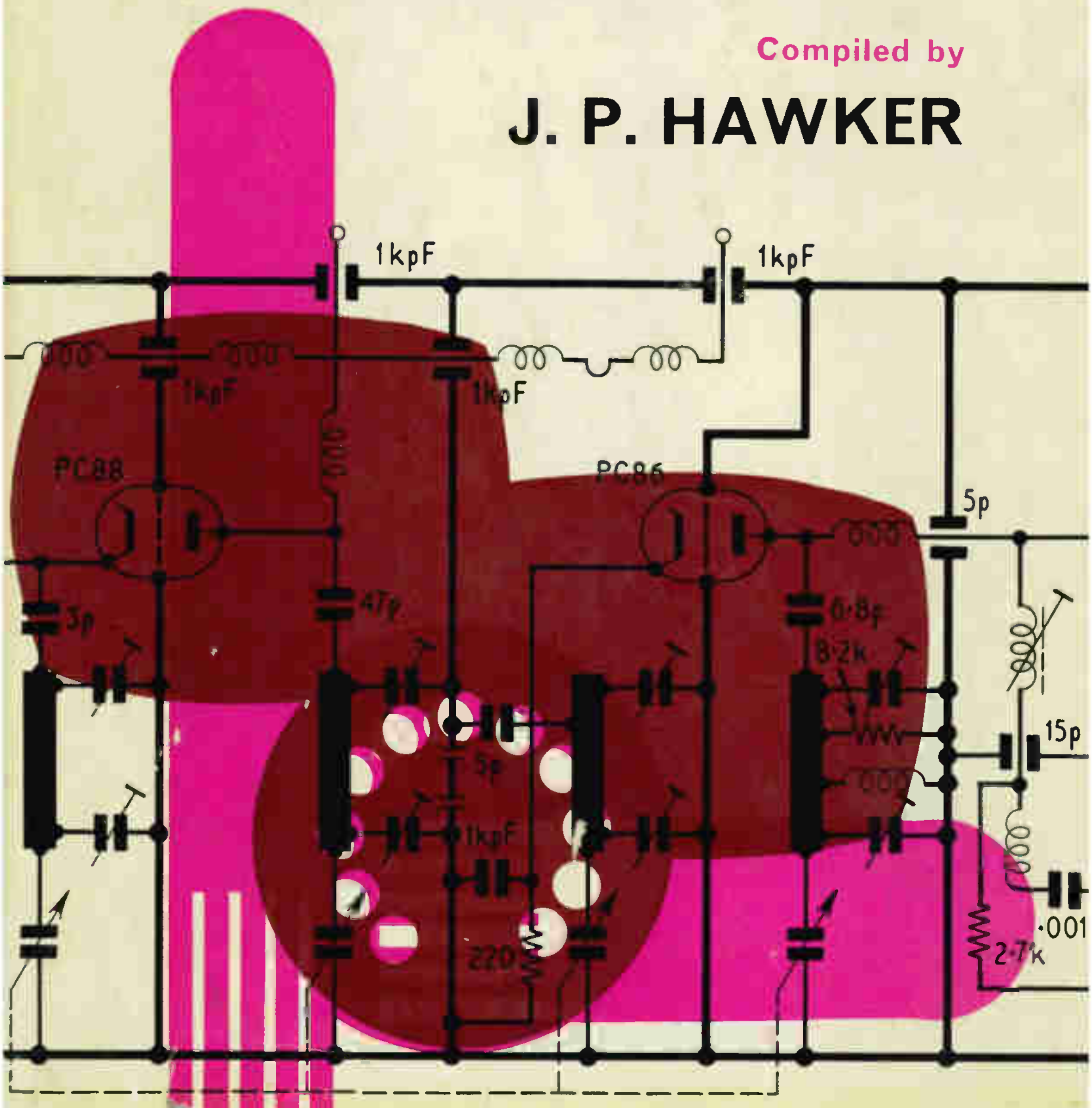
PRACTICAL WIRELESS

Radio and Television Reference Data

Compiled by

J. P. HAWKER



This handy book provides the practical reference data that radio and television servicemen, radio constructors, enthusiasts and amateurs always need. It has been compiled with the day-to-day requirements of servicemen particularly in mind. Contents include: full details of colour codes; a comprehensive collection of practical, everyday formulae for calculating the values of biasing components, potential dividers, etc.; aerial dimensions; a quick frequency-wavelength conversion table; full lists of radio and television broadcasting stations and frequencies; common symbols and abbreviations; notes on Amateur radio and a list of call-sign prefixes; communication receiver I.F.s; mathematical data including logarithm tables; wire and cable data; battery equivalents; and a full and up-to-date listing of valve, transistor and cathode-ray tube pin connections, bases, ratings and equivalents, including selected CV types.

A worthwhile reference source for all who are in any way concerned with installing, maintaining, constructing, operating or servicing radio equipment.

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"PRACTICAL WIRELESS"

RADIO AND TELEVISION REFERENCE DATA

Compiled by
J. P. HAWKER

GEORGE NEWNES LIMITED
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CONTENTS

COLOUR CODES

Resistors

THE complete information on resistors given by modern colour coding systems includes: value, tolerance and grade. These characteristics are usually indicated either (1) by a series of three or more colour rings which are read from the end of the resistor towards its centre; or, alternately, (2) by reading first the body colour; secondly, the tip colour; thirdly, the spot or band colour. In system (2) the fourth colour (tolerance) is indicated by marking the second tip but, since the colours normally differ from those used to designate value, no confusion is likely to arise.

In each system, the first colour to be read indicates the first figure of the value; the second colour gives the second figure of the value; and the third colour gives the number by which the first two figures should be multiplied in order to arrive at the true value of the resistor. The fourth colour shows the tolerance: the accepted tolerances being ±1 per cent, ±2 per cent, ±5 per cent, ±10 per cent and ±20 per cent. Where no tolerance is indicated, it may be assumed that the tolerance is ±20 per cent.

Grade 1, high-stability, composition resistors are coded as (1) above, the grade being denoted by either a fifth band of Salmon Pink, or the body being of that colour.

Colour	*1st Significant Figure "A"*	*2nd Significant Figure "B"*	*Multiplier "C"*	*Tolerance "D"*
Black	—	0	1	—
Brown	1	1	10	± 1%
Red	2	2	100	± 2%
Orange	3	3	1,000	—
Yellow	4	4	10,000	—
Green	5	5	100,000	—
Blue	6	6	1,000,000	—
Violet	7	7	10,000,000	—
Grey	8	8	100,000,000	—
White	9	9	1000,000,000	—
Gold	—	—	0·1	± 5%
Silver	—	—	0·01	±10%
No colour	—	—	—	±20%

Examples: A resistor with a blue body, a grey tip and an orange spot would have a value of 68,000 ohms with a tolerance of ±20 per cent. The addition of a silver band or tip would indicate a tolerance of ±10 per cent.

A resistor with four bands of colour, the end one being orange, the next orange, followed by brown and gold would have a value of 330 ohms with a tolerance of ±5 per cent. In this case the body colour would have no significance, unless Salmon Pink (sometimes indicated by a fifth band), which would indicate a Grade 1 resistor.

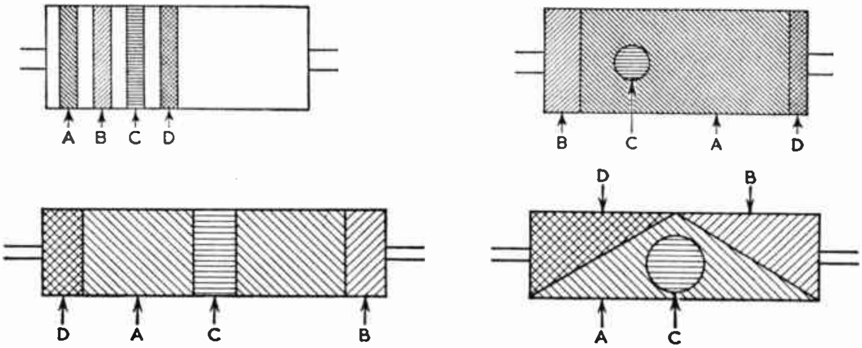


Fig. 1. Colour coding systems for resistors. That shown above left is most frequently used.

