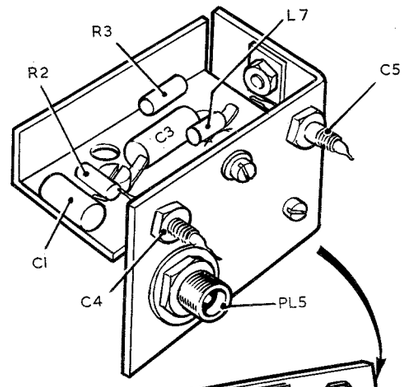
should be made to ensure that there is no evidence of a short circuit on the ht supply and then the fuse FS1 should, if necessary, be renewed.

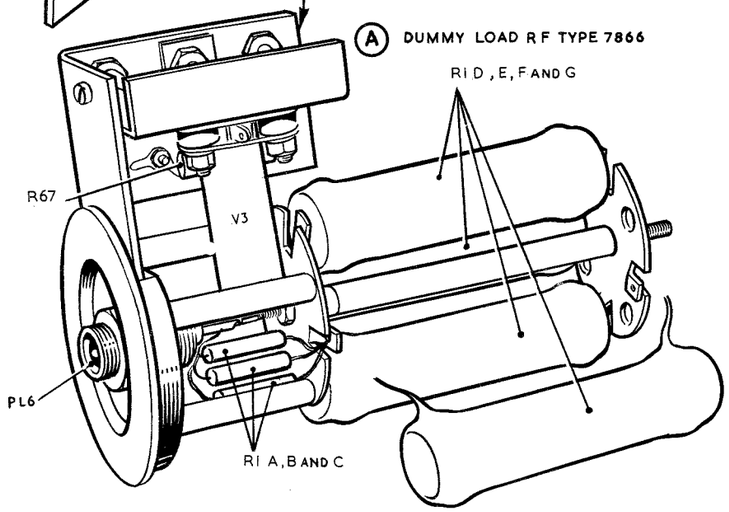
107. The meter M2 provides a means of localizing most of the fault conditions which may exist in the remaining circuits introduced by the SERVICE SELECTOR switch SWA. When suspect readings are being consistently obtained in all the switch positions in which M2 is used, the display and meter drive circuit components should be checked and the balance of the stage verified. If the fault is found to be in the af oscillator stage, the stabilized 70V ht supply should be checked first, then, if the voltage is incorrect, the stabilizer valve V5 and associated components should be checked.

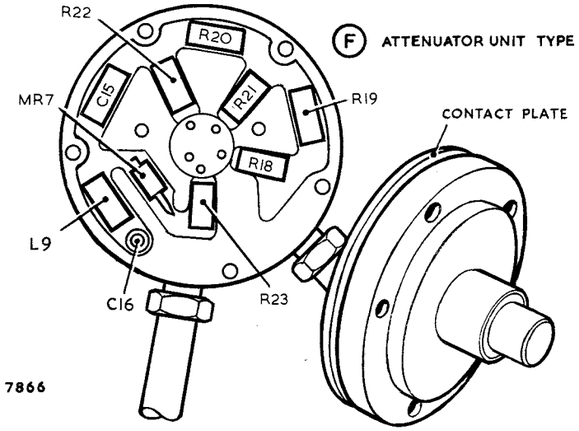
108. When a series of suspect readings are obtained in one or more of the switch positions, the following summary of the possible faults will be of assistance in localizing the cause:-

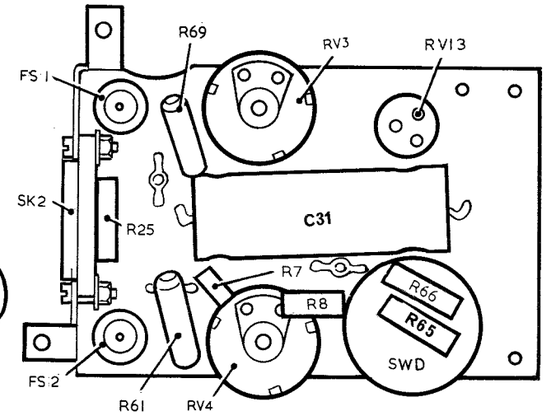
Switch Position	
B only	R7, RV4, R8, R60. Setting of RV4 may be incorrect.
A only	RV3, R5, R9, R6. Calibration of RV3 may be incorrect.
C only	R64, RV5. Setting of RV5 may be incorrect.
D only	No components are employed solely for this switch position.
E only	RV9. The setting of this control may be incorrect and should be checked. The components of the modulation amplifier should all be checked.
F only	RV10. The setting may be incorrect.
J only	RV13. The setting may be incorrect.
K only	RV2, R39. The setting of RV2 may be incorrect.

