'TRADER' SERVICE SHEET

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PHILCO 471

TABLE, CONSOLE, RADIO-GRAM

A TRIODE-PENTODE used as an I.F. and A.F. amplifier, is a feature of the Philco 471 3-valve (plus rectifier) A.C. 3-band superhet chassis. It has a short-wave range of 16·6-52 metres and provision for a gramophone pick-up and an extension speaker. The set can be adjusted for mains of 200-230 V and 231-260 V, 40-100 C/S in both cases.

The chassis is fitted in a table receiver, a console and a radio-gramophone, all of which bear the model number 471, and have identical circuits. Our *Service Sheet* was prepared on a table receiver.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L3** (S.W.) and **L5** (M.W., L.W.) to single-tuned circuits **L4, C27** (S.W.), **L6, C27** (M.W.), **L7, C27** (L.W.). Provision for connection of special all-wave aerial to "Red" and "Blk." sockets. I.F. filter **L1, C22** is shunted across aerial-earth circuit.

First valve (**V1, Philco 6A7**) is a heptode operating at electron coupled frequency changer. Oscillator grid coils **L8** (S.W.), **L10** (M.W.), **L11** (L.W.) are tuned by **C28**; parallel trimming by **C29** (S.W.), **C31, C32** (M.W.), **C4, C34** (L.W.); series tracking by **C3, C30** (S.W.), **C33** (M.W.), **C35** (L.W.); anode reaction coil **L9.**

Second valve, a triode-pentode (**V2, Philco 6F7B**) operates as intermediate frequency and audio frequency amplifiers. Variable-mu R.F. pentode section is I.F. stage with tuned-primary tuned-secondary transformer couplings **C36, L12, L13, C37** and **C38, L14, L15, C39.** **Intermediate frequency 451 KC/S.**

Diode second detector is part of double diode output pentode valve (**V3, Philco Pen/DD/61**). Audio frequency component in rectified output is developed across manual volume control **R8** and passed via coupling condenser **C10** to C.G. of **V2** triode section, which is resistance-capacity coupled by **R10, C11, R11** to **V3** pentode. Provision for connection of gramophone pick-up across manual volume control by switch **S20.** Fixed tone correction in **V3** pentode anode circuit by **C16**; two-point tone control by switch **S21** and condenser **C17.** Provision for connection of low-impedance external speaker across secondary of **T1.**

Second diode of **V3,** fed for **V2** pentode anode via **C15,** provides D.C. potential which is developed across **R14** and fed back through a decoupling circuit as G.B. to F.C. and I.F. valves, giving automatic volume control. Delay voltage is obtained from tapping on G.B. resistance **R15.**