Preferred Values and Associated Tolerances

Tolerance			*Tolerance*			*Tolerance*		
±5%	±10%	±20%	±5%	±10%	±20%	±5%	±10%	±20%
1·0	1·0	1·0	2·2	2·2	2·2	4·7	4·7	4·7
1·1	—	—	2·4	—	—	5·1	—	—
1·2	1·2	—	2·7	2·7	—	5·6	5·6	—
1·3	—	—	3·0	—	—	6·2	—	—
1·5	1·5	1·5	3·3	3·3	3·3	6·8	6·8	6·8
1·6	—	—	3·6	—	—	7·5	—	—
1·8	1·8	—	3·9	3·9	—	8·2	8·2	—
2·0	—	—	4·3	—	—	9·1	—	—
						10·0	10·0	10·0

Capacitors

Although many capacitors continue to be marked directly with their value and rating, several systems of colour coding are also in use. These differ according to the type of capacitor and the extent of the information to be conveyed, though in all cases the same basic code to that used for resistors is adopted, except for the 0·1 and 0·01 multipliers. Information that may be shown by colour coding includes: value, temperature coefficient, tolerance and voltage rating. In addition, the connection to the outer foil of tubular paper capacitors may be indicated by a band of colour, usually black, being placed on the casing close to the appropriate connection. All values are colour coded in picofarads (to convert to microfarads divide by 1,000,000).

Ceramic dielectric: There are two preferred methods: the five-band or dot colour code and the six-band or dot colour code; see tables.

Ceramic Dielectric Capacitor Five-band or Dot Colour Code

Colour	*Temperature Coefficient*		*Capacitance Value*				
	Rated Value Tolerance		*First Figure*	*Second Figure*	*Multiplier*	*Tolerance*	
						More than 10 pF	*10 pF or Less*
	"*A*"		"*B*"	"*C*"	"*D*"	"*E*"	
Black .	0	±30	—	0	1	±20%	—
Brown .	−33	±30	1	1	10	±1%	±0·1 pF
Red .	−75	±30	2	2	10^2	±2%	±0·25 pF
Orange .	−150	±30	3	3	10^3	—	—
Yellow .	−220	±30	4	4	10^4	—	—
Green .	−330	±60	5	5	—	±5%	—
Blue .	−470	±90	6	6	—	—	—
Violet .	−750	±120	7	7	—	—	—
Grey .	—	—	8	8	10^{-2}	—	—
White .	−330	±500	9	9	10^{-1}	±10%	±1 pF

Note. If it is inconvenient to apply the colour code it is recommended that the temperature coefficient be indicated by a single body colour in accordance with this colour code, the capacitance value and tolerance to be given in figures.

Ceramic Dielectric Capacitor Six-band or Dot Colour Code

Colour	*Temperature Coefficient*			*Capacitance Value*				
	Significant Figure		*Multiplier*	*First Figure*	*Second Figure*	*Multiplier*	*Tolerance*	
	Value Tolerance *						*More than 10 pF*	*10 pF or Less*
	"*A*"		"*B*"	"*C*"	"*D*"	"*E*"	"*F*"	
Black .	—	—	− 1	—	0	1	±20%	—
Brown .	—	—	−10	1	1	10	±1%	±0·1 pF
Red .	1·0	±0·15	-10^2	2	2	10^2	±2%	±0·25 pF
Orange .	1·5	±0·25	-10^3	3	3	10^3	—	—
Yellow .	2·2	±0·35	-10^4	4	4	10^4	—	—
Green .	3·3	±0·6	− 1	5	5	—	±5%	—
Blue .	4·7	±0·9	—	6	6	—	—	—
Violet .	7·5	±1·2	10^2	7	7	—	—	—
Grey .	—	—	10^3	8	8	10^{-2}	—	—
White .	—	—	10^4	9	9	10^{-1}	±10%	±1 pF

* Or ±40 parts per million per °C., whichever is the greater.

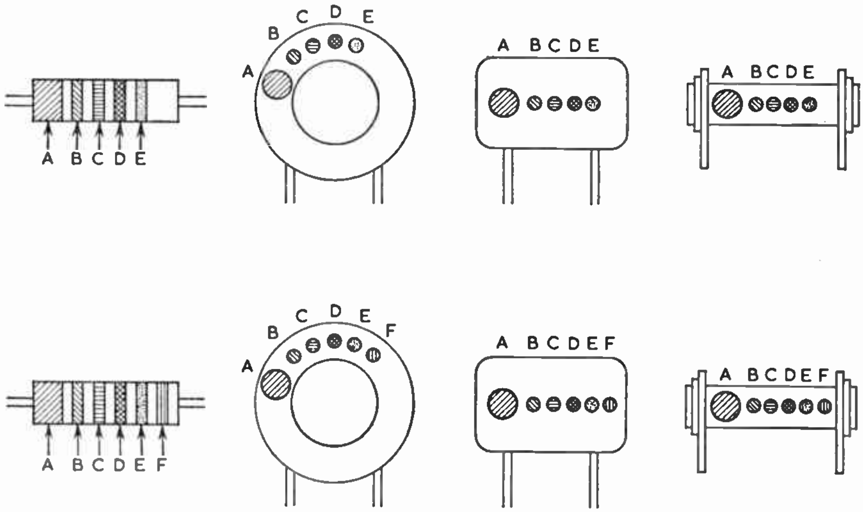


Fig. 2. Five band or dot (above) and six band or dot (below) colour code systems for ceramic dielectric capacitors. (*British Standards* B.S. 2133A: Part 1: 1960.)

Tubular, Metallised-Paper: The values may be colour coded in picofarads, indicated by three dots, having the same significance as in the third, fourth and fifth columns in the first table for ceramic dielectric capacitors given on page 6.

Alternative Methods: While the above systems are those recommended for current usage, several other methods may be met in practice. For example, one colour only may be used to denote tolerance, two colours to denote tolerance and voltage rating, three colours to denote capacitance in picofarads, five colours to denote capacitance in picofarads (first three colours), tolerance (fourth dot) and voltage rating (fifth dot). The order in which the dots are to be read is sometimes indicated by an arrow, but in all cases is from left to right, the first dot being that nearest to one end.

In such instances, tolerance and voltage rating are coded as follows:

Colour	*Tolerance* (%)	*Voltage Rating*
Black	—	—
Brown	1	100
Red	2	200
Orange	3	300
Yellow	4	400
Green	5	500
Blue	6	600
Violet	7	700
Grey	8	800
White	9	1000
Silver	10	—
Gold	5	—

Coding of American capacitors also differs slightly from that described above: the RMA three-dot code is used for capacitors having a tolerance of 20 per cent, the dots indicating the capacitance in picofarads; the RMA six-dot code gives (*top row*) first, second and third significant figures; (*bottom row*) voltage rating, tolerance and decimal multiplier. American fixed ceramic capacitors have a broad band followed by four narrow bands or dots giving temperature coefficient, first significant figure, second significant figure, decimal multiplier and tolerance, this system being similar to that described for British capacitors of this type. American war-surplus mica and moulded paper capacitors are marked according to American War Standards or Joint Army–Navy specifications. These markings are similar in appearance to the RMA six-dot system, but the first dot of the top row indicates type (black/mica, silver/paper), the second and third dots give first and second significant figures, while the bottom row indicates characteristic, tolerance and decimal multiplier.

Colour Code for Current-operated Fuses

Colour	*Rating (A)*	*Colour*	*Rating (A)*
Green and yellow	0·010	Green	0·750
Red and turquoise	0·015	Blue	1·0
Eau-de-Nil	0·025	Light blue	1·5
Salmon pink	0·050	Purple	2·0
Black	0·060	Yellow and purple	2·5
Grey	0·100	White	3·0
Red	0·150	Black and white	5·0
Brown	0·250	Orange	10·0
Yellow	0·500		

(*British Standards Institution*)

The Greek Alphabet

Capital	*Small*	*Name*	*Capital*	*Small*	*Name*
Α	α	alpha	Ν	ν	nu
Β	β	beta	Ξ	ξ	xi
Γ	γ	gamma	Ο	ο	omicron
Δ	δ	delta	Π	π	pi
Ε	ε	epsilon	Ρ	ρ	rho
Ζ	ζ	zeta	Σ	σ	sigma
Η	η	eta	Τ	τ	tau
Θ	θ	theta	Υ	υ	upsilon
Ι	ι	iota	Φ	φ	phi
Κ	κ	kappa	Χ	χ	chi
Λ	λ	lambda	Ψ	ψ	psi
Μ	μ	mu	Ω	ω	omega

FORMULAE

Ohm's Law

$$E = I \times R$$

where E is the potential difference in volts, I the direct current in amperes and R the resistance in ohms.

