SERVICE MANUAL

PHILIPS

"PHILETTE"

Radio Receiver Type L3G91T

SERVICE DEPARTMENT
WADDON FACTORY ESTATE
CROYDON . SURREY

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SERVICE MANUAL FOR THE

PHILIPS RADIO RECEIVER

TYPE L3G91T

TRANSISTOR COMBINATION

T1	OC44	Frequency Changer.
T2	OC45	1st I.F. Amplifier.
T3	OC45	2nd I.F. Amplifier.
T4	OC78D	Driver.
T5	OC78	Output (Matched Pair).
T6	OC78	
X1	OA70	Detector.

SUPPLY VOLTAGE

9 volts D.C.

CONSUMPTION

With a supply of 9 V. and the receiver switched to M.W., under no signal conditions the battery drain should be between 6—9 mA.

BATTERY TYPES

Ever Ready PP9, Vidor T6009

WAVEBAND RANGES

M.W. 188 — 555 metres.
L.W. 1,177—2,000 metres.

TRIMMING FREQUENCIES

I.F. 470 Kc/s.
M.W. 537 Kc/s, 640 Kc/s, 1,610 Kc/s, 1,425 Kc/s.
L.W. 180 Kc/s.

CABINET DIMENSIONS

Height 7¼" Width 9½" Depth 3"

PRECAUTIONARY NOTE

Information concerning the properties and use of transistors has been published in various technical journals and books. For engineers who are not yet familiar with the technique involved, the following notes may be of assistance. It will be evident that certain methods of fault-finding, measurements, etc., hitherto regarded as "normal" can cause damage to equipment using transistors.

1. Transistors are temperature conscious. The current which flows between base and collector (with emitter disconnected) is approximately doubled for every 7° C. temperature rise. This current is multiplied by the amplification factor when the emitter is grounded. There is a maximum working temperature above which the current will increase until the transistor is destroyed.

   Apart from working conditions, heat alone is detrimental and they should not be subjected to temperatures above 60° C. in storage, etc.

2. A temperature rise of about 1° C. is produced by a dissipation of about 2.5 mW. in a transistor. For this reason the output transistors are equipped with cooling fins which must always be fitted when the receiver is operative.

3. The output transistors (Tr.5, Tr.6) are supplied as a matched pair. If either one or both transistors require replacement a replacement matched pair must be used.

4. When a resistance meter is being used for fault-finding, care must be taken to ensure that the voltage applied from the meter battery does not exceed the normal circuit potential at the point being measured. Due to current flow through the transistors caused by the meter battery, false readings will be observed, when making resistance checks on some parts of the circuit. In these instances it will be necessary to disconnect the component under test.

5. Voltage surges can cause damage. Although low voltages are involved, it is essential to switch the apparatus off before replacing transistors and components. Soldering to the transistor leads must be done rapidly with the aid of a heat shunt (i.e., grip the leads with a pair of pliers).

6. Transistors are photo-electric. Glass cased units are painted black. This paint must not be scratched or chipped. Whilst exposure to light does no harm,

it will modulate the transistor current (e.g., such a transistor operating under a fluorescent light will produce hum).

7. Transistors are adversely affected by humidity. The glass cased units are fragile, and a crack may not be conspicuous. Ingress of moisture will cause the unit to deteriorate at a rate depending on the size of the flaw. Care must, therefore, be exercised in handling and storage.

SERVICING NOTES

This receiver utilises the printed wiring technique. Part of the chassis consists of a printed wiring panel to which are mounted the circuit components.
It is recommended that "60/40" Resin Cored Solder be used for any repairs. On no account must ordinary flux be used as this will lead to corrosion of metal parts, and a lowering of the insulation resistance between the copper foil strips. In addition it will attack the moulded chassis material.

The soldering iron used should be such as to enable joints to be quickly made, without overheating the chassis. A bit diameter of about 6 mm. is recommended. In addition a small stiff brush (e.g., a stiff toothbrush, not nylon) will be of assistance in removing melted solder from the contact points.

To replace components held by their lugs (i.e., I.F. and A.F. transformers) heat the lugs, and remove the solder with the brush. Release the lugs one by one by gently prising them inwards using a small screwdriver. When replacing, first ensure that the soldering iron bit and tags are tinned.

To replace components held by their own wire ends (capacitors, resistors, etc.), cut the wires to the faulty component as close to the body of the faulty component as possible. Fit the replacement component to the wire ends left projecting from the chassis, using solder springs. The solder springs should lie against the chassis plate in order to prevent "loosening" of the printed "wiring." A break in the printed wiring can be repaired by bridging it with a small piece of wire.