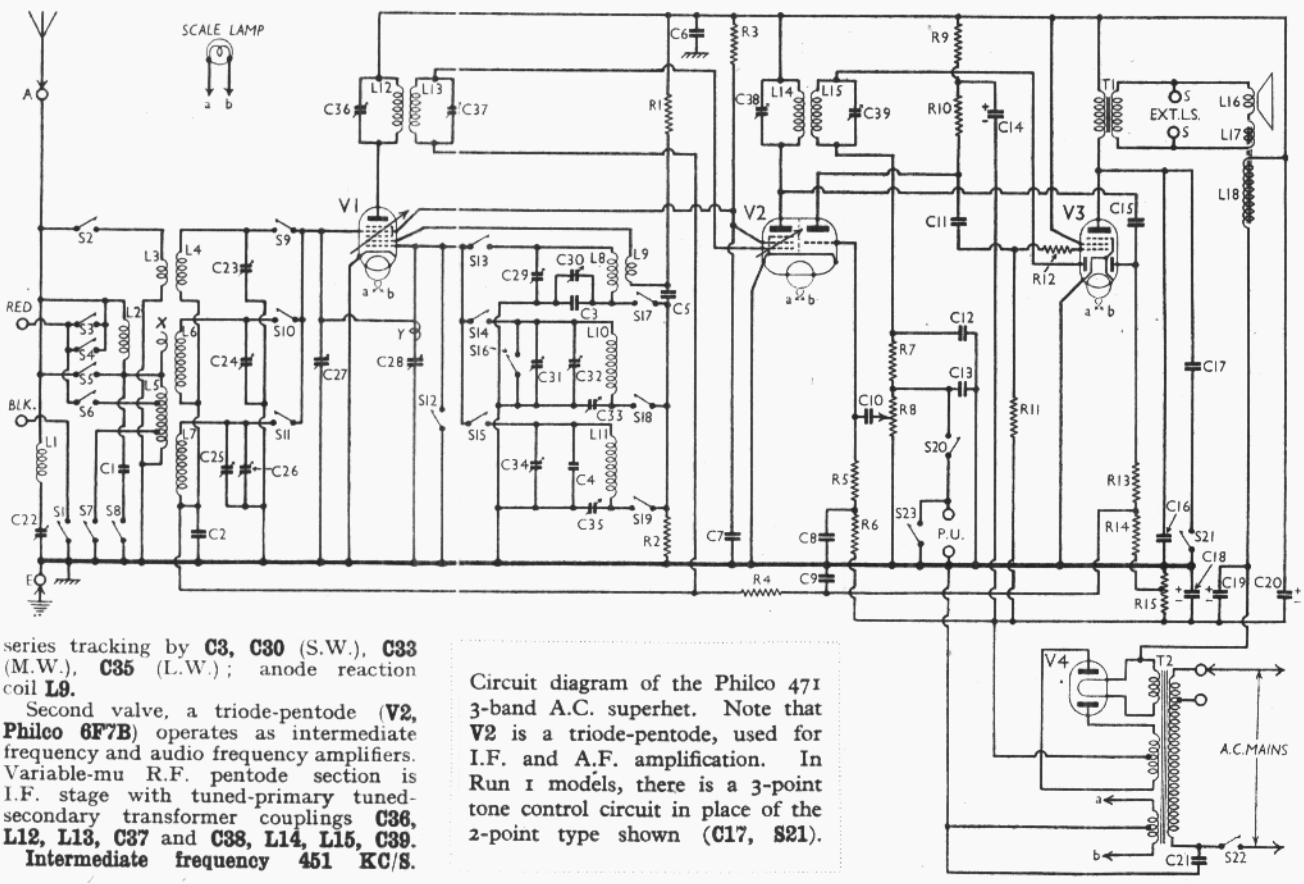
H.T. current is supplied by full-wave rectifying valve (**V4, Philco 80**). Smoothing by speaker field coil **L18** and dry electrolytic condensers **C19, C20.** Mains R.F. by-passing by **C21.**