The formula may also be stated:

$$I = \frac{E}{R} \quad \text{and} \quad R = \frac{E}{I}$$

EXAMPLES: (1) *What is the voltage drop across a* 33,000-*ohm resistor through which a current of* 2 *mA is flowing?*

$$E = I \times R = \frac{2}{1,000} \times 33,000 = 66 \text{ volts}$$

(2) *What value of cathode bias resistor should be used to obtain a* 3-*volt bias voltage for a tetrode valve operating with an anode current of* 8 *mA, a screen current of* 2 *mA and no grid current?*

$$R = \frac{E}{I\,(\text{total})} = \frac{3 \times 1,000}{(8 + 2)} = 300 \text{ ohms}$$

N.B. In this type of problem it should be remembered that the current flowing through the cathode resistor is the sum of anode, screen, suppressor grid and control grid currents.

(3) *What will be the current flowing through a* 10,000-*ohm bleeder resistor connected across a* 250-*volt power supply?*

$$I = \frac{E}{R} = \frac{250 \times 1,000}{10,000} = 25 \text{ mA}$$

N.B. The multiplication by 1,000 gives the answer in milliamperes.

Power

The following formulae apply to d.c. circuits.

$$W = E \times I$$

By consideration of Ohm's Law this may be stated also in the following forms:

$$W = I^2R$$

or

$$W = E^2/R$$

where W is the power in watts, E the potential difference in volts, I the current in amperes and R the resistance in ohms.

Resistors

Resistors in Series

$$R \text{ (total)} = R_1 + R_2 + R_3 \ldots$$

Thus the total resistance of a chain of resistors in series is the sum of the individual resistors which form the chain.

EXAMPLE: *What is the effective resistance of a 33k resistor and a 0·25M resistor connected in series?*

Note that all values must be changed into a common unit before addition.

$$R = R_1 \times R_2 = 33\text{k} + 0{\cdot}25\text{M} = 33{,}000 + 250{,}000$$
$$= \underline{283{,}000 \text{ ohms}}$$

Resistors in Parallel

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots$$

Where there are only two resistors, this formula may be stated:

$$R = \frac{R_1 \times R_2}{R_1 + R_2}$$

N.B. The effective resistance of a number of resistors in parallel must always be less than that of any one of the individual resistors.

EXAMPLES: (1) *What is the effective resistance of* 2,000-*ohm*, 5,000-*ohm and* 10,000-*ohm resistors connected in parallel?*

$$\frac{1}{R} = \frac{1}{2{,}000} + \frac{1}{5{,}000} + \frac{1}{10{,}000} = \frac{5 + 2 + 1}{10{,}000}$$
$$\therefore \; R = 1{,}250 \text{ ohms}$$

(2) *What value resistor should be connected in parallel across a* 60,000-*ohm resistor in order to reduce the effective circuit resistance to* 20,000 *ohms?*

$$20{,}000 = \frac{60{,}000 \times R}{60{,}000 + R}$$
$$\therefore \; 20{,}000\,(60{,}000 + R) = 60{,}000R$$
$$\therefore \; R + 60{,}000 = 3R$$
$$\therefore \; R = \underline{30{,}000 \text{ ohms}}$$

The table opposite can be used for the rapid calculation of the value of two resistors connected in parallel.

Potential Divider

Where two resistors are connected across a supply (see Fig. 3), the voltage across one, in the absence of a load, is derived from the following formula:

$$e = E \times \frac{R_1}{R_1 + R_2}$$

Resistors in Parallel

This table can be used directly to find the value of any two resistors in parallel under 1,000 ohms in the 10% or 20% preferred ranges, and for other values by manipulation of the decimal point. This table can also be used for finding the values of capacitors in series or inductors in parallel.

*R*1	*R*2											
	10	12	15	18	22	27	33	39	47	56	68	82
10	5·00	5·46	6·00	6·43	6·88	7·30	7·68	7·96	8·24	8·48	8·72	8·91
12	5·46	6·00	6·67	7·20	7·71	8·33	8·80	9·23	9·58	9·88	10·22	10·5
15	6·00	6·67	7·50	8·81	8·92	9·64	10·3	10·8	11·4	11·8	12·3	12·7
18	6·43	7·20	8·18	9·0	9·90	10·8	11·6	12·3	13·0	13·6	14·2	14·8
22	6·88	7·71	8·92	9·9	11·0	12·1	13·2	14·1	16·0	15·8	16·6	17·4
27	7·30	8·38	9·64	10·8	12·1	13·5	14·8	16·0	17·2	18·2	19·3	20·3
33	7·68	8·80	10·3	11·6	13·2	14·8	16·5	17·9	19·4	20·8	22·2	23·5
39	7·96	9·23	10·8	12·3	14·1	16·0	17·9	19·5	21·3	23·0	24·8	26·4
47	8·24	9·58	11·4	13·0	15·0	17·2	19·4	21·3	23·5	25·6	27·8	29·9
56	8·48	9·88	11·8	13·6	15·8	18·2	20·8	23·0	25·6	28·0	30·7	33·3
68	8·72	10·2	12·3	14·2	16·6	19·3	22·2	24·8	27·8	30·7	34·0	37·2
82	8·91	10·47	12·7	14·8	17·4	20·3	23·5	26·4	29·9	33·3	37·2	41·0
100	9·09	10·71	13·0	15·2	18·0	21·3	24·8	28·1	32·0	35·9	40·5	45·0
120	9·23	10·91	13·3	15·6	18·6	22·0	25·9	29·4	34·0	38·2	43·4	48·7
150	9·38	11·11	13·6	16·1	19·2	22·9	27·0	31·0	35·8	40·7	46·8	53·0
180	9·47	11·25	13·8	16·4	19·6	23·5	27·9	32·0	37·3	42·7	49·3	56·3
220	9·57	11·37	14·1	16·6	20·0	24·0	28·7	33·1	38·7	44·6	51·95	59·7
270	9·64	11·49	14·2	16·9	20·3	24·6	29·4	34·1	40·0	46·4	54·3	62·9
330	9·71	11·57	14·35	17·1	20·6	25·0	30·0	34·9	41·1	47·9	56·4	65·7
390	9·75	11·64	14·44	17·26	20·8	25·2	30·4	35·4	41·9	49·0	57·9	67·8
470	9·79	11·70	14·53	17·34	21·0	25·5	30·8	36·0	42·7	50·0	59·4	69·8
560	9·82	11·75	14·56	17·44	21·2	25·8	31·2	36·4	43·3	50·9	60·6	71·5
680	9·86	11·79	14·68	17·53	21·3	26·0	31·5	36·9	44·0	51·7	61·8	73·2
820	9·88	11·82	14·73	17·61	21·4	26·1	31·7	37·2	44·4	52·4	62·8	74·5
1,000	9·90	11·85	14·78	17·68	21·5	26·3	32·0	37·5	44·9	53·0	63·6	75·8

Note manipulation of decimal point: *Examples.* 82 with 82 = 41 ohms; 820 with 82 = 74·5 ohms; 820 with 820 = 410 ohms; 8,200 with 820 = 745 ohms; 82,000 with 82,000 = 41,000 ohms.

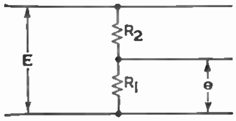
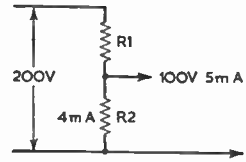


Fig. 3 (left). Potential divider.

Fig. 4 (right). Example of a potential divider.



Where a load is drawn from a potential divider, the differing currents in each section of the divider must be taken into account.

EXAMPLE: *A potential divider is to be connected across a 200-volt H.T. line so as to provide an output of 100 volts at 5 mA with a standing current of 4 mA, see Fig. 4.*

The current flowing through R_1 will be $5 + 4 = 9$ mA since R_1 must provide a voltage drop of 100 volts.

Then, from Ohm's Law,

$$R_1 = \frac{E}{I} = \frac{100}{9} \times 1{,}000 \simeq 11{,}000 \text{ ohms}$$

and

$$R_2 = \frac{100}{4} \times 1{,}000 = 25{,}000 \text{ ohms}$$

Biasing

Value (ohms) of cathode biasing resistors may be calculated from the following formula:

$$R \text{ (cathode)} = \frac{\text{Grid bias volts required (volts)}}{\text{Total cathode current (amps)}}$$

The value of the associated by-pass capacitor is given approximately by:

$$C \simeq \frac{1}{6{\cdot}28 \times f \times (R/10)}$$

where C is the by-pass capacitor in farads, f is the lowest frequency to be by-passed and R the resistance across C.