CHASSIS REMOVAL

Remove the rear section of the cabinet by unscrewing the two ornamental fixing screws.

Unsolder the car radio aerial socket connections.
Remove the knobs (pull off), springs and station scale. Remove the two long fixing pillars and bottom fixing nut. The centre section of the cabinet can now be removed, and if necessary the chassis separated from the front section of the cabinet.

The printed plate is held in position by two spring clips fitted to the permanent magnet of the loudspeaker. If the panel is separated from the chassis it is important to replace the insulating washer fitted between the loudspeaker and the printed plate when re-assembling the unit.

REPLACING THE DRIVE CORD

Make up the cord to the dimensions shown.
Turn the gang to minimum (i.e., fully anti-clockwise position).

Fit one end of the cord to the tension spring and anchor the other end of the spring to the tuning drum.

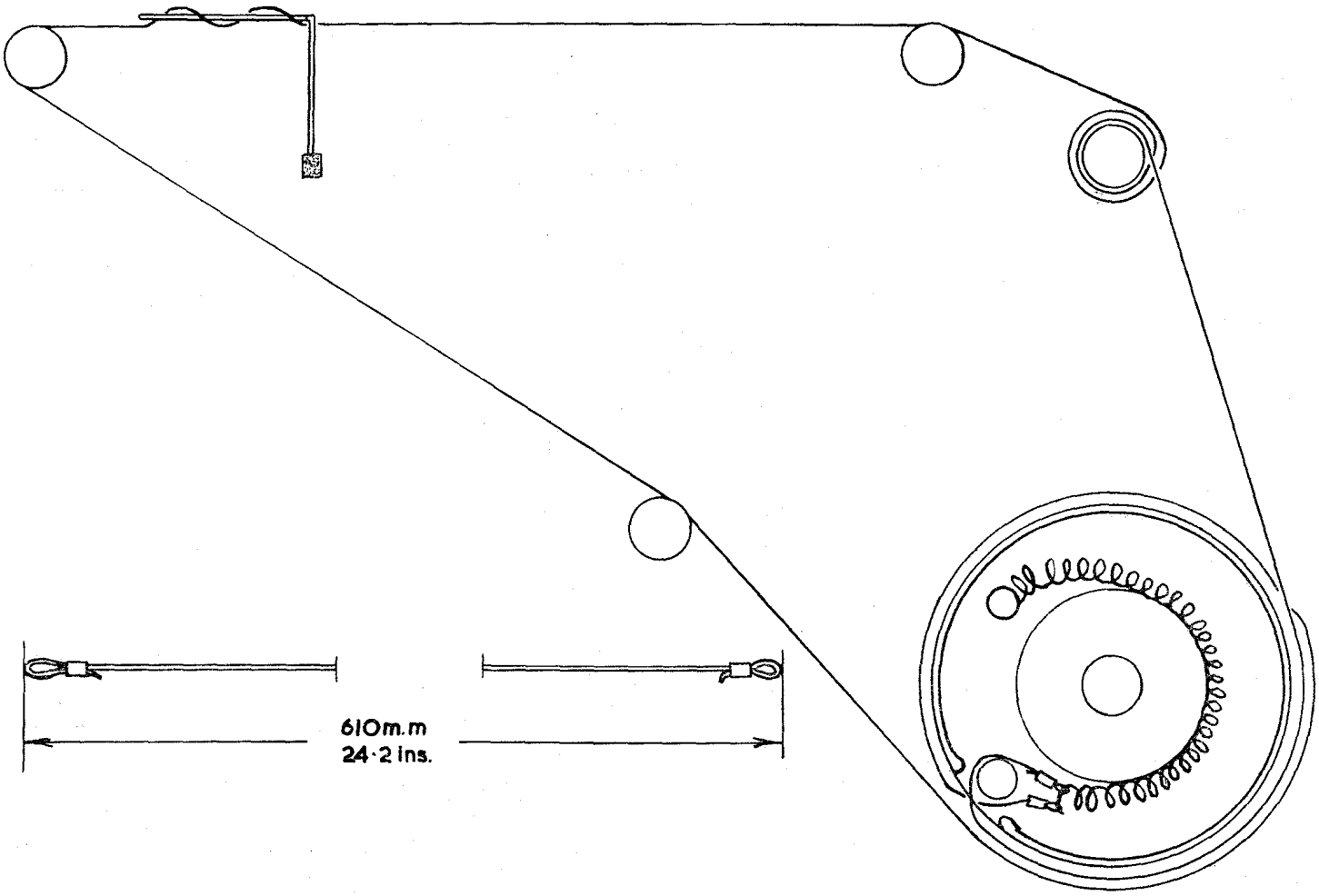
Wind on one turn in a clockwise direction round the drum and pass the cord over the bottom pulley, followed by the left and right-hand pulleys. Wind two turns round the tuning spindle in a clockwise direction winding from back to front, then pass the cord half a turn round the tuning drum in a clockwise direction and anchor to the tension spring.