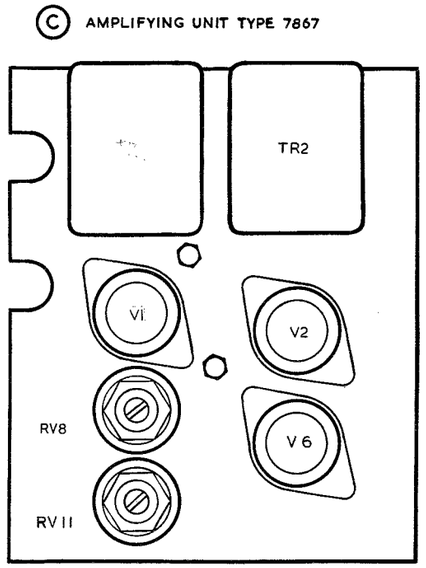












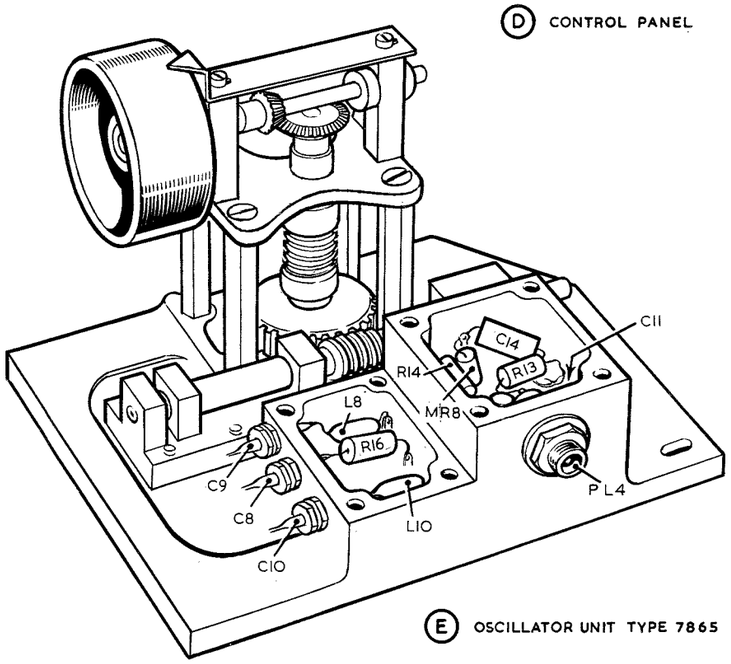


Fig. 5.
AL1, Sep.72

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Performance tester Type 9170 — component layout (front)