Alternating Current

$$E_{\text{r.m.s.}} = 0{\cdot}707\ E_{\text{max.}}$$

$$I_{\text{r.m.s.}} = 0{\cdot}707\ I_{\text{max.}}$$

$$E_{\text{max.}} = 1{\cdot}414\ E_{\text{r.m.s.}}$$

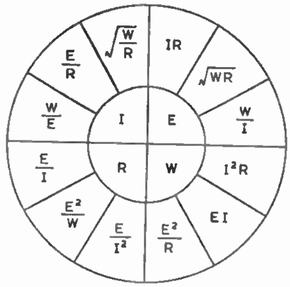
$$I_{\text{max.}} = 1{\cdot}414\ I_{\text{r.m.s.}}$$

$$E_{\text{av.}} = 0{\cdot}637\ E_{\text{max.}} = 0{\cdot}901\ E_{\text{r.m.s.}}$$

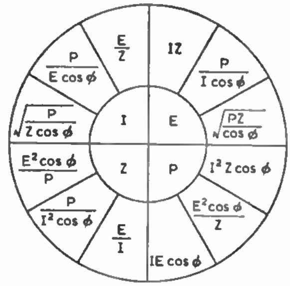
$$I_{\text{av.}} = 0{\cdot}637\ I_{\text{max.}} = 0{\cdot}901\ I_{\text{r.m.s.}}$$

$$E_{\text{peak-to-peak}} = 2 \times E_{\text{max.}} = 2{\cdot}828 \times E_{\text{r.m.s.}}$$

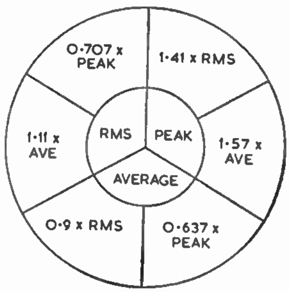
True power = apparent power ($E \times I$) $\times$ power factor ($\cos \phi$) where ϕ is the phase difference.



OHMS LAW FOR D.C. CIRCUITS



OHMS LAW FOR A.C. CIRCUITS



A.C. VOLTAGE RELATIONSHIPS

W WATTS E VOLTS I AMPS R OHMS
Z IMPEDANCE P TRUE POWER
ϕ PHASE ANGLE

Fig. 5. Ohm's Law and a.c. voltage relationships.

Power factor is ratio of watts to volt-amperes: P.F. $= W/(E_{r.m.s.} \times I_{r.m.s.})$.

Current in circuit containing inductance only

$$I = E/\omega L$$

where I is the r.m.s. current in amps, E is the r.m.s. voltage in volts, L the inductance in henries and $\omega = 2\pi f (\pi = 3{\cdot}14$ approximately, $f =$ frequency in c/s).

Current in circuit containing capacitance only

$$I = E \times \omega C$$

C being in Farads.

Current in circuit containing inductance, capacitance and resistance

$$I = E/\sqrt{(R^2 + (\omega L - 1/\omega C)^2)}$$

R being in ohms.

Impedance

$$Z = \sqrt{R^2 \times (X_L - X_C)^2}$$
$$= \sqrt{R^2 \times (2\pi f L - 1/(2\pi f C))}$$

X_L being inductive reactance and X_C capacitive reactance (in ohms).

Phase

When A.C. flows through a purely resistive circuit the current maxima and minima keep in step with the voltage maxima and minima; such a circuit is said to be *in phase*.

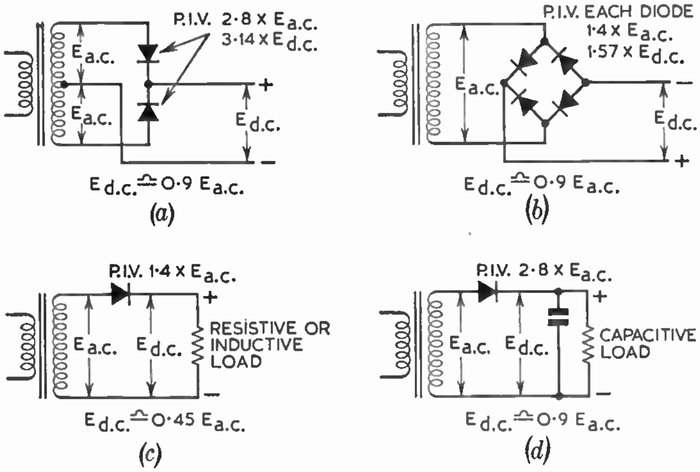


Fig. 6. Fundamental power supply relationships. (a) *Full-wave circuit.* (b) *Bridge circuit.* (c) *Half-wave circuit with resistive load.* (d) *Half-wave circuit with capacitive load.*

An inductive reactance in the circuit will cause the current in an A.C. circuit to lag behind the voltage, called *lagging phase.* The phase lag will be 90° in a circuit containing inductive reactance only.

Similarly, a purely capacitive reactance will cause the current to *lead* the voltage by 90°.

Capacitors

Capacitors in Series

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \ldots$$

Where there are only two capacitors, this formula may be stated:

$$C = \frac{C_1 \times C_2}{C_1 + C_2}$$

See also the table on page 11.

EXAMPLE: *What is the effective capacitance of a 250-pF capacitor in series with a 0·001-μF capacitor?*

$$C = \frac{250 \times 1{,}000}{250 + 1{,}000} = \frac{250{,}000}{1{,}250} = \underline{200 \text{ pF}}$$

Capacitors in Parallel

$$C = C_1 + C_2 + C_3 \ldots$$

EXAMPLE: *What is the effective capacitance of a 0·0002-μF capacitor in parallel with a 50-pF capacitor?*

$$C = 200 + 50 = \underline{250 \text{ pF}}$$

Note that both values must be expressed in the same units.

Inductors

Inductances in Series $L = L_1 + L_2 + L_3 \ldots$

Inductances in Parallel $\frac{1}{L} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$

See also the table on page 11.

Capacitive Reactance

The reactance of a capacitor in an A.C. circuit is derived from the formula:

$$X_c = \frac{1,000,000}{2\pi fC}$$

where X_c is the capacitive reactance in ohms, f the frequency in cycles per second, C the capacitance in microfarads and π is approximately 3·14.

EXAMPLE: *What is the reactance of a 0·1-μF capacitor at 5,000 c/s?*

$$X_c = \frac{1,000,000}{2 \times 3{\cdot}14 \times 5,000 \times 0{\cdot}1} = \frac{200}{0{\cdot}628} = 318 \text{ ohms}$$

The values shown in the tables below are typical of those encountered in radio servicing and construction.

C	X_c (ohms)				
	50 c/s	100 c/s	1,000 c/s	5,000 c/s	15,000 c/s
100 pF	31,800,000	15,900,000	1,590,000	318,000	106,000
500 pF	6,370,000	3,180,000	318,000	63,700	21,200
0·001 μF	3,180,000	1,590,000	159,000	31,800	10,600
0·005 μF	637,000	318,000	31,800	6,370	2,120
0·01 μF	318,000	159,000	15,900	3,180	1,060
0·1 μF	31,800	15,900	1,590	318	106
1·0 μF	3,180	1,590	159	31·8	10·6

C	X_c (ohms)				
	500 kc/s	1 Mc/s	5 Mc/s	10 Mc/s	50 Mc/s
10 pF	31,800	15,900	3,180	1,590	318
50 pF	6,370	3,180	637	318	63·7
100 pF	3,180	1,590	318	159	31·8
500 pF	637	318	63·7	31·8	6·37
0·001 μF	318	159	31·8	15·9	3·18
0·005 μF	63·7	31·8	6·37	3·18	0·637

The reactance of a given capacitor thus decreases as the frequency increases, and capacitive reactance is by convention considered negative.

Inductive Reactance

The reactance of an inductance in an A.C. circuit is given by the formula:

$$X_L = 2\pi f L$$

where X_L is the inductive reactance in ohms, f is the frequency in kilocycles and L the inductance in millihenrys. Exactly the same formula may be used with f in megacycles and L in microhenrys, or with f in cycles and L in henrys. π is 3·14 approximately.

The reactance of a given inductor increases as the frequency increases. Inductive reactance is by convention considered positive.

In a combination of inductance and capacitance the net reactance is the difference between them, thus

$$X = X_L - X_C$$

There will be a particular frequency (resonance) at which the inductive and capacitive reactances are equal and cancel out, so that the net reactance becomes zero, leaving only the resistance of the circuit to impede the flow of current.

Resonance of a Tuned Circuit

$$f = \frac{1{,}000{,}000}{2\pi \times \sqrt{(L \times C)}}$$

$$\simeq \frac{159{,}000}{\sqrt{(L \times C)}}$$

where f is the resonant frequency in kilocycles per second, L is the inductance in microhenrys and C is the capacitance in picofarads.

Output Transformer Ratio

$$N = \sqrt{\left(\frac{R_L}{Z}\right)}$$

where N is the transformer turns-ratio, R_L the optimum load resistance of the output valve and Z the impedance of the loudspeaker.