Fit the pointer as shown in the diagram.

CIRCUIT DESCRIPTION

The receiver functions from a 9 V. L.T. supply, the positive side of the battery being connected to chassis.
The internal ferroxcube rod aerial, tuned by C1 and C11 forms the tuned input circuit for the first transistor Tr.1 (OC44). S3/S4 is the M.W. section, and S1/S2 is switched into circuit on L.W. A car radio aerial input socket is connected to the base circuit via C28 and S21. Tr.1 operates as a self oscillating mixer. Oscillator feedback is taken from the collector through low impedance windings S5/S7a to the emitter. C2, the oscillator tuning capacitor, is suitably shaped so that a padding capacitor is not required. The trimming capacitor is C10 on M.W. with C7 connected in parallel on L.W. Negative bias is applied to the base of Tr.1 by the fixed potentiometer R1, R2.

The I.F. circuit is comprised of two OC45 transistors (Tr.2 and Tr.3) connected in grounded emitter circuits. The I.F. output from Tr.1 is passed via the 1st I.F. transformer S8-S10 to the base-emitter circuit of the 1st I.F. amplifier Tr.2. A.V.C. is applied to the base of this transistor by returning the D.C. bias potentiometer R3/R4 to the top of the detector diode load R27. In addition Tr.2 is biased by the negative volts drop across R7. The bias for Tr.3 is a combination of the fixed negative voltage applied to the base from the junction of R10/R8 and the volts drop across the emitter resistor R9. Both of the I.F. transistors are neutralised; Tr.2 by C23/R5 and Tr.3 by C24/R6.



From the 3rd I.F. transformer secondary S16, signals are fed to the detector diode X1 (OA70). Audio signals appearing across the load resistor R27 are passed via the volume control R11 to the base circuit of the driver transistor Tr.4 (OC78D). Due to the low input impedance of Tr.4 the coupling capacitor C21 is large in value (1 mfd.). Tr.4 is transformer coupled to the output stage; a matched pair of OC78 transistors biased for Class B operation. A single ended push pull circuit is used, so that an output transformer is not required. Correct matching for the output circuit is obtained by using a high impedance loudspeaker (30 Ω). Negative feedback between the output circuit and the emitter of Tr.4 is applied by R17.

Bias for Tr.4 is a combination of the negative potential applied to the base by the potential divider R14/R18 and the volts drop across the emitter resistors R15/R16. Tr.5 and Tr.6 are biased by the potential divider R20, R21, R22, R23. The voltage across R21 provides the bias for Tr.5 and the voltage across R23 the bias for Tr.6.

TRIMMING INSTRUCTIONS

1. Pointer Setting

Set the tuning gang to maximum and adjust the pointer to the right-hand edge of the scale trimming line.
NOTE: The trimming line is located between the M.W. and L.W. scale blocks, and represents 180° movement of the tuning gang from the maximum position.

2. General

(a) Sound output should be observed by disconnecting the loudspeaker and connecting an output meter in parallel with a 30 Ω load resistor across the loudspeaker leads. An output level of 50 mW. should be used when trimming.

(b) If a suitable trimming tool is not available for trimming the cores of the I.F. and oscillator coils, one can easily be made, by cutting a slot in the end of an insulated No. 10 knitting needle.

3. I.F. Trimming

Switch to M.W.

Turn the tuning gang to minimum and the volume control to maximum.

Apply a modulated signal of 470 Kc/s to the base of Tr.1 via a 470 KpF capacitor connected in parallel with a 2.2 MΩ resistor.

Trim the cores in the following order:—
S11, S14, S8, S11, S8.

NOTE: To trim S14 the metal coil cover must first be removed. The cover must be replaced as soon as the coil has been trimmed.

4. Oscillator Trimming

Switch to M.W.

Turn the tuning gang and the volume control to maximum.

Apply a modulated signal of 537 Kc/s to the base of Tr.1 via a 470 KpF capacitor connected in parallel with a 2.2 MΩ resistor.

Trim S7 for maximum output.

Set the gang so that the pointer lines up with the left-hand edge of the scale trimming line (see section "Pointer Setting").

Adjust the generator frequency to 1,610 Kc/s and trim C10 for maximum output.

Repeat as necessary.