Fig. 5.
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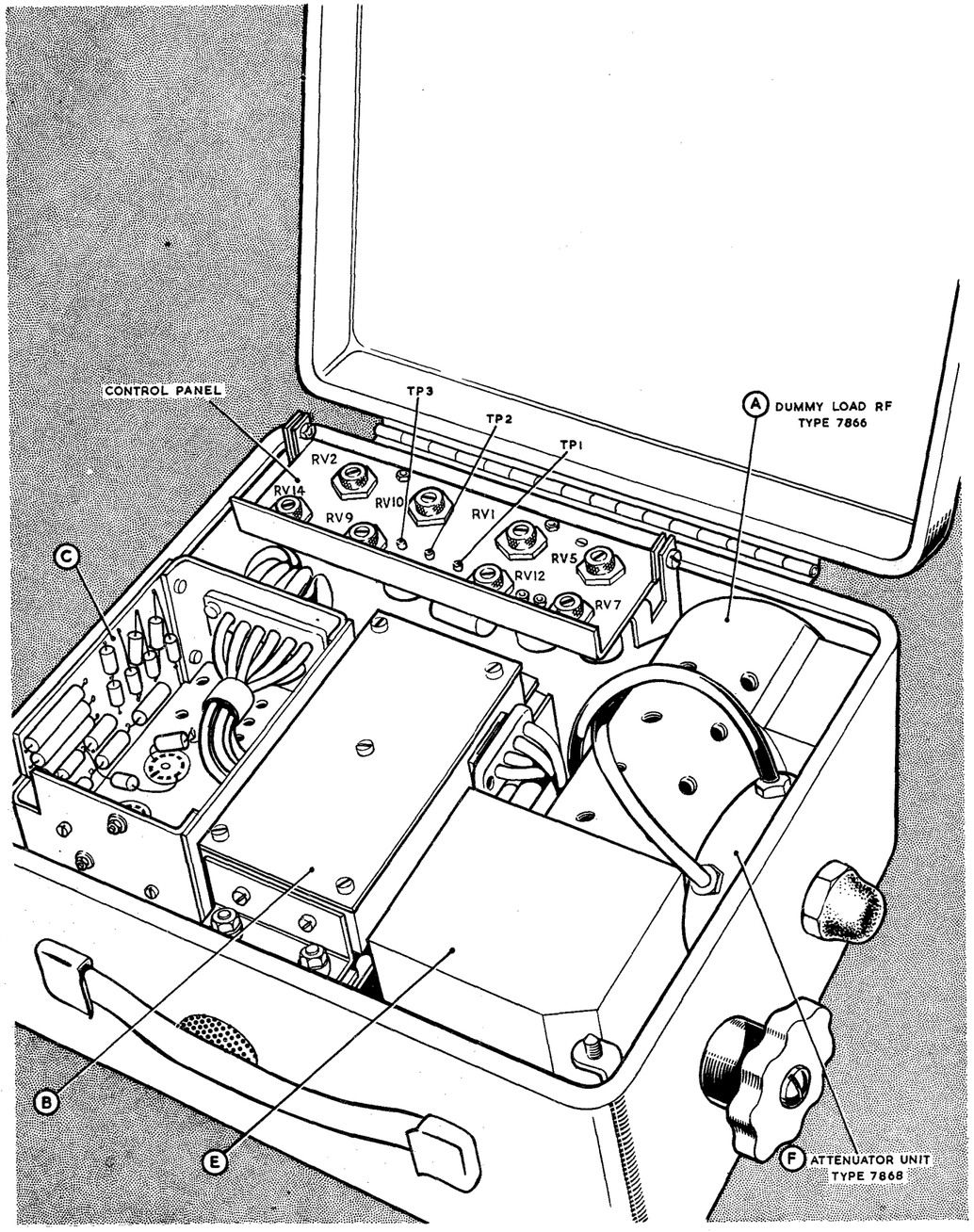
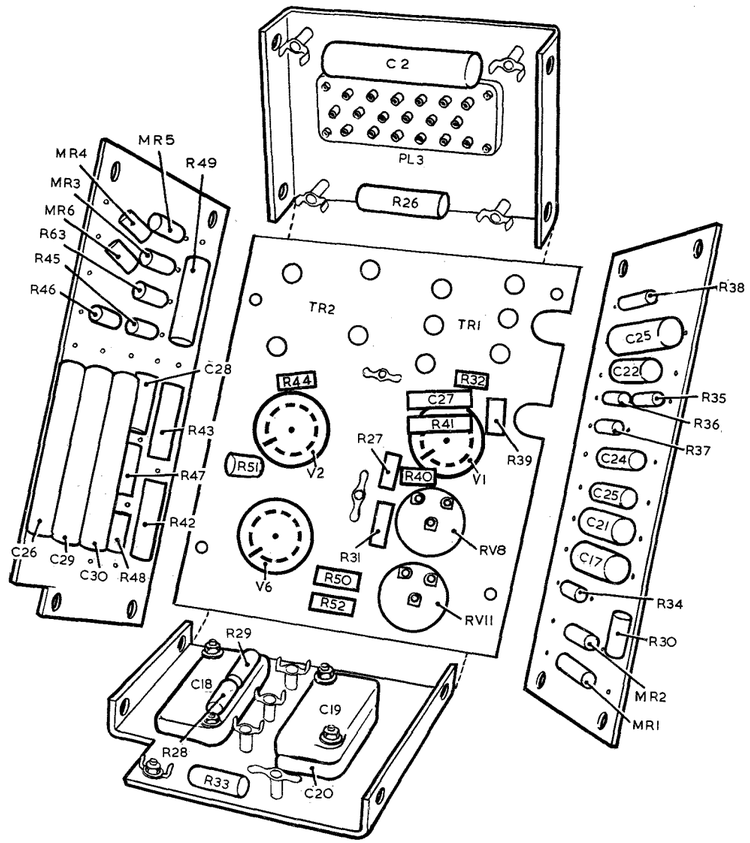
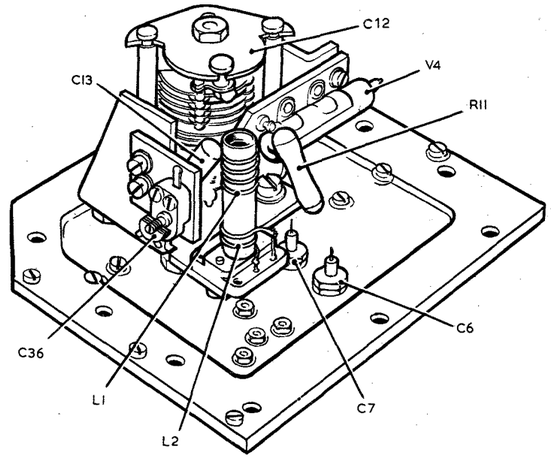
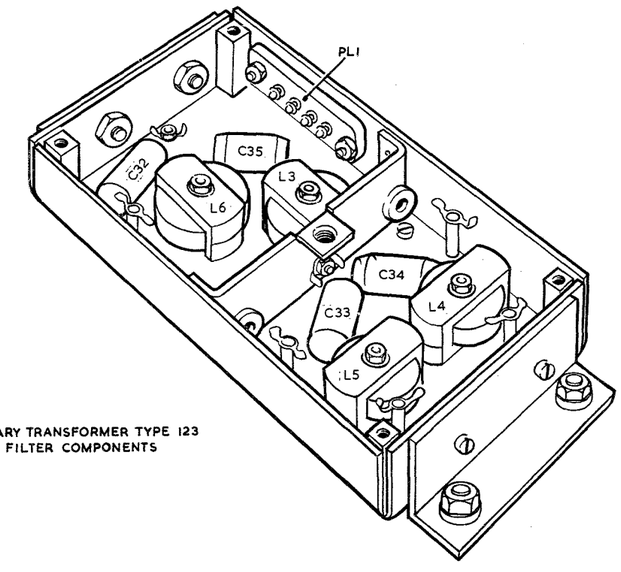




