PRIVATE AND CONFIDENTIAL

FOR TRADE USE ONLY

"His Master's Voice"

SERVICE MANUAL

for

FIVE-VALVE A.C. RECEIVER

DUAL-WAVE MODEL 660

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TECHNICAL SPECIFICATION

VOLTAGE RANGE

200 to 260 volts, 40 to 60 cycles.

It is important that the receiver be operated at the correct voltage; the voltage taps on the mains transformer should be utilized as follows:

Voltage of A.C. Supply	Use Tap Designated
200–220	200
221–240	240
241–260	260

CONSUMPTION

82 watts.

WAVE LENGTH RANGE

13.9 metres (21.57 megacycles) to 47 metres (6.38 megacycles).

187.5 metres (1600 kc.) to 545 metres (550 kc.).

INTERMEDIATE FREQUENCY

457.5 kc.

MAX. UNDISTORTED POWER OUTPUT

4.5 watts.

DIMENSIONS

Height	Width	Depth
35¾″	29½″	13½″

WEIGHT

Nett	Gross
64 lbs.	74 lbs.

LOUDSPEAKER

Model 660 uses a 12in. speaker, the field winding of which acts as filter choke.

D.C. resistance of field coil, cold ..	1800 ohms.
D.C. resistance of voice coil ..	2 ,,
400 cycle impedance of voice coil	2.35 ,,

VALVES

6J8G, 6U7G, 6B8G, 6V6G, 5Y3G.

CIRCUIT DESCRIPTION

This model is a superheterodyne in which a 6J8G triode-hexode acts as frequency changer.

The oscillator circuit is designed to provide relatively constant output voltage over the wide tunings range incorporated in this receiver.

The 6J8G is band pass coupled to a 6U7G, which acts as I.F. amplifier and which is in turn coupled to a 6B8G, the diodes 1 and 2 of which are used as signal and AVC rectifiers respectively, the signal diode being tapped down one-third on the secondary of the I.F. transformer coupling these two tubes.

The amplifier section of the 6B8G acts as first A.F. stage and is resistance capacity coupled to the 6V6G output stage.

AVC is applied to 6J8G, 6U7G and 6B8G tubes.

The aerial coupling transformer on the broadcast band is a high efficiency, iron-cored type employing Litz-wire coils.

The I.F. transformers also use Litz-wire coils and high-efficiency iron-dust cores. The coils are tuned by silver-coated titanium dioxide fixed condensers.

The oscillator circuit padding adjustment is carried out inductively on both bands by means of adjustable iron cores in the oscillator coils, while on the short-wave band a certain amount of equalisation of oscillator output at the low frequency end of the band is obtained by feedback across the .00054uF Oscillator padding condenser; which feedback is introduced from the oscillator plate circuit by the 0.01uF condenser connected to the top side of the padding condenser.

The padding condensers are held to a tolerance of $\pm$ 1%.

Inverse feedback is applied to the complete audio system, through the Tone Monitor Control from the secondary of the output transformer to a tap on the volume control. In this manner the whole of the audio system benefits from the distortion reducing properties of the negative feedback system.

In addition, the circuits associated with the Tone Monitor Control provide selective feedback varying with frequency, thus providing control of tonal balance. Furthermore, the degree of feedback varies with the setting of the volume control in such a way as to provide the best response for both local and distant reception at all volume levels.

The speaker field winding placed in the negative HT line is used as a filter choke in conjunction with two 16uF wet-type electrolytic condensers, one of which is a regulating type which automatically prevents the rise of voltage beyond a safe limit during the warming-up period.

Note.—It is essential that the positions of these two condensers in the circuit shall not be interchanged.

These condensers are mounted on the speaker and are thus protected from damage should the power be accidentally switched on while the speaker is out of circuit. A voltage divider is placed across the field to obtain required bias for RF circuits.

Jacks are provided at the back of the chassis for the connection of an extension speaker. They are in the secondary circuit of the output transformer and directly in shunt to the voice coil in the set speaker.