EXAMPLE: *What should be the turns-ratio of a transformer designed to match a 3-ohm loudspeaker to a valve which requires a load of 5,000 ohms for optimum performance?*

$$N = \sqrt{\left(\frac{5{,}000}{3}\right)} = \sqrt{(1{,}666)} = 40{\cdot}8$$

The primary winding should therefore have 40·8 times as many turns as the secondary winding.

Extension of Meter Ranges

Ammeter Shunts:

$$\text{Shunt} = \frac{\text{Meter resistance}}{(n - 1)}$$

where n is the number of times by which the full-scale deflection is to be increased.

EXAMPLE: *It is desired to measure currents up to 500 mA. on a 10-mA. f.s.d. meter with an internal resistance of 30 ohms. What value shunt should be placed in parallel across the meter?*

$$\text{Shunt} = \frac{30}{(50 - 1)} = \frac{30}{49} \simeq 0{\cdot}61 \text{ ohm}$$

Voltmeter Series Resistors:

$$R = \text{meter resistance} \times (n - 1)$$

where n is the number of times by which the full-scale deflection is to be increased and R is the required series resistor.

Milliammeter as Voltmeter:

To use a milliammeter as a voltmeter a suitable resistor should be connected in series with the meter. The value of this resistor can be calculated from the formula:

$$R = \frac{E}{\text{Meter current (f.s.d.)}} - \text{Meter resistance}$$

where E is the required full-scale deflection of the voltmeter.

Inductance

An approximate formula to give the inductance of a single layer coil is:

$$L(\mu\text{H}) = \frac{a^2n^2}{9a + 10l}$$

where a is radius of coil in inches; n is number of turns and l is length of coil in inches.

To calculate the number of turns for a desired inductance of a single-layer coil:

$$n = \frac{5L}{a^2b}\left[1 + \sqrt{\left(1 + \frac{0{\cdot}36a^3b^2}{L}\right)}\right]$$

where b is number of turns per inch.

The Decibel

Gain and attenuation are frequently expressed in decibels (abbreviation dB). The decibel is one-tenth of a Bel, which is numerically the logarithm (to base 10) of the power ratio. That is, if the power gain is 10^x, then the gain in Bels $= x = 10x$ dB. Points to note are that it is the logarithm of a ratio and not an absolute unit, and that this ratio is a ratio of power and not of voltage or current. It may, however, be used for the comparison of voltages if the impedance is kept constant, as in these circumstances power is proportional to (voltage)^2, and hence

$$\text{Gain (dB)} = 10 \log_{10} \frac{(V_{\text{out}})^2}{(V_{\text{in}})^2} = 20 \log_{10} \frac{V_{\text{out}}}{V_{\text{in}}}$$

Gains and attenuations can, using decibels, be added and subtracted instead of multiplied and divided. Some examples are given in the following table.

$V_{\text{out}}/V_{\text{in}}$	*Power ratio*	*dB*	$V_{\text{out}}/V_{\text{in}}$	*Power ratio*	*dB*
100 : 1	10,000 : 1	+40	2 : 1	4 : 1	+ 6
31·6 : 1	1,000 : 1	+30	1·41 : 1	2 : 1	+ 3
10 : 1	100 : 1	+20	1·12 : 1	1·26 : 1	+ 1
3·16 : 1	10 : 1	+10	1 : 100	1 : 10,000	−40

Time Constant

The time constant is the length of time required for the voltage across a capacitor C, charged through a resistor R, to reach 63 per cent $(1 - 1/e)$ of the applied voltage, where the time is measured in seconds, R in ohms and C in farads.

In a circuit containing inductance L and resistance R the time constant is the length of time for the current to reach 63 per cent of its maximum, and is equal to L/R, where L is in henrys and R in ohms.

Valve Characteristics

Valves:

$$\text{Mutual conductance} = g_m = \frac{\mu \times 1{,}000}{r_a} \text{ in A/volt}$$

$$\text{Amplification factor} = \mu = \frac{g_m \times r_a}{1{,}000}$$

$$\text{Anode impedance} = r_a = \frac{\mu \times 1{,}000}{g_m} \text{ ohms}$$

$$\text{Stage gain} = A = \frac{\mu \times R_a}{R_a + r_a}$$

where R_a is anode load in ohms.

If R_a is small compared with r_a

$$A \simeq g_m \times R_a$$

Voltage Amplifiers:

$$e_0 = -\mu e_g \frac{R_a}{R_a \times r_a}$$

where e_0 is voltage output, e_g is input signal voltage.

Power Amplifier:

$$\text{p (watts)} = \left(\frac{\mu e_g}{r_a \times R_a}\right)^2$$

Power output of single pentode $\simeq 0{\cdot}33 \times I_a \times E_a$ where I_a is d.c. anode current and E_a is d.c. anode voltage.

Optical Range

Range (miles)

$$= 1{\cdot}225\sqrt{\text{Height of transmitting aerial (ft)} \times \text{Height of receiving aerial (ft)}}$$

For v.h.f. communications the 1·225 factor can normally be increased to between 1·4 and 2.

Note that the aerial heights are *heights above sea level.*

Crossover Networks

Crossover networks are used when two (or more) loudspeakers are to be connected to obtain a wider frequency response. A large loudspeaker is generally used for the lower frequencies, and a pressure unit or small speaker for the higher frequencies.

The crossover is used to separate the units so that inter-modulation distortion is reduced where the loudspeaker responses overlap, also to keep the extreme low frequencies from entering the pressure unit and damaging the diaphragm assembly.

Fig. 7 shows the various types employed. The quarter-section types are the cheapest to manufacture, but have an attenuation of only 6 dB/octave away from the crossover frequency.

10 dB/octave is obtainable from the networks shown in Fig. 7 (*c*) and (*d*).

From the filter type, half-section (Fig. 7 (*e*) and (*f*)) an attenuation of 12 dB/octave is obtainable; and although this type does not provide as constant a resistance as Fig. 7 (*c*) and (*d*), this is offset by the greater attenuation, this characteristic often being preferable as the inter-modulation distortion is further decreased.

Choke and Capacitor Values for Crossover Networks

Choke		*Capacitor*	
L1	2·4 mH	C1	10·6 μF
L2	1·5 mH	C2	17 μF
L3	1·7 mH	C3	15 μF
L4	3·4 mH	C4	7·5 μF
L5	3·83 mH	C5	6·6 μF

The figures in this table are for a crossover at 1,000 c/s with 15-ohm loudspeakers.

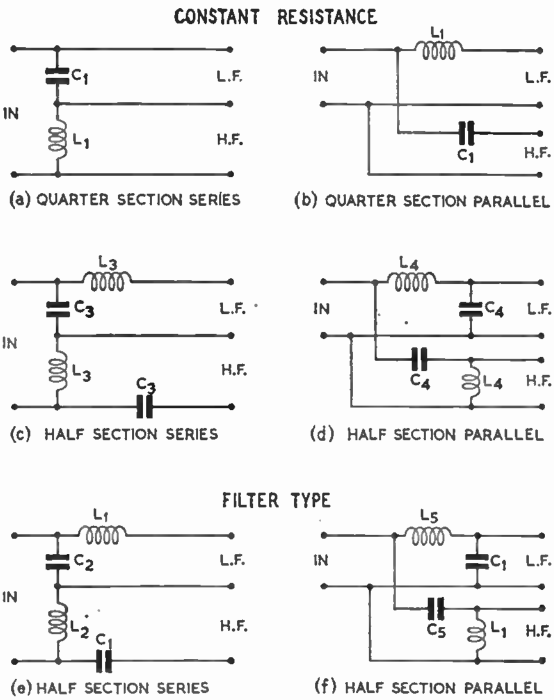


Fig. 7. Crossover network circuits.

The crossover frequency is inversely proportional to the component values; thus we may say:

(1) to double the crossover frequency, halve the values of L and C;

(2) to halve the crossover frequency, double the values of L and C.

When halving the loudspeaker impedance, multiply all C values by two, divide all L values by two and so on.

To keep the insertion loss low, normal electrolytic capacitors should not be used, as they require a d.c. polarizing voltage and will cause a high loss due to the high resistive component. Air-cored coils having low resistance should be used in preference to iron-cored ones.

For high-fidelity installations the half-section parallel constant resistance type (Fig. 7 (*d*)) is preferred.

Line Matching

It is often necessary for a number of loudspeakers to be run from one source and for each loudspeaker to consume only a limited amount of power.