C AMPLIFYING UNIT TYPE 7867



E OSCILLATOR UNIT TYPE 7865



B ROTARY TRANSFORMER TYPE 123
FILTER COMPONENTS

Performance tester Type 9170 – component layout (rear)

Fig. 6.
Issued Jan. 68.

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Fig. 6.
Chap!. A.L.

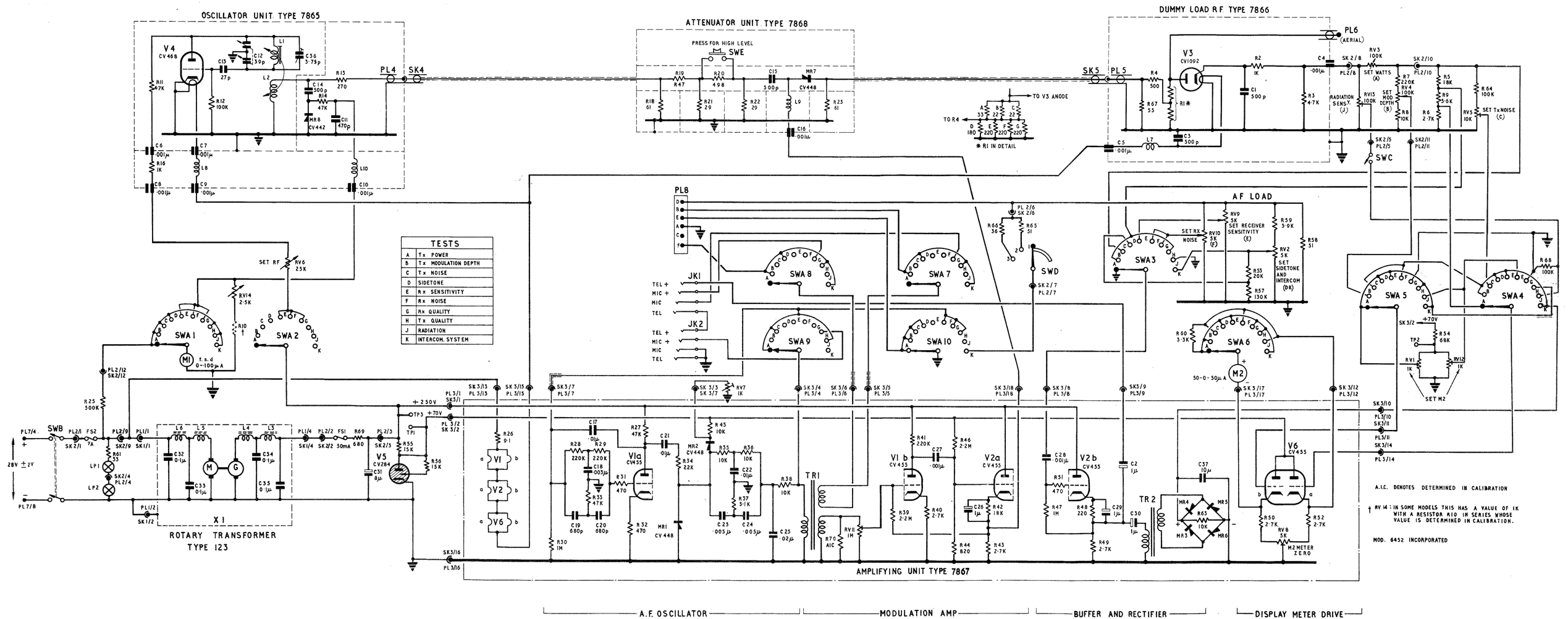


Fig.7

AL1, Sep.72

Performance tester Type 9170 – circuit

Chapter 2

SERVICING

CONTENTS

ILLUSTRATIONS

APPENDICES

Introduction

1. This chapter deals with the servicing of the test sets Type 740 and 740A. The information given here is issued as an interim measure and may be amended as necessary when experience of this instrument has been gained in Service use. All the controls required for normal operations are mounted on the outside of the case and the remainder which are mounted inside are all accessible for servicing purposes.

2. The sub-assemblies of the instrument are fitted inside the case and their disposition is shown in fig. 5 in Chap. 1 which also gives the general component location. In addition, the above chapter provides the general circuit diagram for the complete instrument.

3. When any of the components located in the sub-assemblies has to be renewed, it is essential that the procedure for dismantling detailed in Appendix 1 should be followed carefully in the sequence given. The sequence of assembly should be the reverse of that for dismantling. Care should be exercised to ensure that screws, etc., which are removed during dismantling are kept in a container specially set aside for the purpose rather than left indiscriminately on the bench. In some instances locking nuts have to be slackened when preset potentiometers are being adjusted and these should always be tightened on completion of the operation.

4. The servicing as detailed in this Chapter is designed to ensure that the equipment is functioning satisfactorily. It is normally to be carried out at third line servicing only and it should be noted that no attempt is to be made to perform the servicing at a lower level unless otherwise specified in the appropriate servicing schedule, as this would probably result in the calibration being invalidated.

General

5. As a preliminary step, remove the two screws which hold the front and rear hinged panels in position and make a thorough inspection for any signs of unserviceability. If any components show signs of overheating, check that no overload exists and then renew the appropriate component(s).

6. Check that the ratings of the fuses FS1 and FS2 are correct. Renew, if necessary. The replacement stores for these are fuses, Type 300 (Stores Ref. 10H/18446) and fuses, Type 148 (Stores Ref. 10H/18613) respectively. Check that the two scale lamps are serviceable. Renew, if necessary. The replacement store for these is a Joint-Services item referenced X953247.

9. Check the voltage of the input power supply on the instrument meter M1 and adjust if necessary, to between 27 and 29 volts. This is an essential qualification which must be satisfied before proceeding further and, additionally, the voltage must be maintained within these limits throughout the complete procedure which follows.

10. The instrument is dependent on the rotary transformer Type 123 for its HT power supply which determines the overall performance of the instrument; this should therefore be checked first before dealing with the functional circuits.

11. The general instructions for servicing the rotary transformer are given in A.P. 4343, Vol. 1, Sect. 1, Chap. 1 and Sect. 8, Chap. 1, and A.P. 1186D, Vol. 1, Sect. 3, Chap. 1 and these should now be referred to. In addition, the following specific conditions apply to the rotary transformer Type 123. The brushes and bearings should be renewed every 500 hours and the commutator should be skimmed every 500 hours. In this connection it should be borne in mind that the minimum permissible diameter of both the commutators is 0·625 in. Realignmant for magnetic neutral is essential when any of these operations is carried out. An exploded view of the rotary transformer is shown in fig. 1 for reference.

Note . . .

The times given above are provisional and may be amended in light of Service experience.
The pole pieces are shown out of the frame but they should not be taken out during normal dismantling.

12. Check the voltage at test point TP3 which should be between 225 and 275 volts. When this is found to be below 225V switch the instrument off, disconnect PL2 and test for an electrical overload at TP3. The load is normally about 25,000 ohms and if the reading is near this value, check the capacitors in the filter section. These are located in the box attached to the underside of the rotary transformer and are accessible when the cover plate of the box, held in position by screws, is removed. Renew any component found to be faulty. If the resistance reading at TP3 is low, the fault will probably be in the amplifying unit Type 7867 and the components of this unit are immediately accessible when the rear hinged panel is opened. The faulty component should then be determined by a process of elimination of those components directly associated with the HT supply.

13. The + 70V stabilized supply for the amplifying unit Type 7867 should also be verified at test point TP1. If this voltage is incorrect, this will be caused by either an overload or a faulty stabilizer valve. Remove the plug PL2 and test for an overload at TP1. The normal DC load should be about 10,000 ohms. If the reading is considerably below this figure, the faulty component should then be determined by a process of elimination of those components directly associated with the stabilized supply. If, on the other hand, the load is normal, renew V5.

14. The display meter stage is in the amplifying unit Type 7876 and, as it is required for a number of the functional tests which follow, it should now be checked for balance by carrying out the following check and adjustment procedure:—

(1) Check that the meter pointer is mechanically centred.

(2) Switch on and check that the supply voltage is between 27 and 29V. Before making any external connections other than that to the 28V supply, check the meter pointer on all positions of the selector switch in the following manner:—

A—Reject 50±4 divisions
B—Central±2 divisions
C– Central±0·5 divisions
D—Reject 50±4 divisions
E—Reject 50±4 divisions
F—Pass 50±4 divisions
G—Central±0·5 divisions
H—Central±0·5 divisions
J—Reject 50±4 divisions
K—Reject 50±4 divisions

If the above readings cannot be obtained, the test set should be aligned as set out below:—

H—Adjust RV8 for central reading of meter
A—Adjust RV1 for Reject 50 reading on meter
J—Adjust RV12 for Reject 50 reading on meter
F—Check that reading is Pass±1 division.

The above is to be repeated until the correct readings are obtained.

15. Next set the selector switch to position B and measure the open circuit AF voltage at pins B and F on plug PL8. This should be 10 mV. If it is less than 9 mV adjust RV7 until it measures 10 mV. If this fails to produce the required voltage, test V1 and renew, if it is below standard.