Any speaker having a voice coil impedance between 2.5 and 4 ohms may be connected to these jacks. (The output transformer on the extension speaker must, of course, be first removed.) An impedance of 3 ohms at 400 cycles is recommended and the speaker should be preferably of the permanent magnet type. The H.M.V. extension speaker is specially designed for this purpose and has, in addition, its own constant impedance volume control.

The core of the output transformer is internally connected to the positive HT line to prevent corrosion troubles.

CIRCUITS

The circuit diagram of Model 660, together with all component values, is shown on page 4.

WAVE-BAND SWITCHING

This is carried out by means of a single-deck switch. The oscillator primary coils are connected in series and not switched. Capacitive feedback is applied across the padding condenser on the short-wave band, and this is switched by contacts on the wave-change switch.

The first position of the switch (extreme anti-clockwise) connects the short-wave and associated components, and the second position the broadcast circuits.

Only the broadcast band dial lamp circuit is switched; being cut out when the wave-change switch is in the short-wave position. See that when in the broadcast position both wave bands are illuminated, while in the short-wave position only the short-wave band is illuminated.

TONE MONITOR

This is a four-position switch. The following effects are secured in the various switch positions:

1st Position (Wide Range): Normal bass response, and treble boosted to compensate for side-band. attenuation. For highest fidelity.

2nd Position (Normal): Normal bass and small degree of treble cut. For normal and long-distance reception.

3rd Position (Bass): As in "Normal" position, but additional treble cut, for reduced background noise and particularly for pick-up operation.

4th Position (Speech): Boosted treble response and bass cut, for improved intelligibility of speech.

PRELIMINARY TESTS

(1) Switch on receiver and note that dial lights up on both bands in B/C position of switch, and on S/W band only in S/W position of switch.

(2) If no signals can be tuned in, remove the shield from the 6B8G valve and with the volume control full on and earth wire disconnected, touch the finger to the grid cap of the valve, when a loud hum should be heard; this hum should also be heard when the bottom pick-up jack is touched, and indicates that the AF side of the receiver is working, so that the fault probably lies in the RF or IF circuits. Should no hum be heard, a fault exists between first AF stage input and the speaker.

(3) Check all valves for heater continuity and freedom from internal shorts.

(4) To determine if the fault lies in the loud speaker, connect A.C. voltmeter or output meter, range 0-3 volts approx. to the voice coil terminals of the speaker. Switch on receiver, turn volume control fully on, and tune across the broadcast band when stations are known to be transmitting. If meter does not deflect, the fault lies in the receiver circuits or in the field circuit of the speaker. If the meter deflects but no sound is heard, the speaker voice coil circuit is at fault.

(5) If the fault is still undiscovered, remove chassis and speaker from cabinet and compare voltages with table given on page 5.

DISMANTLING

REMOVAL OF CHASSIS

(1) Remove knobs. (Knobs without screws pull straight off shaft.)