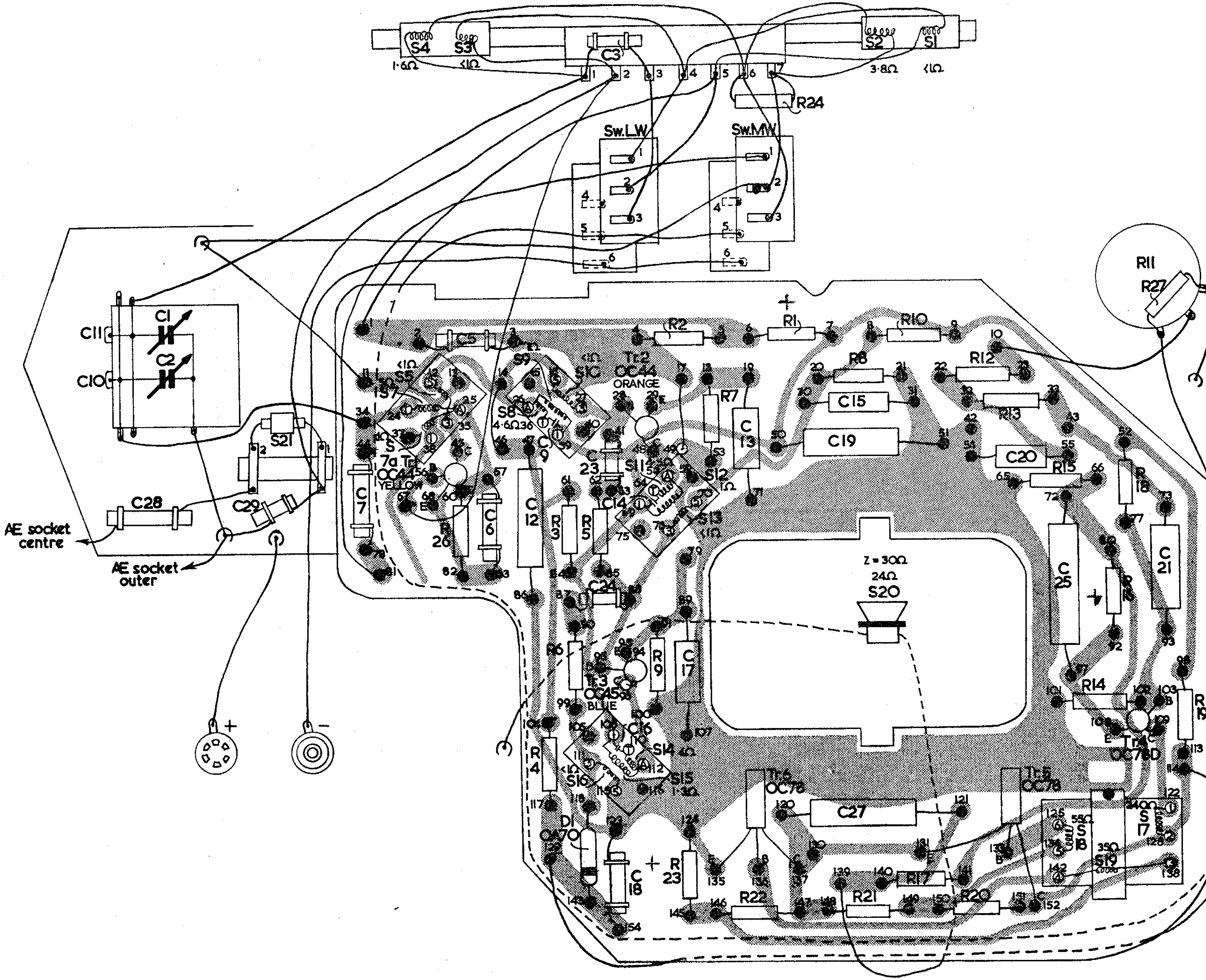
5. M.W. Aerial Trimming

Switch to M.W. and turn the volume control to maximum.
Ensure that the cover of S14 is in position.
Apply a modulated signal of 640 Kc/s to the base of Tr.1 via a 470 KpF capacitor connected in parallel with a 2.2 MΩ resistor.
Rotate the tuning gang to the position of maximum output.
Without altering the gang position, disconnect the generator from Tr.1 and loosely couple the signal to the aerial circuit. This can be conveniently done by clipping the generator output lead, onto the insulation of the connecting leads between the M.W. and L.W. sections of the internal aerial.
Trim S3/S4 for maximum output.
Change the input frequency to 1,425 Kc/s and trim C11 for maximum output.