Functional circuits

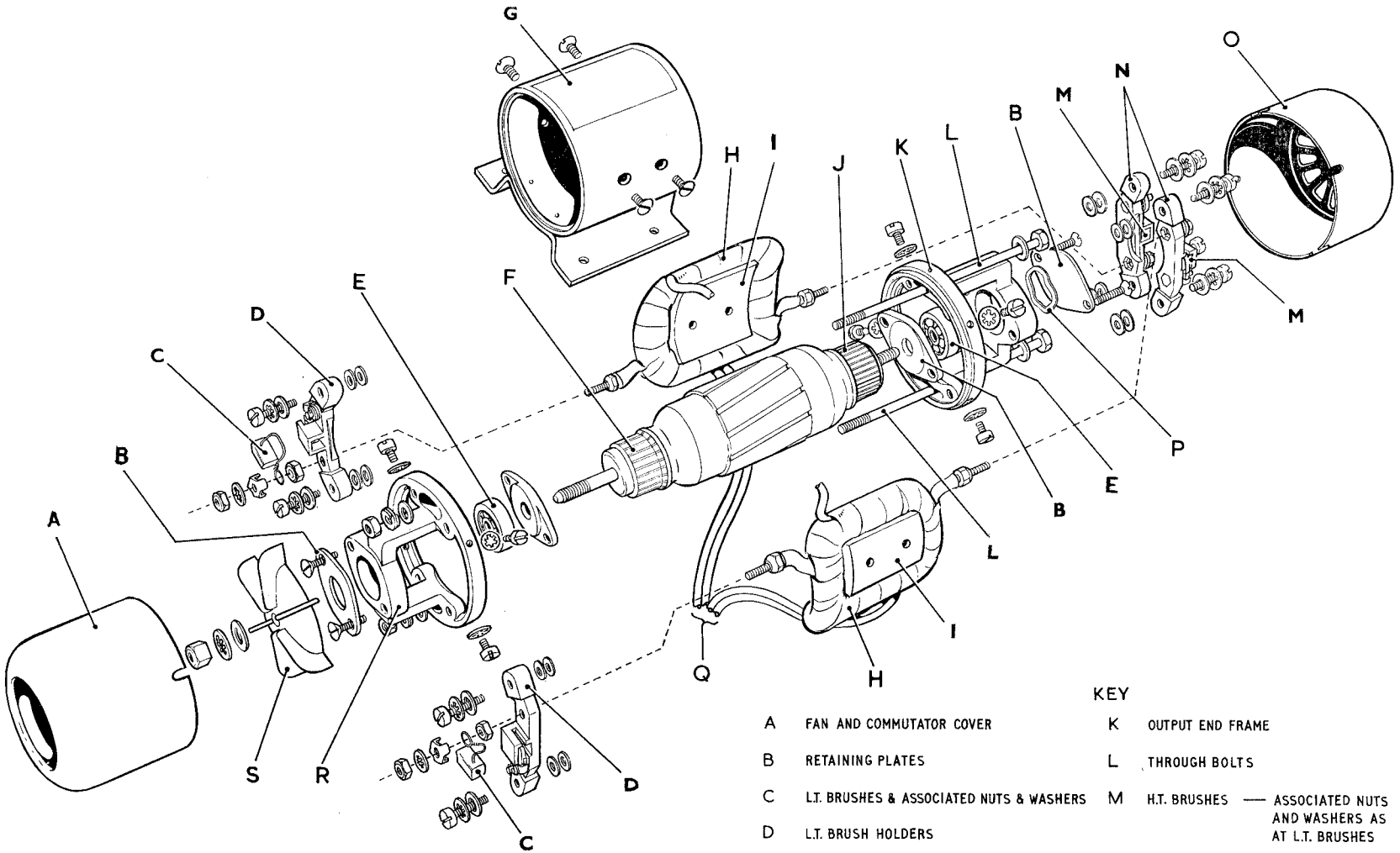
16. The functional circuits introduced for the ten positions of the service selector switch SWA should now be checked and adjusted as detailed in the following paragraphs (para. 17 to 30).

Transmitter power (switch position A)

17. Select a serviceable VHF transmitter-receiver and set it up on the bench. Adjust the output of the transmitter to give a 100 Mc/s CW output of 1 watt, measured on a specially checked test set Type 740 (see *Note* below) connected to the aerial output plug of the transmitter via the 20 ft. coaxial connector, and then transfer the transmitter output still via the coaxial connector, to the plug PL6 on the test set being serviced. With the SET WATTS control RV3 set for 1 watt, the needle on the meter M2 should now be central. If the needle is not central, adjust the SET M2 preset potentiometer RV1 until it is so. Repeat this test for 5 watts and for the maximum output of the transmitter and again for the same three power levels with transmitter frequencies of 125 Mc/s and 156 Mc/s. The meter needle should remain within plus or minus 15 per cent. for nominal readings between 3 and 10 watts and within 0·25 watts for the 1 and 2 watts positions. If this requirement is not met, the dummy load Type 7866 should be removed and a serviceable unit fitted in its place. The test detailed in this paragraph should then be repeated. The dummy load which is removed should be serviced in accordance with the instructions given in Appendix 2.

Note . . .

The local standard is determined by taking two or more test sets Type 740 *and aligning them as detailed in para.* 14 *above. These test sets are then used to measure the power output from a common source and can be considered as standard if they give similar readings.*



KEY

A	FAN AND COMMUTATOR COVER	K	OUTPUT END FRAME
B	RETAINING PLATES	L	THROUGH BOLTS
C	L.T. BRUSHES & ASSOCIATED NUTS & WASHERS	M	H.T. BRUSHES — ASSOCIATED NUTS AND WASHERS AS AT L.T. BRUSHES
D	L.T. BRUSH HOLDERS		
E	BALL RACES	N	H.T. BRUSH HOLDERS
F	L.T. COMMUTATOR	O	COMMUTATOR COVER
G	MILD STEEL FRAME	P	CORRUGATED WASHER
H	FIELD WINDINGS	Q	CONNECTIONS L.T.+ YELLOW L.T.− BROWN H.T.+ RED H.T.− BLACK
I	POLE PIECES	R	INPUT END FRAME
J	H.T. COMMUTATOR	S	FAN

Fig. 1. Exploded view of the rotary transformer Type 123

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Transmitter modulation depth (switch position B)

18. There is no unit of test equipment available to enable an independent check of the modulation depth to be made at the time of going to print but there is one under development. In the meantime a check of the modulation depth test circuit will have to be made by comparing its performance with that of a standard performance tester Type 9170 which is known to be serviceable and which is kept specially to make this test.