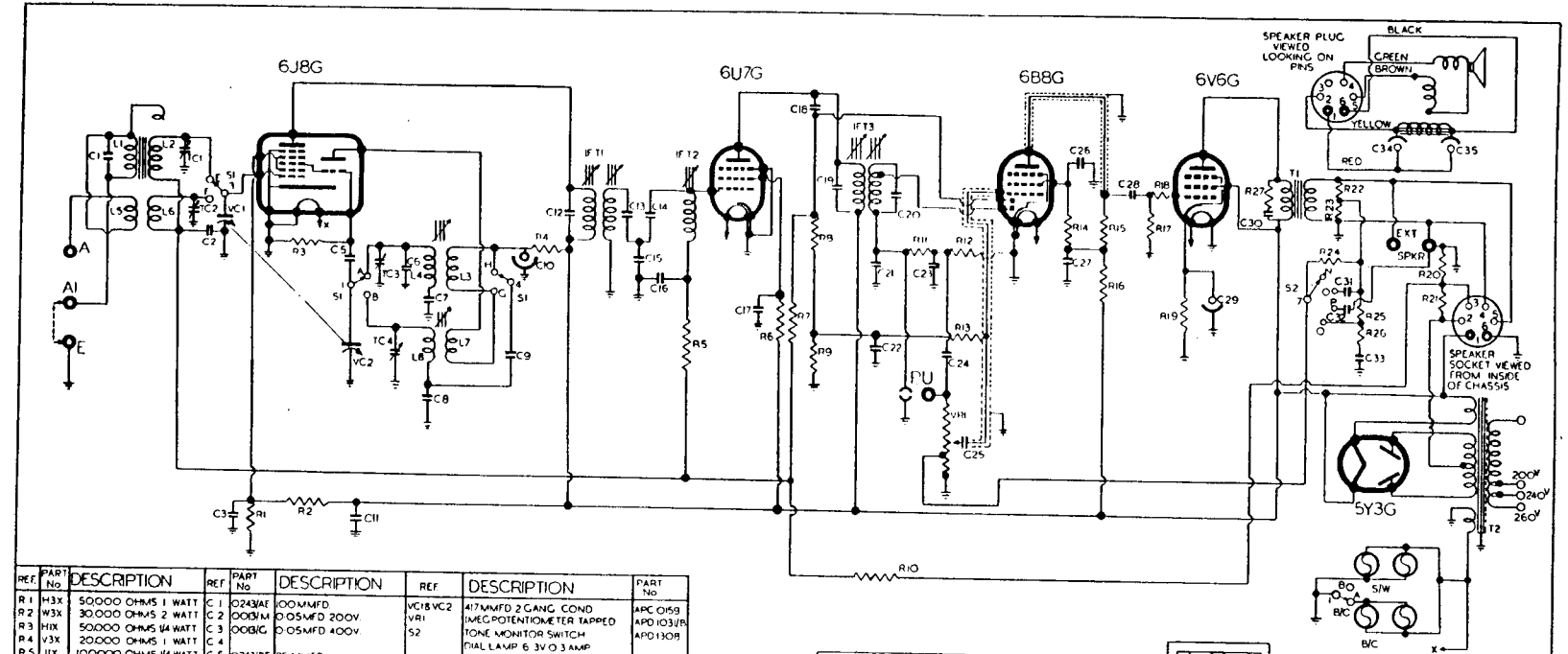
(2) Disconnect speaker plug and power plug.

(3) Remove nuts from two fixing bolts from underside of shelf; the chassis is now free.

REMOVAL OF LOUDSPEAKER

(1) Remove 6-pin plug from back of chassis.

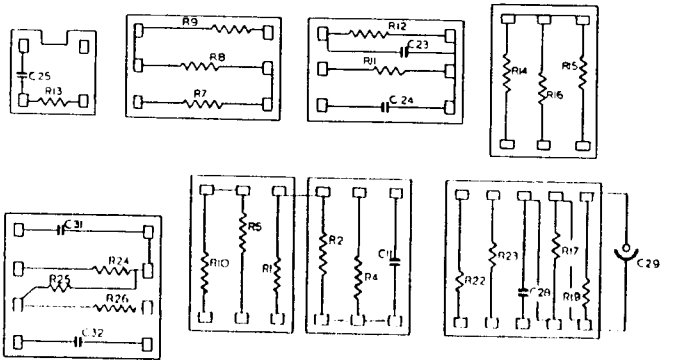
(2) Remove four screws holding speaker chassis to baffle, and withdraw speaker.