COMPONENTS AND VALUES

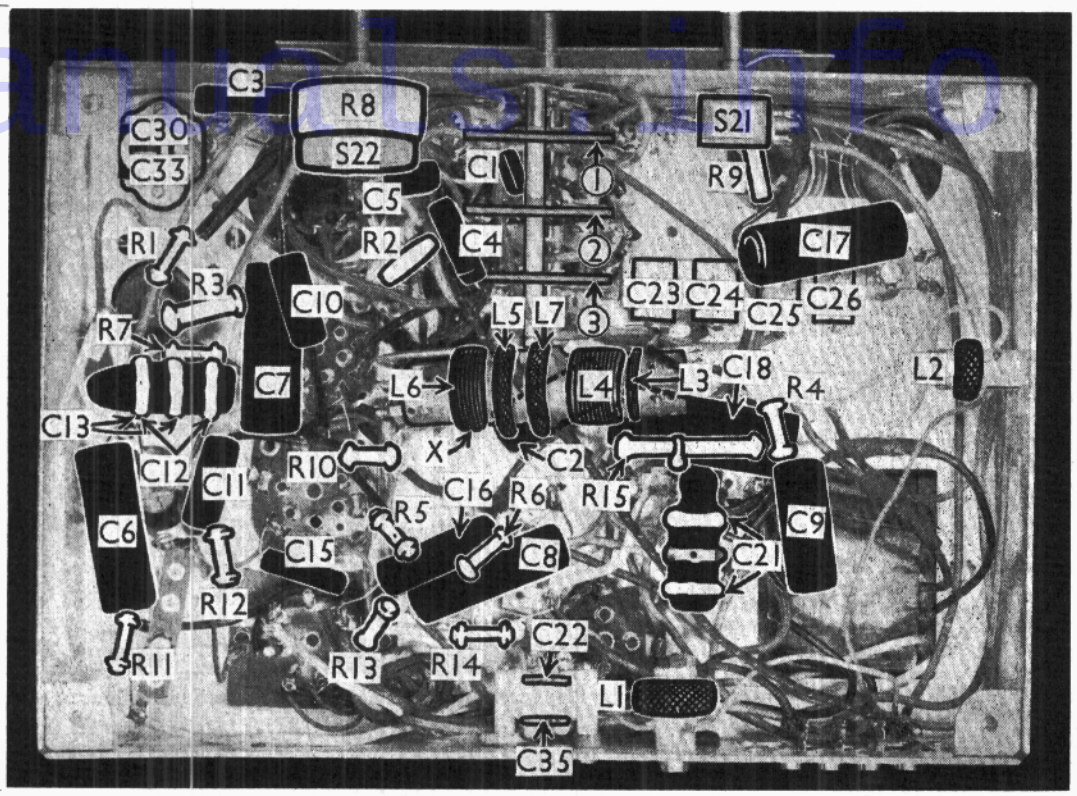
	RESISTANCES	Values (ohms)
R1	V1 osc. anode resistance	15,000
R2	V1 osc. C.G. resistance	51,000
R3	V1 and V2 S.G.'s H.T. feed	20,000
R4	A.V.C. line decoupling	1,000,000
R5	V2 triode C.G. resistance	490,000
R6	V2 triode C.G. decoupling	1,000,000
R7	I.F. stopper	51,000
R8	Manual volume control	350,000
R9	V2 triode anode decoupling	10,000
R10	V2 triode anode load	51,000
R11	V3 C.G. resistance	490,000
R12	V3 C.G. I.F. stopper	99,000
R13	V3 A.V.C. diode load	330,000
R14		490,000
R15	V2 and V3 G.B. resistance	100*

* 40 + 60 O.

	CONDENSERS	Values (μF)
C1	L5 L.W. trimmer	0·00005
C2	V1 tetrode C.G. decoupling	0·05
C3	Osc. S.W. tracker	0·00225
C4	Osc. L.W. trimmer	0·00007
C5	Osc. anode condenser	0·00025
C6	H.T. supply R.F. by-pass	0·1
C7	V1 and V2 S.G.'s by-pass	0·1
C8	V3 triode C.G. decoupling	0·1
C9	A.V.C. line decoupling	0·05
C10	A.F. coupling to V2 triode	0·01
C11	V2 to V3 A.F. coupling	0·01
C12	I.F. by-passes	0·00011
C13		0·00011



Circuit diagram of the Philco 471 3-band A.C. superhet. Note that **V2** is a triode-pentode, used for I.F. and A.F. amplification. In Run 1 models, there is a 3-point tone control circuit in place of the 2-point type shown (**C17, S21**).



Under-chassis view. The switch units are numbered, and are shown in detail on page VIII. The coupling **X** is associated with coils **L5** and **L6**. The centre tag of **C21** is a bearer. **C30** and **C33** are adjusted through a hole in the chassis deck.