6. L.W. Aerial Trimming

Switch to L.W. and turn the volume control to maximum.
Apply a modulated signal of 180 Kc/s to the base of Tr.1 via a 470 KpF capacitor connected in parallel with a 2.2 MΩ resistor.
Rotate the tuning gang to the position of maximum output.
Without altering the gang position disconnect the generator from Tr.1 and loosely couple the signal to the aerial circuit. This can be conveniently done by clipping the generator output lead onto the insulation of the connecting leads between the M.W. and L.W. sections of the internal aerial.
Trim S1/S2 for maximum output.

7. Repeat Section 5



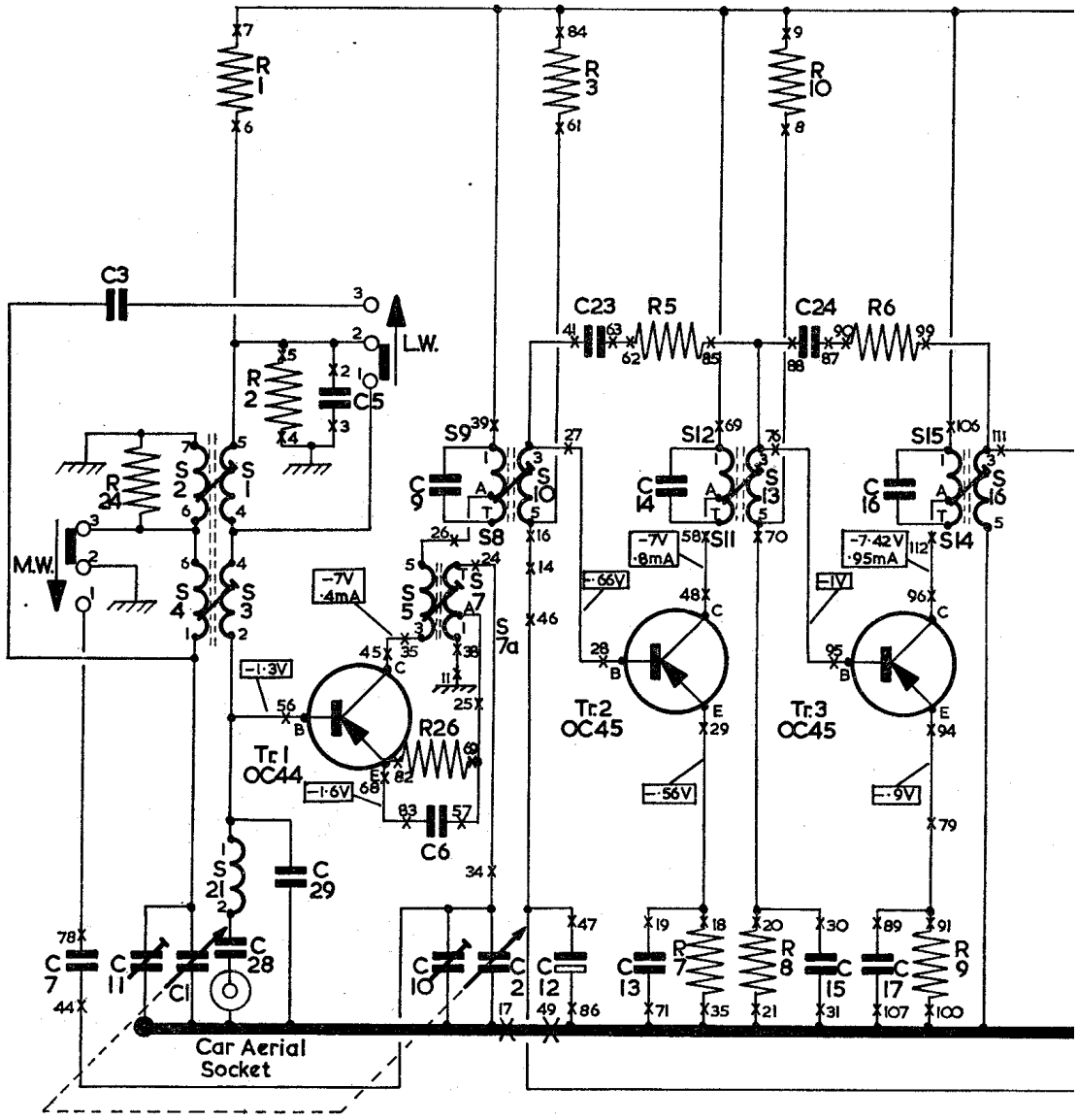
S4
S3
1·6Ω
<1Ω
C3
S2
S1
3·8Ω
<1Ω
R24
Sw.L.W.
Sw.M.W.
R11
R27
C11
C1
C2
C10
S21
C28
C29
AE socket centre
AE socket outer
C5
R2
R1
R10
R12
R8
C15
R13
C19
C20
R15
Tr.2
OC44
ORANGE
S9
S10
S5
S7
S8
4·6Ω
Tr.1
OC44
YELLOW
C7
C6
C12
C9
C23
S11
S12
S13
C14
R3
R5
R26
R7
C13
R18
C21
C25
R16
C24
Z = 30Ω
24Ω
S20
R6
Tr.3
OC45
BLUE
R9
C17
C16
S14
S15
S16
R4
D1
OA70
C18
R23
R22
R21
R20
R17
Tr.6
OC78
Tr.5
OC78
C27
R14
Tr.4
OC78D
R19
S17
S18
S19