19. Set the selector switch to position B and the SET MOD depth control to the modulation depth to be expected from the transmitter in use on the standard tester. Connect the standard tester to the transmitter output via the 20 ft. coaxial connector. Tune the transmitter to 125 Mc/s and then note the position of the M2 meter needle relative to the centre balance line. Now remove the standard tester and connect the unit to be tested, similarly adjusted, in its place. If the reading on the second meter is radically different from that of the standard set, test the buffer valve V2 and the resistors R5, 6 and 9. Renew any of these components which are faulty and then repeat the comparison check above. If this does not correct the discrepancy in the readings, the amplifying unit Type 7867 should be removed and a serviceable unit fitted in its place.

Transmitter noise (switch position C)

20. The circuit required for this test has been checked during the modulation depth test and no individual test is therefore necessary.

Sidetone (switch position D)

21. Set the selector switch to position D and connect the output of the signal generator Type 65, set to 1,000 c/s, to pins A and D of plug PL8. Adjust the output level of the signal generator for mid-scale reading on instrument meter M2. The signal generator output level should be within the limits 2·2V and 2·3V. If the level is outside these limits, set it to 2·3V and then adjust the set sidetone preset control RV2 for a mid-scale reading.

Receiver noise (switch position F)

22. Connect the instrument to the aerial plug of the transmitter-receiver via the normal 20 ft. coaxial connector and set the transmitter-receiver for reception on 130 Mc/s. Set the selector switch to position F and adjust the oscillator unit frequency to receiver frequency. Adjust the SET RF control RV6 for correct reading in instrument meter M1. If the meter needle does not rise to the required level until the maximum clockwise setting of the control is reached the oscillator unit Type 7865 should be removed and a serviceable unit fitted in its place. If, on the other hand, this reading can be obtained within the range of the SET RF control, connect a 0–1 milliameter to the plug PL3 on the receiver and note the meter reading.

23. Next disconnect the coaxial connector to the transmitter-receiver under test and substitute a signal generator Type 62 tuned to 130 Mc/s. Adjust the output level from the signal generator, unmodulated, until the same reading is obtained in the meter connected to the receiver. The signal level must now be between 7 and 13 μV at the receiver input. If it is outside these limits, renew the attenuator unit Type 7868 and repeat the check with the signal generator. If this does not produce the required correction, renew the oscillator unit Type 7865.

24. Connect the output of the signal generator Type 65, set to 1,000 c/s, to pins A and D of the plug PL8 on the instrument and adjust the voltage level until mid-scale reading is obtained in the instrument meter M2. The output voltage from the signal generator should be between 0·2V and 0·25V and if it is outside these limits, set the level to 0·22V and adjust the receiver noise preset potentiometer RV10 until a mid-scale reading is obtained in M2.

Receiver sensitivity (switch position E)

25. Set the service selector switch to position E and check the level of the AF voltage across the contacts on switch sections SWA7 and 8. This should be between 8 and 12 millivolts, and if not, test and renew V1. Should the level still be too low, renew the amplifying unit Type 7867.

26. Next connect the output of the signal generator Type 65 to pins A and D of plug PL8 and adjust the voltage level for mid-scale reading on instrument meter M2. The input level should now be between 0·85V and 0·9V. If the level is outside these limits, adjust the level to 0·87V and then adjust the sensitivity preset potentiometer RV9 until mid-scale reading is obtained.

Receiver quality (switch position G)

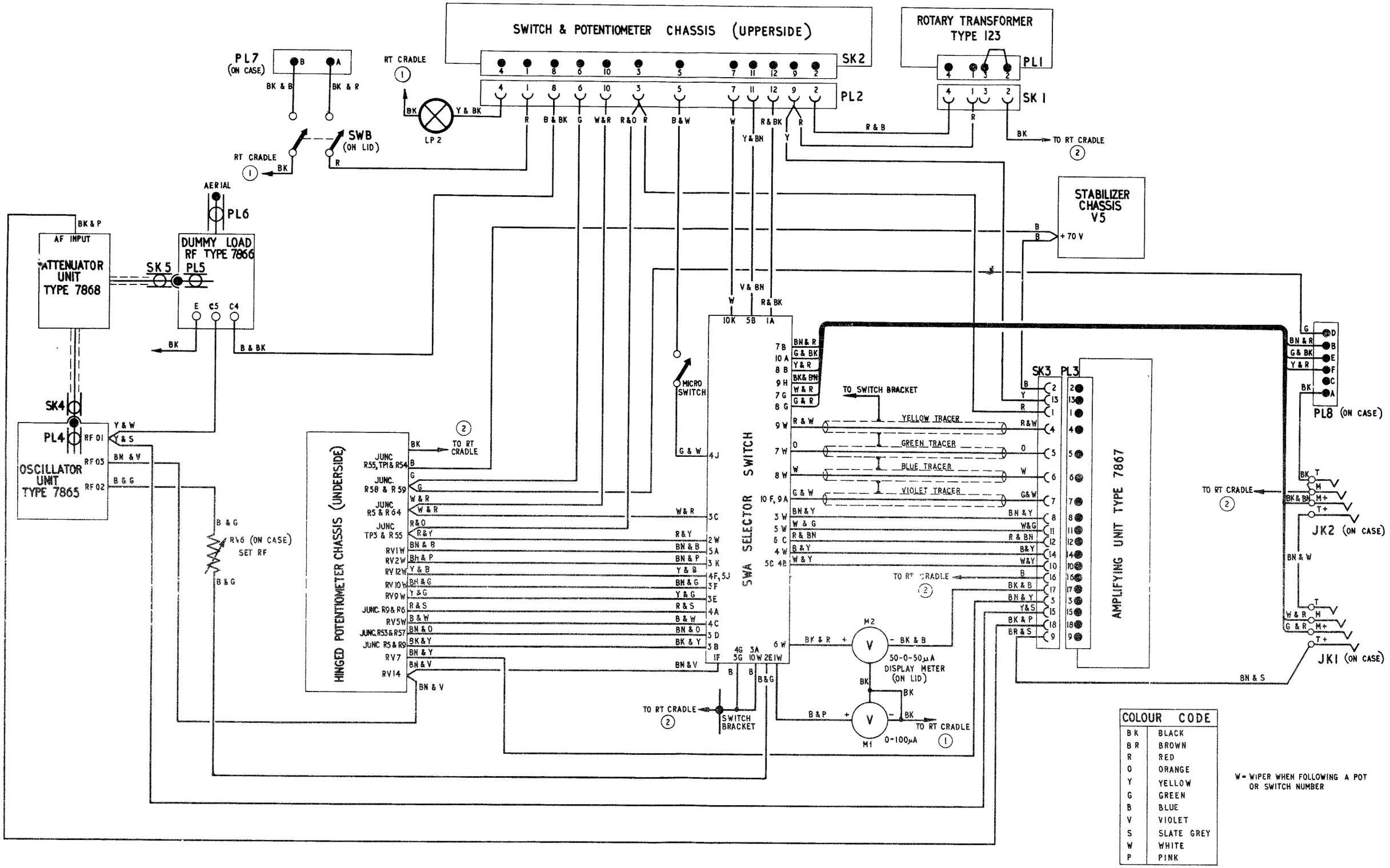
27. This test will have to be made qualitatively by connecting a mic/tel set to JK1 and with the RF output of the test set still connected to the test receiver, make an arbitrary assessment of the frequency response.