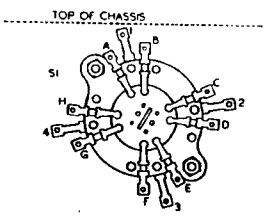


REF.	PART No	DESCRIPTION
R1	H3X	50,000 OHMS 1 WATT
R2	W3X	30,000 OHMS 2 WATT
R3	H1X	50,000 OHMS 1/4 WATT
R4	V3X	20,000 OHMS 1 WATT
R5	J1X	100,000 OHMS 1/4 WATT
R6	AN3X	75,000 OHMS 1 WATT
R7	P1X	1 MEGOHM 1/4 WATT
R8	O1X	500,000 OHMS 1/4 WATT
R9	O1X	500,000 OHMS 1/4 WATT
R10	AB3X	10 MEGOHMS 1 WATT
R11	H1X	50,000 OHMS 1/4 WATT
R12	N1X	250,000 OHMS 1/4 WATT
R13	AA1X	2 MEGOHMS 1/4 WATT
R14	AL3X	3 1 WATT
R15	O3X	500,000 OHMS 1 WATT
R16	H1X	50,000 OHMS 1 WATT
R17	O1X	500,000 OHMS 1/4 WATT
R18	H1X	50,000 OHMS 1/4 WATT
R19	Z1W	250 OHMS 3 WATT
R20	V1X	20,000 OHMS 1/4 WATT
R21	K1X	150,000 OHMS 1/4 WATT
R22	T1X	100 OHMS 1/4 WATT
R23	T1X	100 OHMS 1/4 WATT
R24	AM1X	75,000 OHMS 1/4 WATT
R25	V1X	20,000 OHMS 1/4 WATT
R26	AF1X	3000 OHMS 1/4 WATT
R27	T3X	100 OHMS 1 WATT

REF.	PART No	DESCRIPTION
C 1	0243/AF	100 MMFD.
C 2	0003/M	0.05 MFD 200V.
C 3	0008/G	0.05 MFD 400V.
C 4		
C 5	0243/BE	25 MMFD.
C 6	0243/BF	15 MMFD.
C 7	0243/BH	437 MMFD.
C 8	0243/AT	5400 MMFD.
C 9	0003/N	0.01 MFD 600V.
C 10	0014/AB	4MFD 350PVELEC COND.
C 11	0013/A	0.5 MFD 400V.
C 12	0243/AB	100 MMFD.
C 13	0243/AZ	50 MMFD.
C 14	0243/AZ	50 MMFD.
C 15	0243/C	5000 MMFD.
C 16	0013/AA	0.05 MFD 200V
C 17	0013/E	0.1 MFD 400V
C 18	0243/O	50 MMFD.
C 19	0243/AB	100 MMFD.
C 20	0243/AB	100 MMFD.
C 21	0243/AE	100 MMFD.
C 22	0013/Q	0.1 MFD 200V
C 23	0243/AF	100 MMFD.
C 24	0013/K	0.02 MFD. 300V.
C 25	0013/E	0.1 MFD 400V.
C 26	0013/E	0.1 MFD. 400V.
C 27	0013/A	0.5 MFD. 400V.
C 28	0013/S	0.02 MFD. 600V.
C 29	0014/T	5 MFD. 25V ELEC. COND.
C 30	0013/S	0.02 MFD 600V.
C 31	0013/O	.002 MFD 600V.
C 32	0013/O	.002 MFD. 600V.
C 33	0013/Q	0.1 MFD. 200V.
C 34	0014/Q	16 MFD. 550V ELEC. COND.
C 35	0014/P	16 MFD. 350V ELEC. COND. REGULATING TYPE.

REF.	DESCRIPTION	PART No
VC1 & VC2	417 MMFD 2 GANG COND	APC 0159
VR1	MEG. POTENTIOMETER TAPPED	APD 1031/B
S2	TONE MONITOR SWITCH	APD 1308
	DIAL LAMP 6.3V 0.3 AMP	
IF T1	1ST IF TRANSFORMER	APD 1296
IF T2	2ND IF "	APD 1297
IF T3	3RD IF "	APD 1298
	12" SPEAKER	APC 1676
T1	OUTPUT TRANSFORMER	APD 1263
T2	MAINS TRANSFORMER	APD 1261
L1 & L2	B/C AERIAL COIL	APD 1614
L3 & L4	B/C OSCILLATOR COIL	APC 0085 LZ
L5 & L6	S/W AERIAL COIL	APC 0219/C
L7 & L8	S/W OSCILLATOR COIL	APC 0219/D
TC1 & TC2	AIR TRIMMER 15 P.MMFD	APD 1276/B
TC3 & TC4		
S1	WAVE CHANGE SWITCH	APD 1621





Dual-Wave Model 660

VOLTAGE TABLE

Values given are ± 10% with receiver tuned to point of no reception, broadcast band, with line voltage of 240 volts (mains transformer primary tap set for 240 volts). If a voltmeter having less than 1000 ohms per volt is used, allowance must be made for the voltage drop caused by the voltmeter.