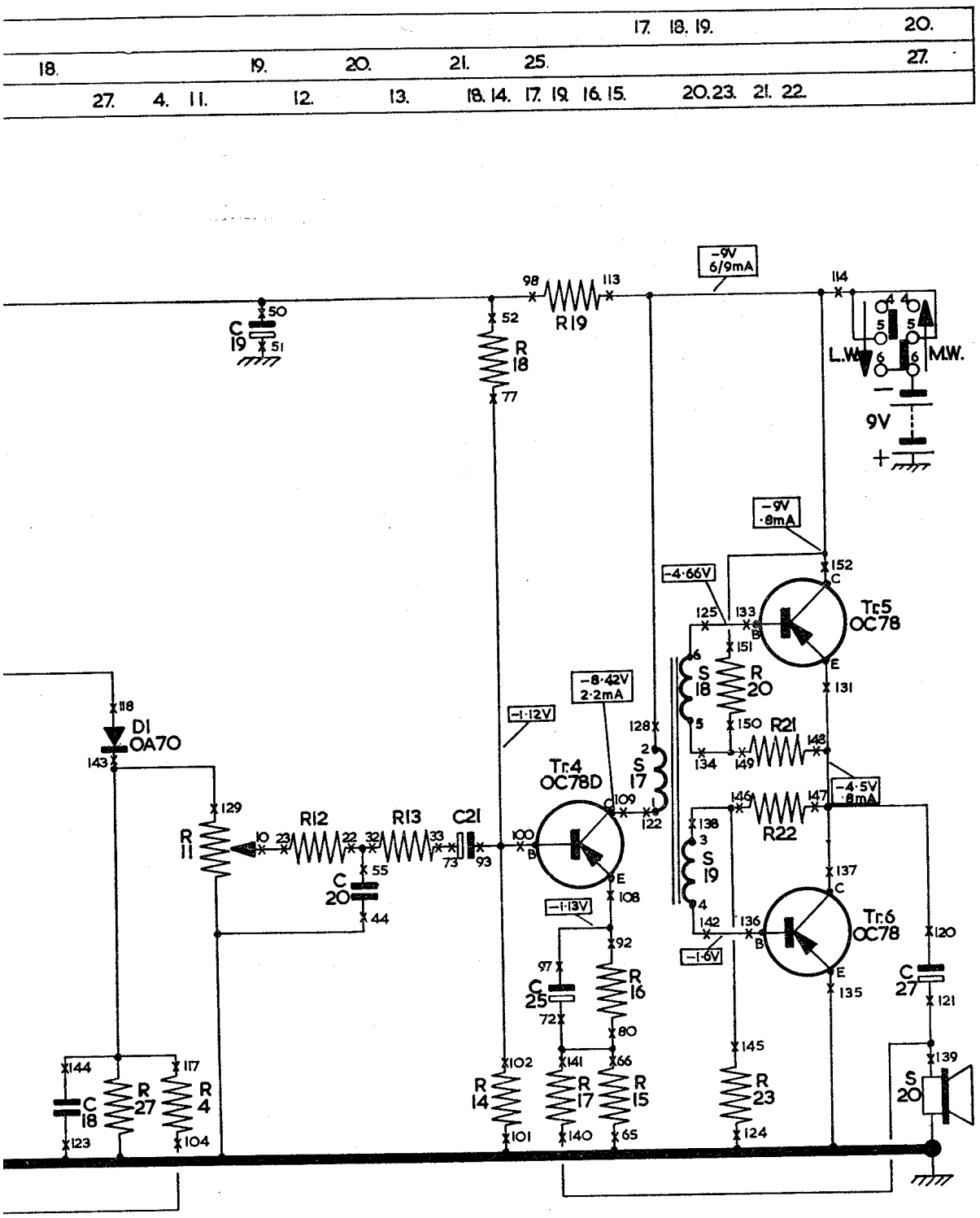
CAPACITORS

C1	196.1 pF
C2	110 pF
C3	68 pF
C5	10,000 pF
C6	6,800 pF
C7	250 pF
C9	91 pF
C10	2-30 pF
C11	2-30 pF
C12	10 uF
C13	82,000 pF
C14	91 pF
C15	47,000 pF
C16	91 pF
C17	82,000 pF
C18	10,000 pF
C19	100 uF
C20	47,000 pF
C21	1 uF
C23	56 pF
C24	18 pF
C25	100 uF
C27	100 uF
C28	10pF
C29	18 pF