Transmitter quality (switch position H)

28. Set the service selector switch to position H and connect the output of the signal generator Type 65 to the mic. contacts of JK2. Set the signal generator frequency to 1,000 c/s and the output level to 10 mV and then measure the voltage appearing at pins B and F on plug PL8 on open circuit. This should be not less than 9 mV.

Radiation (switch position J)

29. Set the service selector switch to position J and erect the telescopic aerial on the instrument. Check that, with the instrument aerial at a reasonable distance from the transmitter receiver aerial and the transmitter transmitting on normal maximum power, a mid-scale reading is obtained on the test set meter M2. If not, adjust RV13 until a mid-scale reading is obtained.



COLOUR	CODE
B K	BLACK
B R	BROWN
R	RED
O	ORANGE
Y	YELLOW
G	GREEN
B	BLUE
V	VIOLET
S	SLATE GREY
W	WHITE
P	PINK

W= WIPER WHEN FOLLOWING A POT OR SWITCH NUMBER

Fig. 2

Performance tester Type 9170 wiring diagram

Fig. 2

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Intercom (*switch position K*)

30. Set the service selector switch to position K and connect the output of the signal generator Type 65 to pins A and D of PL8. Adjust the output level of the signal generator to approximately 1·9V when a mid-scale reading in M2 should be obtained. In addition, a voltage of 10 mV should appear at pins B and F of plug PL8.

Appendix 1

DISMANTLING INSTRUCTIONS FOR THE PERFORMANCE TESTER TYPE 9170

CONENTS

ILLUSTRATIONS

Introduction

Note . . .

The wiring of the performance tester Type 9170 *especially at the entry to the unitor plugs and sockets should be handled with the utmost care.*

1. The following instructions should be followed when any of the sub-assemblies have to be removed for servicing and a serviceable unit fitted in its place. Where additional instructions are necessary for dismantling individual sub-assemblies, these will also be given.

2. Some of the sub-assemblies can be removed without disturbing the remaining items and these are the dummy load Type 7866, the amplifying unit Type 7867, the oscillator unit Type 7865, microswitch SWC and the two potentiometer chassis. When the attenuator unit Type 7868, the rotary transformer Type 123 and the SET RF potentiometer RV6 have to be removed, one or more of the first mentioned items will have to be removed as an initial step. Access to the sub-assemblies is obtained by unscrewing two captive screws on the top and bottom hinged panels.

3. Care should be exercised when dismantling to ensure that all nuts, screws and washers which are removed are kept in a container specially set aside for the purpose.

4. A considerable number of feed-through capacitors are employed in this instrument and it is stressed that the maximum care should be exercised when dismantling to ensure that these capacitors are not damaged as they are extremely fragile.

5. When any of the germanium diodes have to be renewed, care should be taken to ensure that the thermal shunts in the form of loops in the connecting leads are incorporated.

Removal of dummy load Type 7866

6. The procedure is as follows:—

(1) Disconnect the coaxial socket SK5 from the load unit.

(2) Unsolder the three connections to C4 (blue black), C5 (yellow white) and chassis (black).

(3) Remove the three 4BA fixing screws through the top of the tester case.

The load can now be removed through the bottom cover by first rotating it so that the rectangular block attached to the side of the cylinder is facing the rear and then pulling the load out.

Removal of amplifying unit Type 7867

7. The procedure is as follows:—

(1) Disconnect the socket SK3 from the rear of the chassis on the side of the case and remove the four 6BA screws—two in bracket on side of case and two in the rotary transformer chassis. The amplifying unit can now be removed. The two bakelite panels of the chassis are each held in position by four 6BA screws and when these are removed and resistor R51 is unsoldered from the grid of V2, the two panels can be opened out as they are now only held in position by the wiring. This facilitates the renewal of the more inaccessible components.

Removal of oscillator unit Type 7865

8. The procedure is as follows:—

(1) Disconnect the coaxial socket SK4.

(2) Uncouple the extension spindle by removing the 6BA screw holding the coupler to the main tuning spindle.

(3) Remove the five 6BA holding screws. Two are screwed into tapped bushes in the chassis of the rotary transformer and the other three in a bracket attached to the side of the tester case have nuts fitted.