To do this the amplifier used has an output transformer having a relatively low output impedance, say 2000 ohms. Assuming the output of the amplifier to be 50 watts, it would be possible to run 100 loudspeakers from it, each loudspeaker to consume 0·5 watts. As the loudspeakers would be connected in parallel, the individual impedance of each one would have to be $200 \times 100 = 20{,}000$ ohms.

It is, of course, possible to arrange the loudspeakers to consume varying amounts of power thus.

5 loudspeakers consuming 5 watts
10 loudspeakers consuming 2 watts
5 loudspeakers consuming 1 watt

The relative impedance can then be calculated as follows:

Amplifier output	50 watts
Impedance	200 ohms
Therefore line voltage . . .	100 volts

Therefore:

(1) for 5-watt loudspeaker, $W = \frac{E^2}{Z}$

$$\text{Impedance} = \frac{100^2}{5} = 2{,}000 \text{ ohms}$$

(2) for 2-watt loudspeaker

$$\text{Impedance} = \frac{100^2}{2} = 5{,}000 \text{ ohms}$$

(3) for 1-watt loudspeaker

$$\text{Impedance} = \frac{100^2}{1} = 10{,}000 \text{ ohms}$$

Matching

The maximum power from a generator (for example a valve or semiconductor) will be delivered to its load when the load resistance is equal to the internal resistance of the generator.

With a generator of internal impedance R and e.m.f. E feeding into a matched load, power in the load W will be $E^2/(4R)$ watts.

Where the load is not correctly matched a loss of power occurs, see table below.

Load resistance/generator resistance	*Power in Load*	*Power loss in decibels*
0·1	0·33 $\times E^2/(4R)$	4·80
0·2	0·556 $\times E^2/(4R)$	2·55
0·33	0·75 $\times E^2/(4R)$	1·25
0·5	0·888 $\times E^2/(4R)$	0·52
1·0	$E^2/(4R)$	0
2·0	0·888 $\times E^2/(4R)$	0·52
3·0	0·75 $\times E^2/(4R)$	1·25
5·0	0·556 $\times E^2/(4R)$	2·55
10·0	0·33 $\times E^2/(4R)$	4·80

A mismatch by a ratio of 2:1 or 1:2 will thus reduce the power developed in the load by about 11 per cent.

AERIALS

Resonant Half-wave Dipole Aerials

$$\text{Length (feet)} = \frac{492 \times k}{\text{Frequency (Mc/s)}}$$

where k is a factor which varies between 0·92 and 0·98 according to the thickness of the conductor in relation to the wavelength and to the end effect of the aerial insulators. The thicker the conductor, the less will be the length.

For wire h.f. aerials

$$\text{Length (feet)} \simeq \frac{470}{\text{Frequency (Mc/s)}}$$

Typical Dimensions of H.F. Wire Aerials

	Overall length
Amateur bands	
80 metre (3,600 kc/s)	130 ft
40 metre (7,050 kc/s)	66 ft 3 in.
20 metre (14,100 kc/s)	33 ft 2 in.
15 metre (21,200 kc/s)	22 ft 1 in.
10 metre (28,400 kc/s)	16 ft 6 in.
Broadcast bands	
75 metre (3,950 kc/s)	119 ft
60 metre (4,850 kc/s)	99 ft
49 metre (6,100 kc/s)	77 ft
41 metre (7,200 kc/s)	65 ft 3 in.
31 metre (9,650 kc/s)	48 ft 8 in.
25 metre (11,850 kc/s)	39 ft 9 in.
19 metre (15,300 kc/s)	30 ft 9 in.
16 metre (17,800 kc/s)	26 ft 5 in.
13 metre (21,600 kc/s)	21 ft 9 in.
11 metre (25,850 kc/s)	18 ft 3 in.

For centre-fed dipole aerials each arm will be slightly less than one-half of the overall length indicated, taking into account the gap at the feed point.

V.H.F. Aerials for Television, V.H.F./F.M. and Amateur Bands

Diameter of tubing	*Dipole length (in.)*	*Reflector length (in.)*	*Spacing (in.)*
½-in.	5,270/frequency (Mc/s)	5,666/frequency (Mc/s)	1,770/frequency (Mc/s)
⅜-in.	5,400/frequency (Mc/s)	5,783/frequency (Mc/s)	1,770/frequency (Mc/s)
¼-in.	5,453/frequency (Mc/s)	5,902/frequency (Mc/s)	1,770/frequency (Mc/s)

Typical Dimensions for Television Aerials

Channel	*Mean frequency (Mc/s)*	*Dipole ft in.*	*Director ft in.*	*Reflector ft in.*	*Spacing* $\frac{1}{8}\lambda$ *ft in.*
1	43·5	10 7	10 1	11 1	2 9
2	50	9 3	8 9½	9 8½	2 4½
3	55	8 5	8 0	8 10	2 2½
4	60	7 8½	7 4	8 1	2 0
5	65	7 1	6 9	7 5	1 10½
6	178	2 7½	2 6	2 9	8½
7	183	2 6½	2 5	2 8	8
8	188	2 5½	2 4	2 7	8
9	193	2 4½	2 3	2 6	7½
10	198	2 3½	2 2½	2 5	7¼
11	203	2 3	2 2	2 4½	7
12	208	2 2½	2 1½	2 4	7
13	213	2 2	2 1	2 3	7

FREQUENCY AND WAVELENGTH

THE velocity of electromagnetic wave propagation in a given medium is constant, and in space is equal to that of light, $c = 2{\cdot}998 \times 10^8$ metres/second approximately. For most practical applications c is taken as 3×10^8 metres/second. The frequency, in terms of velocity (c) and wavelength (λ) in metres,

$$f = c/\lambda$$

More useful forms are:

$$f \text{ (in c/s)} = 3 \times 10^8/\lambda = 300{,}000{,}000/\lambda$$
$$f \text{ (in kc/s)} = 3 \times 10^5/\lambda = 300{,}000/\lambda$$
$$f \text{ (in Mc/s)} = 300/\lambda$$

Useful datum points for mentally converting frequency and wavelength are given in the following table.

Frequency–Wavelength Conversion

f in Mc/s .	1	3	10	30	100	300	1,000	3,000
λ in metres	300	100	30	10	3	1	0·3	0·1

The table on the following pages gives conversion points throughout the range 10·0–99·9 in 0·1 steps, and may be used for both wavelength-to-frequency and frequency-to-wavelength conversion provided that the correct units and position of the decimal points are ascertained from the table above.