CONDENSERS (*Continued*)		Values (μF)
C14*	V2 triode anode decoupling	8·0
C15	V3 A.V.C. diode feed	0·00011
C16	Fixed tone corrector	0·01
C17	Tone control condenser	0·05
C18*	G.B. circuit by-pass	35·0
C19*, C20*	H.T. smoothing	8·0
C21	Mains circuit R.F. by-pass	0·015
C22‡	Aerial I.F. filter tuning	0·000375
C23‡	Aerial circuit S.W. trimmer	0·000035
C24‡	Aerial circuit M.W. trimmer	0·000035
C25‡, C26‡	Aerial circuit L.W. trimmers	0·000035, 0·000035
C27†	Aerial circuit tuning	—
C28†	Osc. circuit tuning	—
C29‡	Osc. circuit S.W. trimmer	—
C30‡	Osc. circuit S.W. tracker	0·0006
C31‡, C32‡	Osc. circuit M.W. trimmers	—, —
C33‡	Osc. circuit M.W. tracker	0·0015
C34‡	Osc. circuit L.W. trimmer	—
C35‡	Osc. circuit L.W. tracker	0·000045
C36‡	1st I.F. trans. pri. tuning	—
C37‡	1st I.F. trans. sec. tuning	—
C38‡	2nd I.F. trans. pri. tuning	—
C39‡	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial I.F. filter coil	15·0
L2	Aerial choke coil	55·0
L3	Aerial S.W. coupling coil	0·4
L4	Aerial S.W. tuning coil	0·2
L5	Aerial M.W. and L.W. coupling	95·0
L6	Aerial M.W. tuning coil	4·0
L7	Aerial L.W. tuning coil	15·0
L8	Osc. S.W. tuning coil	0·1
L9	Osc. reaction coil	0·4
L10	Osc. M.W. tuning coil	2·0
L11	Osc. L.W. tuning coil	6·0
L12, L13	1st I.F. trans. Primary	8·0
	1st I.F. trans. Secondary	12·0
L14, L15	2nd I.F. trans. Primary	8·0
	2nd I.F. trans. Secondary	12·0
L16	Speaker speech coil	2·0
L17	Hum neutralising coil	0·1
L18	Speaker field coil	2,000·0
T1	Speaker input trans. Pri.	250·0
	Speaker input trans. Sec.	0·2

OTHER COMPONENTS (*Continued*)		Approx. Values (ohms)
T2	Mains trans. Pri. total	35·0
	Mains trans. Heater sec.	0·2
	Mains trans. Rect. fil. sec.	0·1
	Mains trans. H.T. sec. total	480·0
S1-19	Waveband and muting switches	—
S20, S23	Gram. pick-up switches	—
S21	Tone control switch	—
S22	Mains switch, ganged R8	—
x, y	Small couplings	—

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, remove the five control knobs (pull off) and the four self-tapping bolts (with washers) holding the chassis to the bottom of the cabinet, which can now be withdrawn to the extent of the speaker leads. This is sufficient for normal purposes.

To free the chassis entirely, unsolder, the speaker leads and *when replacing* connect them as follows, numbering the tags from bottom to top: 1, red; 2, black; 3, green/white; 4, white; 5, green.

Removing Speaker.—If it is necessary to remove the speaker from the cabinet, remove the nuts and spring washers from the four bolts with ornamental heads, holding it to the front of the cabinet. *When replacing*, see that the transformer is on the right.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver (which was adjusted for mains of 200-230 V) when it was operating on mains of 230 V. The receiver was tuned to the lowest wavelength on the medium band and the volume control was at maximum, but there was no signal input.

It will be noticed that two figures are given for the anode voltages and currents of **V2.** The first is for the pentode section of the valve, while the second is for the triode.

Voltages were measured on the 1,200 V scale of an Avometer, with chassis as negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6A7E*	250	7·0	130	4·0
V2 6F7B	250	10·2	130	2·2
	105	2·2	—	—
V3 Pen/DD/61	245	28·0	250	6·7
V4 80	360†	—	—	—

* Oscillator anode (G2) 150 V, 5·8 mA.
† Each anode, A.C.

GENERAL NOTES

Switches.—**S1-S19** and **S20, S23** are the wavechange and pick-up switches, in three ganged rotary units beneath the chassis. These units are indicated by numbers in circles and arrows in our under-chassis view, and diagrams are given on page VIII.

The table below gives the switch positions for the four control positions, starting from fully anti-clockwise. O indicates open, and C, closed.

S21 is the tone control switch at the front of the chassis, of the single pole shorting type (Run 2). In Run 1 a 3-point tone control was fitted. See under Chassis Divergencies.