(4) Unsolder the connections to the feedthrough capacitors C8 (blue green), C9 (yellow, green and yellow white) and C10 (brown violet).

Removal of microswitch SWC

9. The procedure is as follows:—

(1) Remove the green white tag from the common point on the switch and the blue white tag from the upper of the two side contacts.

(2) Remove the two 6BA screws which fix the switch to the case.

The switch can now be removed.

Removal of potentiometer chassis

10. There are two potentiometer chassis. The first is fixed to the framework in which the rotary transformer is fitted and it can be removed by disconnecting the plug PL2 and then removing the four 6BA screws which fix the chassis to the framework.

11. The second is hinged on two captive screws which normally hold it fixed. The components mounted on the underside are easily accessible when these screws are loosened and the chassis lifted up.

Removal of attenuator unit Type 7868

12. The procedure is as follows:-

(1) Remove the dummy load Type 7866 first (*Para.* 6).

(2) Remove lead soldered to feed-through capacitor C16, taking care not to damage same, then remove, by disconnecting co-axial socket SK4, the remaining lead.

(3) Remove the rubber cap from the PRESS FOR HIGH and then remove the hexagonal fixing nut which holds the attenuator to the side of the case. It should be noted that the rubber sealing ring fitted in the recess on the outer face of the fixing nut and also the one in the attenuator casting must be in position when reassembling the attenuator.

Removal of rotary transformer Type 123 *assembly*

Note . . .

Access to the filter box on the underside of the rotary transformer can be had by removing five 6BA securing screws.

13. Removal of the Rotary Transformer assembly may be made through the bottom of the Performance Tester by opening the rear hinged panel and proceeding as follows:—

(1) Disconnect Socket SK1.

(2) Remove the four 4BA nuts securing the assembly to the frame via the anti-vibration mountings.

(3) Withdraw the Rotary Transformer assembly.

Note . . .

Care should be taken not to damage the anti-vibration mountings, and any damaged mountings discovered should be replaced.

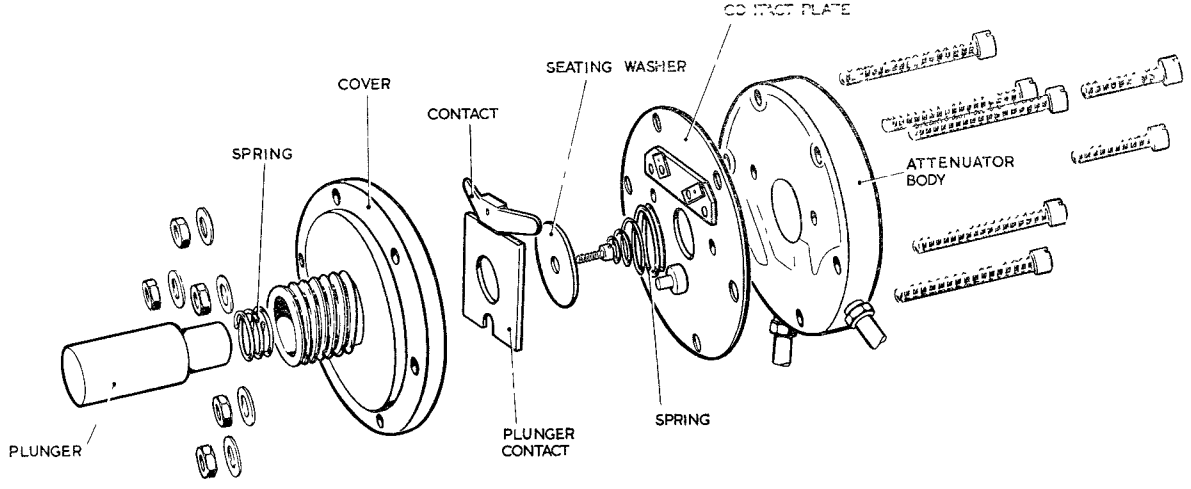

Fig. 1. Exploded view of attenuator unit Type 7868

Detailed dismantling of sub-assemblies

14. Three sub-assemblies, the oscillator unit Type 7865, the rotary transformer Type 123 and the attenuator unit Type 7868 may have to be dismantled for component renewal, and some aspects of the procedure to be followed merit special mention as detailed below.

Oscillator unit Type 7865

15. The oscillator triode valve V4 may have to be renewed and access to this is obtained by loosening eleven 4BA captive screws and removing the main cover. The connections from the grid (pin 1), anode (pin 2), heater/cathode (pins 6 and 7) and heater (pin 3) should then be unsoldered and the valve removed by sliding it out of the holder. The connecting wires for pins 4, 5 and 8 on the new valve should be cut short before being fitted as they are not required. The valve connections should now be soldered to the appropriate points in the circuit.

16. The RF seal, which consists of a 14 in. length of tinned copper braid (Manufacturers' Specification 16/5/·004) fitted into the channel in the cast cover, should be renewed each time the unit has to be dismantled.

Rotary transformer Type 123

17. The rotary transformer Type 123 assembly is removed as indicated in para. 13. The rotary transformer Type 123 is then removed from the framework in which it is fitted as follows:—

(1) Remove the five 6BA screws which secure the cover on the filter box on the underside of the assembly.

(2) Unsolder the connections to L5 (yellow), L4 (red) and the connections (black and brown) from the earth tag.

(3) Remove the four 6BA screws securing the cradle of the motor to the filter box.

The rotary transformer can now be removed from the cradle and dismantled as indicated in Sect. 5, Chap. 2, para. 11.

Attenuator unit Type 7868

18. The attenuator unit Type 7868 may require to be dismantled to renew the germanium diode and the procedure is as follows:—

(1) Remove the five 65A bolts and nuts which hold the attenuator body and cover (*fig.* 1) together. The cover together with the plunger, strap and associated springs of switch SWE can now be removed.

(2) Remove the two outer 6BA screws from the underside of the main casting (NOT the centre one).

(3) Unsolder the two connections to the switch contacts and remove the contact plate.

The components in the compartments of the casting are now accessible for servicing. The germanium diode should normally be the only component which has to be renewed.

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