S	2.4.1.3. 21. 5. 7. 7a. 9. 8. 10. 12. 11. 13. 15 14. 16.
C	7. 3. 11. 1. 28. 29. 5. 6. 10. 9. 2. 12. 23. 13. 14. 24. 15. 17. 16.
R	24. 1. 2. 26. 3. 5. 7. 8. 10. 6. 9.

All voltages taken with respect to chassis using 20.000Ω/V voltmeter.
Set switched to M.W.
Numbers and crosses correspond with numbers and holes on the layout diagram.





CIRCUIT DIAGRAM

RESISTORS

R1	39,000 Ohm
R2	10,000 Ohm
R3	68,000 Ohm
R4	12,000 Ohm
R5	1,200 Ohm
R6	3,900 Ohm
R7	680 Ohm
R8	4,700 Ohm
R9	1,000 Ohm
R10	22,000 Ohm
R11	50,000 Ohm
R12	1,000 Ohm
R13	1,500 Ohm
R14	12,000 Ohm
R15	15 Ohm
R16	470 Ohm
R17	2,200 Ohm
R18	47,000 Ohm
R19	680 Ohm
R20	2,700 Ohm
R21	100 Ohm
R22	2,700 Ohm
R23	100 Ohm
R24	1.5M Ohm
R26	3,900 Ohm
R27	18,000 Ohm

SPARE PARTS LIST—TYPE L3G91T

CABINET ASSEMBLY

FRONT MOULDING ASSEMBLY—Red	MK.981.60
Front moulding assembly—Grey	MK.981.63
REAR MOULDING ASSEMBLY—Red	MK.981.62
Rear moulding assembly—Grey	MK.981.65
CENTRE MOULDING	MK.955.45/Grey
Centre moulding	MK.955.45/Blue
Carrying handle	MK.914.32/Red
Carrying handle	MK.914.32/Grey
Aerial socket—Gold	MK.959.91
Aerial socket—Silver	MK.959.92
Self-locking ring for above ...	B.053.ZZ/805
CONTROL KNOBS (2)—Red	MK.855.87
Control knobs (2)—Grey	MK.855.88
Spring clips for knob (2)	MK.955.56
STATION SCALE—Black/Gold ...	MK.706.36
Station scale—Grey/Blue	MK.706.37
POINTER ASSEMBLY	MK.964.29
Felt ring	A3.564.36

CHASSIS ASSEMBLY

PUSH BUTTON ASSEMBLY	MK.959.70
Push button (3)	MK.262.55/Red
Push button (3)	MK.262.55/Grey

DRIVE ASSEMBLY

Tension spring	MK.740.43
Nylon drive cord—650 mm. ...	K.299.ZZ/923

MISCELLANEOUS

Ferroxcube aerial rod	MK.425.06
Aerial tag panel	MK.959.68
Spring clips for printed chassis (2) ...	MK.751.62
Front moulding securing screw (2)	B.058.CD/3×18
Spire fix for mouldings (2)	MK.751.63

TRANSISTORS

T1	OC44
T2	OC45
T3	OC45
T4	OC78D
T5/6 Matched pair	2×OC78

DIODE

D1	OA70

TRANSFORMER AND COILS

S1–2	Aerial coil—L.W.	MK.569.33
S3–4	Aerial coil—M.W.	MK.569.34
S5–7A	Oscillator coil	MK.569.35
S8–10	1st I.F. coil	MK.569.36
S11–13	2nd I.F. coil	MK.569.36
S14–16	3rd I.F. coil	MK.569.37
S17–19	Driver transformer	MK.515.63
S20	Loudspeaker—30 ohms ...	MK.957.16
S21	Aerial loading coil	MK.569.46

SPARE PARTS LIST—TYPE L3G91T—(Contd.)