S22 is the Q.M.B. mains switch, ganged with the volume control **R8.**

Coils.—**L1** and **L2** are on separate formers beneath the chassis. **L3-L7** is an unscreened unit on a tubular former,

Continued overleaf

PHILCO 471—*Continued*

also beneath the chassis. **L8-L11** and the two I.F. transformers **L12, L13** and **L14, L15,** are in three screened units on the chassis deck, the units also containing the associated trimmers.

Scale Lamp.—This is a Tung-Sol miniature centre contact bayonet cap type, rated at 6·3 V, 0·35 A (Philco Part No. 34-2141).

External Speaker.—Two sockets (**S, S**) are provided for the connection of a low impedance (2-3 O) external speaker.

Condensers C14, C20.—In our chassis these are two 8 μF dry electrolytic types in a single tubular container, which forms the negative connection. The tag marked with a red spot is the positive of **C20.** In some chassis, an 8+4μF unit may be fitted, **C14** then being 4μF, its positive tag being marked green.

Couplings X, Y.—These are small capacity couplings, **X** being associated with **L5** and **L6,** and **Y** consisting of a wire from **C27** looped into a tag on **C28.**

Condensers C30, C33 and **C22, C35.**—These are two sets of dual trimmers, the first being adjustable through a hole in the chassis deck, and the second through a hole in the rear of the chassis. The nuts operate **C30** and **C35** respectively, and the screws, **C33** and **C22.**

Condenser C21.—Note that the central tag on this unit is merely a bearer.

Condensers C12, C13.—The tag nearest the side of the chassis is common, the centre tag is the other connection of **C13,** and the remaining tag the other connection of **C12.**

Resistance R15.—This is a 100 O wire-wound component, tapped at 40 O.

Mains Voltage Adjustment.—Although **T2** has a tapped primary, the 231-260 V tapping is permanently connected to the mains input when the set is sent out. To adjust for 200-230 V, connect the spare tapping to the tag of **C21** to which the black rubber mains lead is connected, first unsoldering the wire from **T2** and taping it up to prevent short circuits.

According to the instruction book, the 200-230 V lead is green, and the 231-260 V, black and white. In our case they were dark brown and green, and light and dark brown respectively.

Chassis Divergencies.—Our model was from Run 2, and has the 2-point tone control. In the Run 1 models, **S21** is replaced by two switches in a rotary unit, and **C17** (0·05 μF) is replaced by two condensers of 0·01 μF and 0·02 μF capacity. In the first position of the switch neither condenser is connected; in the second position the 0·01 μF condenser is connected to chassis, and in the third position the 0·02 μF condenser is connected to chassis.

In earlier chassis there may be an additional 5,000 O resistance between the top of **L13, C37** and the control grid of the pentode section of **V2.**

CIRCUIT ALIGNMENT

With gang condenser fully open, see that pointer is over the extreme end of outside blue line on scale.

I.F. Stages.—Switch set to M.W., turn volume control to maximum, and tone control to "brilliant" position. Feed a 451 KC/S signal to grid (top cap) of **V1,** previously disconnecting existing lead. The other signal generator lead goes to E. Adjust **C39, C38, C37** and **C36** in turn for maximum output, keeping input low.

Now feed the 451 KC/S signal into the A socket, via a dummy aerial, replace **V1** top cap connection and adjust **C22** (screw) for *minimum* output.

R.F. and Osc. Stages.—Switch set to L.W., and adjust pointer to 290 KC/S on scale. Feed in a 290 KC/S signal and adjust **C34, C25** and **C26** for maximum output. **C25** and **C26** are in parallel.

Feed in a 160KC/S signal, tune it in, and adjust **C35** (nut), rocking the gang meanwhile for optimum results. Re-trim at 290 KC/S and re-track at 160 KC/S.

Switch set to M.W., and adjust pointer to 1,400 KC/S on scale. Feed in a 1,400 KC/S signal, and adjust **C32, C31** and **C24** for maximum output. Note that **C32** and **C31** are in parallel.