	6J8G BC. Band	6J8G SW. Band	6U7G	6B8G	6V6G
Plate to chassis volts	270	268	270	45	260
Screen to chassis volts	103	106	105	12	270
Cathode to chassis volts	—	—	—	—	12.5
Screen current M A	3.2	3.0	2.1	0.1	3.7
Plate current M A	1.4	1.5	8.6	0.4	44.0
Plate current Osc. Section M/A	5.5	5.5	—	—	—
Plate voltage Osc. Section	157	155	—	—	—

Rectifier filament	5.0 volts
Heaters	6.4 ,,
Input to filter (to C.T of HT winding)	430 ,,
Output from filter (to chassis)	270 ,,
Total HT current in speaker field (measured at terminal 6 of speaker socket)	72 M/A

RADIO FREQUENCY TESTS AND ADJUSTMENTS

Instability, insensitivity, or poor selectivity indicate that the alignment of the tuned circuits is not correct. If a coil or other component associated with the R.F. or I.F. circuits of the receiver has been replaced or repaired, or if the wiring has been disarranged, all circuits must be realigned.

To do this, the following apparatus is required:

(1) An oscillator or signal generator capable of tuning to 457.5 kc., 1600 kc., 1500 kc., 600 kc., 13.9 metres (21.57 mc.), 15 metres (20 mc.), and 45 metres (6.66 mc.), suitably screened and having an attenuator.

(2) An output meter having a range of 0-2 volts AC approximately.

I.F. alignment should always precede R.F. alignment, and even if only one coil or one range of coils has been serviced, the whole of the realignment should be done in order given, i.e., broadcast band first followed by short-wave band.

In carrying out the following operations, it is important that the input to the receiver from the oscillator should be kept low and progressively reduced as the circuits are brought into line, so that the reading on the output meter does not exceed about 1.0 volt.

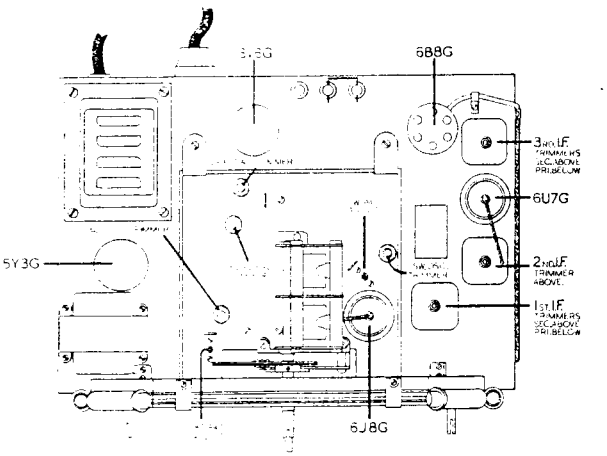
For all alignment operations the output meter should be connected directly across the voice coil terminals of the speaker.

I.F. ALIGNMENT

The sketch alongside shows the layout of all principal components and adjustments referred to in the following procedure.

Before commencing alignment, it is advisable to set the Tone Monitor switch to the "Normal" position.

Rotate volume control fully clockwise and set wave-change switch to "Broadcast" position; rotate tuning control till dial pointer indicates 600 kc., i.e., condenser vanes nearly fully meshed. Connect



output leads of signal generator to the grid cap of the 6J8G through a 0.1 mfd. condenser, and to the receiver chassis or earth terminal. (Note: Do not disconnect the clip and lead from the 6J8G grid.)

(1) Tune signal generator to exactly 457.5 kc.