CAPACITORS

			Working Voltage	Permitted Tolerance %	
C1 } C2 }	Gang	{ 196.1 pF } ... { 110 pF } ...			MK.211.14
C3	Ceramic	68 pF ...		1	HT.930.55
C5	Ceramic	10,000 pF ...	350	+50 −20	HT.930.52
C6	Ceramic	6,800 pF ...	500	+50 −20	HT.930.51
C7	Ceramic	250 pF ...		1	HT.930.58
C9	... ...	91 pF ...			In 1st I.F. coil
C10	Trimmer	2–30 pF ...			{ In Gang
C11	Trimmer	2–30 pF ...			{ Capacitor
C12	Electrolytic	10 uF ...	50		MK.185.18
C13	Polyester	82,000 pF ...	125		C.296.AA/A82K
C14	... ...	91 pF ...			In 2nd I.F. coil
C15	Polyester	47,000 pF ...	125		C.296.AA/A47K
C16	... ...	91 pF ...			In 3rd I.F. coil
C17	Polyester	82,000 pF ...	125		C.296.AA/A82K
C18	Ceramic	10,000 pF ...	500	+50 −20	HT.930.52
C19	Electrolytic	100 uF ...	12		MK.185.02
C20	Polyester	47,000 pF ...	125	+50 −20	C.296.AA/A47K
C21	Electrolytic	1 uF ...	50		MK.185.16
C23	Ceramic	56 pF ...		5	HT.930.54
C24	Ceramic	18 pF ...		5	HT.930.53
C25	Electrolytic	100 uF ...	6		MK.185.01
C27	Electrolytic	100 uF ...	6		MK.185.01
C28	Ceramic	10 pF ...			HT.930.52
C29	Ceramic	18 pF ...		5	HT.930.53

SPARE PARTS LIST—TYPE L3G91T—(Contd.)

RESISTORS

Wattage is based upon an ambient temperature of 70° C.

		Ohms	Wattage	Permitted Tolerance %	
R1	... ...	39,000	... ½	10	48.426.10/39K
R2	... ...	10,000	... ½	10	48.426.10/10K
R3	... ...	68,000	... ½	10	48.426.10/68K
R4	... ...	12,000	... ½	10	48.426.10/12K
R5	... ...	1,200	... ½	10	48.426.10/1K2
R6	... ...	3,900	... ½	10	48.426.10/3K9
R7	... ...	680	... ½	10	48.426.10/680E
R8	... ...	4,700	... ½	10	48.426.10/4K7
R9	... ...	1,000	... ½	10	48.426.10/1K
R10	... ...	22,000	... ½	10	48.426.10/22K
R11	Volume control	50,000	... Log Law		HT.930.04/GL50K
R12	... ...	1,000	... ½	10	48.426.10/1K
R13	... ...	1,500	... ½	10	48.426.10/1K5
R14	... ...	12,000	... ½	10	48.426.10/12K
R15	... ...	15	... ½	10	48.426.10/15E
R16	... ...	470	... ½	10	48.426.10/470E
R17	... ...	2,200	... ½	10	48.426.10/2K2
R18	... ...	47,000	... ½	10	48.426.10/47K
R19	... ...	680	... ½	10	48.426.10/680E
R20	... ...	2,700	... ½	5	48.426.05/2K7
R21	... ...	100	... ½	5	48.426.05/100E
R22	... ...	2,700	... ½	5	48.426.10/2K7
R23	... ...	100	... ½	5	48.426.05/100E
R24	... ...	1.5M	... ½	10	48.426.10/1M5
R26	... ...	3,900	... ½	10	48.426.10/3K9
R27	... ...	18,000	... ½	10	48.426.10/18K

Supplementary Information for the L3G91T

Since the start of production certain electrical changes have been made to this receiver and the Service Manual should be amended as follows:—

Pages 5, 6 and 7.

The battery switch is now fitted in the positive battery lead. The link between connections 17 and 49 has been deleted and the chassis connection to the centre of the printed plate is via a black lead between connection 124 and the speaker earth tag. In receivers incorporating these changes, the loudspeaker is earthed on the opposite side to that shown on Page 5.

Pages 6 and 9.

C20 has been changed from 47 KpF to 10KpF (HT 93052.)
C24 has been changed from 18 pF to 22pF. (HT 93059.)

Pages 7 and 10.

R6 has been changed from 3.9 K ohms to 3.3 K ohms. (4842610/3K3.)
R24 has been changed from 1.5 M. ohms to 0.27 M. ohms (4842610/270K) or 0.22 M. ohms. (4842610/220K.)

Page 4.

From Serial No. 20,000 (Red and Grey cabinet) and 70,000 (Blue and Grey cabinet) the trimming frequencies of the 1st and 2nd I.F. stages have been changed. The trimming frequencies of S8 and S11 are now 468 Kc/s and 472 Kc/s respectively.

The following errors should be amended in the Service Manual

Pages 6 and 9.

C28 should read 10,000 pF.

Page 7.

The base voltage of Tr 6 should read −0.16 v

Page 5.

The D.C. resistance of S19 should read 51 ohms.

PHILIPS

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