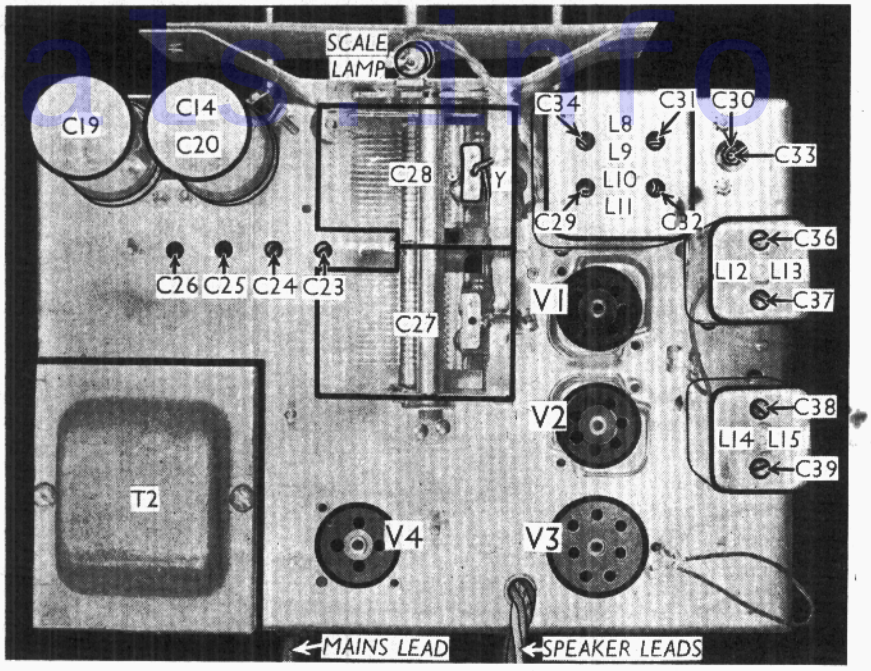
Feed in a 600 KC/S signal, tune it in, and adjust **C33** (screw), rocking the gang meanwhile for optimum results. Re-trim at 1,400 KC/S and re-track at 600 KC/S.

Switch set to S.W. Substitute a 400 O resistor for the dummy aerial, and feed in an 18 MC/S signal. Set pointer to 18 MC/S and adjust **C29** to the second peak from the maximum capacity setting. The peaks are quite close together.

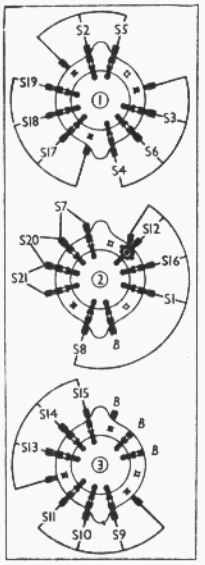
Due to the small difference between the R.F. and oscillator frequencies, the adjustment of **C23** will have a tendency to "pull" the oscillator frequency. By shunting a 0·00035 μF variable condenser across the **C28** section of the gang and tuning it so that the second harmonic instead of the fundamental beats with the incoming signal, this "pull" can be minimised.

Connect the shunt condenser between the tag of **C28** and chassis and tune it (about half open) to the 18 MC/S signal harmonic. Adjust **C23** for maximum output. Disconnect shunt condenser and re-adjust **C29** for maximum output. Check that the 18 MC/S image is received at 17·1 MC/S on the scale.

Feed in a 6 MC/S signal, tune it in, and adjust **C30** for maximum output, rocking the gang meanwhile. Re-trim at 18 MC/S and re-track at 6 MC/S.



Plan view of the chassis. Note the various trimmers, and the small coupling **Y.**



Switch diagrams, looking from the rear of the underside of the chassis.

SWITCH TABLE

Switch	L.W.	M.W.	S.W.	Gram.
S1	O	C	C	C
S2	O	O	C	O
S3	O	O	C	O
S4	C	O	O	O
S5	O	C	O	O
S6	O	C	O	O
S7	O	C	O	O
S8	C	O	O	O
S9	O	O	C	O
S10	O	C	O	O
S11	C	O	O	O
S12	O	O	O	C
S13	O	O	C	O
S14	O	C	O	O
S15	C	O	O	O
S16	O	O	C	C
S17	O	O	C	O
S18	O	C	O	O
S19	C	O	O	O
S20	O	O	C	O
S23	O	O	O	C

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