	0	1	2	3	4	5	6	7	8	9
10	30,000	29,703	29,412	29,126	28,846	28,571	28,302	28,037	27,778	27,523
11	27,273	27,027	26,786	26,549	26,316	26,087	25,862	25,641	25,424	25,210
12	25,000	24,793	24,590	24,390	24,193	24,000	23,809	23,622	23,437	23,256
13	23,077	22,901	22,727	22,556	22,388	22,222	22,059	21,898	21,739	21,583
14	21,429	21,277	21,127	20,979	20,833	20,690	20,548	20,408	20,270	20,134
15	20,000	19,867	19,737	19,608	19,480	19,355	19,231	19,108	18,987	18,868
16	18,750	18,634	18,518	18,405	18,293	18,182	18,072	17,964	17,857	17,752
17	17,647	17,544	17,442	17,341	17,241	17,143	17,045	16,949	16,854	16,760
18	16,667	16,575	16,483	16,393	16,304	16,216	16,129	16,043	15,957	15,873
19	15,790	15,707	15,625	15,544	15,464	15,385	15,306	15,228	15,151	15,075
20	15,000	14,925	14,851	14,778	14,706	14,634	14,563	14,493	14,423	14,354
21	14,286	14,218	14,151	14,084	14,019	13,954	13,889	13,825	13,762	13,699
22	13,636	13,575	13,513	13,453	13,493	13,333	13,274	13,216	13,158	13,100
23	13,043	12,987	12,931	12,875	12,820	12,766	12,712	12,658	12,605	12,552
24	12,500	12,448	12,397	12,346	12,295	12,245	12,195	12,146	12,097	12,048
25	12,000	11,952	11,905	11,858	11,811	11,765	11,719	11,673	11,628	11,583
26	11,538	11,494	11,450	11,407	11,364	11,321	11,278	11,236	11,194	11,152
27	11,111	11,070	11,029	10,989	10,949	10,909	10,870	10,830	10,791	10,753
28	10,714	10,676	10,638	10,601	10,563	10,526	10,489	10,453	10,417	10,381
29	10,345	10,309	10,274	10,239	10,204	10,169	10,135	10,101	10,067	10,033
30	10,000	9,967	9,934	9,901	9,868	9,836	9,804	9,772	9,740	9,709
31	9,677	9,646	9,615	9,585	9,554	9,524	9,494	9,464	9,434	9,404
32	9,375	9,346	9,317	9,288	9,259	9,231	9,202	9,174	9,146	9,109
33	9,091	9,063	9,036	9,009	8,982	8,955	8,929	8,901	8,876	8,850
34	8,823	8,798	8,772	8,746	8,721	8,696	8,671	8,645	8,621	8,596
35	8,571	8,547	8,523	8,499	8,475	8,451	8,427	8,403	8,380	8,356
36	8,333	8,310	8,287	8,264	8,242	8,219	8,197	8,174	8,152	8,130
37	8,108	8,086	8,065	8,043	8,021	8,000	7,979	7,958	7,937	7,916
38	7,895	7,874	7,853	7,833	7,813	7,792	7,772	7,752	7,732	7,712
39	7,692	7,672	7,653	7,633	7,614	7,595	7,576	7,557	7,538	7,519
40	7,500	7,481	7,463	7,444	7,426	7,407	7,389	7,371	7,353	7,335
41	7,317	7,299	7,282	7,264	7,246	7,229	7,211	7,194	7,177	7,160
42	7,143	7,126	7,109	7,092	7,075	7,059	7,042	7,026	7,009	6,993
43	6,977	6,961	6,944	6,928	6,912	6,897	6,881	6,865	6,850	6,834
44	6,818	6,803	6,787	6,772	6,757	6,742	6,727	6,711	6,696	6,682
45	6,667	6,652	6,637	6,622	6,608	6,593	6,579	6,565	6,550	6,536
46	6,522	6,508	6,494	6,479	6,466	6,452	6,438	6,424	6,410	6,397
47	6,383	6,369	6,356	6,343	6,329	6,316	6,302	6,289	6,276	6,263
48	6,250	6,237	6,224	6,211	6,198	6,186	6,173	6,160	6,148	6,135
49	6,122	6,110	6,097	6,085	6,073	6,061	6,048	6,036	6,024	6,012
50	6,000	5,988	5,976	5,964	5,952	5,941	5,929	5,917	5,905	5,894
51	5,882	5,871	5,859	5,848	5,836	5,825	5,814	5,803	5,791	5,780
52	5,769	5,758	5,747	5,736	5,725	5,714	5,703	5,692	5,682	5,671
53	5,660	5,650	5,639	5,629	5,618	5,607	5,597	5,587	5,576	5,566
54	5,556	5,545	5,535	5,525	5,515	5,505	5,494	5,485	5,474	5,464

Examples:

27·2 metres = 11,029 kc/s.
2720 metres = 110·29 kc/s.
272 kc/s = 1102·9 metres.
2·72 Mc/s = 110·29 metres.
27·2 cm = 1102·9 Mc/s.

49·8 metres = 6,024 kc/s.
498 kc/s = 602·4 metres.
4·98 Mc/s = 60·24 metres.
498 metres = 602·4 kc/s.
49·8 cm = 602·4 Mc/s.

	0	1	2	3	4	5	6	7	8	9
55	5,455	5,445	5,435	5,425	5,415	5,405	5,396	5,386	5,376	5,367
56	5,357	5,347	5,338	5,329	5,319	5,310	5,300	5,291	5,282	5,272
57	5,263	5,254	5,245	5,236	5,227	5,217	5,208	5,199	5,190	5,181
58	5,172	5,164	5,155	5,146	5,137	5,128	5,119	5,111	5,102	5,093
59	5,085	5,076	5,068	5,059	5,050	5,042	5,034	5,025	5,017	5,008
60	5,000	4,992	4,983	4,975	4,967	4,959	4,951	4,942	4,934	4,926
61	4,918	4,910	4,902	4,894	4,886	4,878	4,870	4,862	4,854	4,846
62	4,839	4,831	4,823	4,815	4,808	4,800	4,792	4,785	4,777	4,769
63	4,762	4,754	4,747	4,739	4,732	4,724	4,717	4,710	4,702	4,695
64	4,687	4,680	4,673	4,666	4,658	4,651	4,644	4,637	4,630	4,622
65	4,615	4,608	4,601	4,594	4,587	4,580	4,573	4,566	4,559	4,552
66	4,546	4,539	4,532	4,525	4,518	4,511	4,504	4,498	4,491	4,484
67	4,477	4,471	4,464	4,458	4,451	4,444	4,438	4,431	4,425	4,418
68	4,412	4,405	4,399	4,392	4,386	4,380	4,373	4,367	4,360	4,354
69	4,348	4,342	4,335	4,329	4,323	4,316	4,310	4,304	4,298	4,292
70	4,286	4,279	4,273	4,267	4,261	4,255	4,249	4,243	4,237	4,231
71	4,225	4,219	4,213	4,207	4,202	4,196	4,190	4,184	4,178	4,172
72	4,167	4,161	4,155	4,149	4,144	4,138	4,132	4,126	4,121	4,115
73	4,110	4,104	4,098	4,093	4,087	4,081	4,076	4,071	4,065	4,060
74	4,054	4,048	4,043	4,038	4,032	4,027	4,021	4,016	4,011	4,005
75	4,000	3,995	3,989	3,984	3,979	3,973	3,968	3,963	3,958	3,952
76	3,947	3,942	3,937	3,932	3,927	3,922	3,916	3,911	3,906	3,901
77	3,896	3,891	3,886	3,881	3,876	3,871	3,866	3,861	3,856	3,851
78	3,846	3,841	3,836	3,831	3,826	3,822	3,817	3,812	3,807	3,802
79	3,797	3,793	3,788	3,783	3,778	3,774	3,769	3,764	3,759	3,754
80	3,750	3,745	3,741	3,736	3,731	3,727	3,722	3,718	3,713	3,708
81	3,704	3,699	3,694	3,690	3,685	3,681	3,676	3,672	3,667	3,663
82	3,658	3,654	3,649	3,645	3,641	3,636	3,632	3,628	3,623	3,619
83	3,614	3,610	3,606	3,601	3,597	3,593	3,589	3,584	3,580	3,576
84	3,571	3,567	3,563	3,559	3,554	3,550	3,546	3,542	3,538	3,534
85	3,529	3,525	3,521	3,517	3,513	3,509	3,505	3,501	3,496	3,492
86	3,488	3,484	3,480	3,476	3,472	3,468	3,464	3,460	3,456	3,452
87	3,448	3,444	3,440	3,436	3,433	3,429	3,425	3,421	3,417	3,413
88	3,409	3,405	3,401	3,397	3,394	3,390	3,386	3,382	3,378	3,375
89	3,371	3,367	3,363	3,359	3,356	3,352	3,348	3,344	3,341	3,337
90	3,333	3,330	3,326	3,322	3,319	3,315	3,311	3,307	3,304	3,300
91	3,297	3,293	3,289	3,286	3,282	3,279	3,275	3,271	3,268	3,264
92	3,261	3,257	3,254	3,250	3,247	3,244	3,240	3,236	3,233	3,229
93	3,226	3,222	3,219	3,215	3,212	3,208	3,205	3,202	3,198	3,195
94	3,191	3,188	3,185	3,181	3,178	3,175	3,171	3,168	3,165	3,161
95	3,158	3,154	3,151	3,148	3,145	3,141	3,138	3,135	3,131	3,128
96	3,125	3,122	3,118	3,115	3,112	3,109	3,106	3,102	3,099	3,096
97	3,093	3,090	3,086	3,083	3,080	3,077	3,074	3,070	3,067	3,064
98	3,061	3,058	3,055	3,052	3,049	3,046	3,043	3,040	3,036	3,033
99	3,030	3,027	3,024	3,021	3,018	3,015	3,012	3,009	3,006	3,003

Examples:

84·3 metres = 3,559 kc/s.
843 metres = 355·9 kc/s.
8·43 Mc/s = 35·59 metres.
8430 Mc/s = 3·559 cm.
8430 metres = 35·59 kc/s.

57·5 metres = 5·217 Mc/s.
575 kc/s = 521·7 metres.
5·75 Mc/s = 52·17 metres.
575 Mc/s = 52·17 cm.
57·5 kc/s = 5217 metres.