(2) Adjust the trimmer screws of the I.F. transformers for maximum deflection of the output meter, commencing with the third I.F. transformer, and following with the second and first in turn. Reduce the input from the signal generator as the work proceeds, to keep the output meter reading at about 1 volt or less.

(3) Continue this alignment very carefully on each transformer in turn until no greater output can be obtained. It is necessary to completely align all transformers at least twice, preferably three times.

Note.—If trimmer screws are screwed too far in it is possible to obtain a false peak, due to coupling effects between the moveable iron cores. Any trimmer which appears to require screwing too far in should be screwed out considerably and the true peak will then be found.

R.F. ALIGNMENT

With controls set as for I.F. alignment, connect the signal generator output leads through a standard dummy aerial of 200 mmf. capacity to the aerial and earth terminals.

Check that when the ganged condenser is fully meshed, the pointer falls directly over the setting line, marked "S" at the extreme bottom right of the scale; the pointer is a friction fit on the condenser spindle and can be rotated to bring it to the correct setting.

(1) Tune signal generator to 600 kc.

(2) Rotate tuning knob until dial pointer is exactly over 600 kc. mark on scale, and by means of padding adjustment (trimming screw to left of ganged condenser) align receiver so that the 600 kc. signal is tuned in exactly on 600 kc. dial calibration.

(3) Tune signal generator to 1600 kc.

(4) Set pointer exactly over 1600 kc. mark on dial and adjust B.C oscillator trimmer until the signal is tuned in with the pointer on the 1600 kc. line.

(5) Tune signal generator and receiver to 1500 kc.

(6) Adjust B.C aerial trimmer for maximum output on output meter, "rocking" ganged condenser slightly during adjustment if necessary.

(7) Repeat operations 1 to 6 inclusive. **This is important.** Note that any stations receivable are tuned in correctly on calibration. (Discrepancies of two or three kilocycles can be tolerated.)

SHORT-WAVE ALIGNMENT

(1) Set wave-change switch to S.W. range (fully anti-clockwise). Remove the standard dummy aerial from the output lead of the signal generator and substitute a 400-ohm non-inductive resistor: connect to aerial terminal as previously.

(2) Tune signal generator to 45 metres (6.66 mc.).

(3) Rotate tuning knob until pointer is at 45 metres on dial, and adjust S.W. padder screw (to right of gang condenser) until maximum output is obtained with pointer approximately on the 45-metre mark.

(4) Tune receiver and signal generator to 13.9 metres (21.57 mc.) and adjust S.W. Oscillator trimmer condenser until maximum output is obtained with pointer exactly on the 13.9 metre mark. Two settings will probably be found at which this trimmer will peak; take care to use that setting which gives the lower capacity (plunger further out). Failure to select the correct setting will cause serious tracking errors and loss of sensitivity.

(5) Repeat operations (2) to (4) inclusive.

(6) Tune receiver and signal generator to 15 metres (20 mc.) and adjust S.W. aerial trimmer condenser for maximum output, while "rocking" the gang condenser slightly to obtain the true resonant point.

(7) Retune receiver and signal generator to 13.9 metres and note that signal is still tuned in correctly on dial; if not, readjust S.W. oscillator trimmer slightly until dial reads correctly, and then repeat tests 6 and 7.

(8) Check foregoing adjustments carefully to ensure that correct settings have been obtained on all trimmers. The dial should now read correctly throughout.

Note.—The R.F. trimmers on this model are of a plunger type with air dielectric, and possess exceptionally high stability and efficiency. A special adjusting tool can be obtained from the factory, incorporating a box spanner for the condenser locknut and an adjusting hook for the plunger. After loosening the locknut at the top of the condenser the adjusting hook is inserted in the hole which will be found in the top of the plunger, which can then be easily adjusted by moving up or down as required with a slight rotary movement. When adjustment is completed, tighten the locknut securely.

ADDITIONAL DATA

Any further service information desired can be obtained by addressing an inquiry to the Service Department, The Gramophone Company Ltd., 2 Parramatta Road, Homebush.