BROADCASTING ALLOCATIONS AND STATION FREQUENCIES

Broadcasting Allocations

Band	*Frequency*	*Wavelength*	*Area*
Long Waveband	150–285 kc/s.	2,000–1,053 m.	Region 1
Medium Waveband	525–1,605 kc/s.	571–187 m.	All Regions
120 m. band	2·300–2·498 Mc/s.	130·3–120 m.	Region 1. Regions 2 and 3, 2·300–2·495 Mc/s. only
90 m. band	3·200–3·400 Mc/s.	93·69–88·18 m.	All Regions
75 m. band	3·900–4·00 Mc/s.	76·9 –75·0 m.	Region 3. Region 1, 3·95–4·0 Mc/s. only. Region 2 excluded
60 m. band	4·75–5·60 Mc/s. (except 4·995–5·005 Mc/s.)	63·10–59·25 m. (except 60·05–59·95 m.)	All Regions
49 m. band	5·950– 6·200 Mc/s.	50·39–48·36 m.	All Regions
41 m. band	7·100– 7300 Mc/s.	42·23–41·07 m.	Regions 1 and 3 only
31 m. band	9·500– 9·775 Mc/s.	31·56–30·70 m.	All Regions
25 m. band	11·700–11·975 Mc/s.	25·63–25·0 m.	All Regions
19 m. band	15·10 –15·45 Mc/s.	19·86–19·40 m.	All Regions
16 m. band	17·70 –17·90 Mc/s.	16·49–16·75 m.	All Regions
13 m. band	21·45 –21·75 Mc/s.	14·00–13·79 m.	All Regions
11 m. band	25·60 –26·10 Mc/s.	11·71–11·49 m.	All Regions
Band I	41– 68 Mc/s.	7·3–4·4 m.	
Band II	87·5–100 Mc/s.	3·4–3 m.	
Band III	174–216 Mc/s.	1·7–1·4 m.	
Band IV	470–585 Mc/s.	64–51 cm.	
Band V	610–960 Mc/s.	49–31 cm.	

Region 1 roughly comprises Europe, Africa, the U.S.S.R. and Turkey.

Region 2 is the Western Hemisphere, comprising the Americas, Greenland and all countries under the control of the Federal Communications Commission of the United States.

Region 3 includes Australasia, Oceania and Asia, except for the territories included in Regions 1 and 2.

Band IV and Band V Channel Frequencies

Channel	*Frequency (Mc/s)*	*Channel*	*Frequency (Mc/s)*	*Channel*	*Frequency (Mc/s)*
Band IV		*Band V*		53	726–734
				54	734–742
21	470–478	39	614–622	55	742–750
22	478–486	40	622–630	56	750–758
23	486–494	41	630–638	57	758–766
24	494–502	42	638–646	58	766–774
25	502–510	43	646–654	59	774–782
26	510–518	44	654–662	60	782–790
27	518–526	45	662–670	61	790–798
28	526–534	46	670–678	62	798–806
29	534–542	47	678–686	63	806–814
30	542–550	48	686–694	64	814–822
31	550–558	49	694–702	65	822–830
32	558–566	50	702–710	66	830–838
33	566–574	51	710–718	67	838–846
34	574–582	52	718–726	68	846–854

B.B.C. V.H.F./F.M. Stations

Station	*Home (Mc/s.)*	*Programme*	*Light (Mc/s.)*	*Third, "Network Three" (Mc/s.)*	*E.R.P. (kW.)*
Channel Isles	97·1	W. of England	91·1	94·45	0·8 *
Divis (N. Ireland) . . .	94·5	N. Ireland	90·1	92·3	60
Douglas (Isle of Man) . . .	92·8	Northern	88·4	90·6	3·3 mean
Dover	94·4	London	90·0	92·4	0·5–6·5 *
Fort William	93·7	Scottish	89·3	91·5	1·5
Galashiels	93·5	Scottish	89·1	91·3	9·8 *
Holme Moss	93·7	Northern	89·3	91·5	120
Kirk o' Shotts	94·3	Scottish	89·9	92·1	120
Kinlochleven	94·1	Scottish	89·7	91·9	0·002
Llandonna (Anglesey) . . .	94·0	Welsh	89·6	91·8	3–12 *
Llandrindod Wells . . .	93·5	Welsh	89·1	91·3	1·4
Llangollen (N.E. Wales) . .	93·3	Welsh	88·9	91·1	5–11 *
Londonderry	92·7	N. Ireland	88·3	90·55	6 mean
Meldrum (N.E. Scotland) . .	93·1	Scottish	88·7	90·9	60
North Hessary Tor (S. Devon) .	92·5	W. of England	88·1	90·3	60
Oban	93·3	Scottish	88·9	91·1	1·5 *
Orkney	93·7	Scottish	89·3	91·5	3–20 *
Oxford	93·9	Midland	89·5	91·7	6–20 *
	95·85	W. of England			
Peterborough	94·5	Midland	90·1	92·3	1–21 *
Pontop Pike (Newcastle) . .	92·9	Northern	88·5	90·7	60
Rosemarkie (N. Scotland) . .	94·0	Scottish	89·6	91·8	3–12 *
Rowridge (Isle of Wight) . .	92·9	W. of England	88·5	90·7	60
Sandale (Carlisle) . . .	92·5	Scottish	88·1	90·3	120
	94·7	Northern			
Sutton Coldfield	92·7	Midland	88·3	90·5	120
Talconeston (Norwich)	94·1	Midland	89·7	91·9	120
Thrumster (Wick) . . .	94·5	Scottish	90·1	92·3	0·1–10 *
Wenvoe (S. Wales) . . .	92·125	W. of England	89·95	96·8	120
	94·3	Welsh			
West Cornwall	94·1	W. of England	89·7	91·9	4·2 max.*
West Wales (Blaen Plwyf) . .	93·1	Welsh	88·7	90·9	60
Wrotham (Kent)	93·5	London	89·1	91·3	120

All horizontally polarized.

Further stations to be completed by 1964 at: Barnstaple, Barrow, Bath, Brecon, Brighton, Cambridge, Carmarthen, Cheltenham, East Lincolnshire, Enniskillen, Forfar, Grantown-on-Spey, Hereford, Kendal, Larne, Lewis, Machynlleth, Newry, Northampton, Okehampton, Perth, Pitlochry, Rothesay, Scarborough, Sheffield, Shetland, S.W. Scotland.

B.B.C. L.W./M.W. Stations

Wave-length (metres)	*Station*	*Programme*	*Power (kW.)*	*Wave-length (metres)*	*Station*	*Programme*	*Power (kW.)*
1500	Droitwich	Light	400	247	Redmoss	Light	2
464	Daventry	Third	150	247	Redruth	Light	2
464	Edinburgh	Third	2	247	Newcastle	Light	2
464	Glasgow	Third	2	247	Plymouth	Light	0·25
464	Newcastle	Third	2	247	Londonderry	Light	0·25
464	Redmoss	Third	2	224	Lisnagarvey	N. Ireland	100
434	Moorside Edge	Northern	150	224	Londonderry	N. Ireland	0·25
434	Cromer	Northern	2	206	Clevedon	West	20
434	Whitehaven	Northern	2	206	Bartley	West	10
371	Westerglen	Scottish	100	206	Brighton	West	2
371	Burghead	Scottish	100	206	Bexhill	West	2
371	Redmoss	Scottish	5	206	Redruth	West	2
371	Dumfries	Scottish	2	206	Folkestone	West	1
341	Washford	Welsh	100	202	Barrow	Northern	2
341	Penmon	Welsh	8	202	Ramsgate	London	2
341	Towyn	Welsh	5	194	Belfast	Third	1
341	Wrexham	Welsh	2	194	Bournemouth	Third	1
330	Brookmans Park	London	140	194	Fareham	Third	1
285	Start Point	West	120	194	Leeds	Third	1
285	Barnstaple	West	2	194	Liverpool	Third	1
276	Droitwich	Midland	150	194	Preston	Third	1
276	Postwick	Midland	7·5	194	Plymouth	Third	1
261	Stagshaw	Northern	100	194	Redruth	Third	1
261	Scarborough	Northern	2	194	Stockton	Third	0·25–1
247	Moorside Edge	Light	50	194	Swansea	Third	0·25–1
247	Brookmans Park	Light	50	194	Brighton	Third	0·25
247	Westerglen	Light	50	194	Dundee	Third	0·25
247	Burghead	Light	20	194	Exeter	Third	0·25
247	Lisnagarvey	Light	10				

Major European Broadcasting Stations

Wavelength (metres)	*Frequency (kc/s)*	*Station or Programme*	*Country*
1,987	151	Moscow I	U.S.S.R.
1,987	151	Hamburg	Germany
1,935	155	Brasov	Roumania
1,935	155	Tromso	Norway
1,829	164	Paris Inter. (Allouis)	France
1,734	173	Moscow I	U.S.S.R.
1,734	173	V.O.A. (Munich)	Germany
1,648	182	Europe I (Saar)	Germany
1,622	185	Deutschlandsender	Germany (G.D.R.)
1,571	191	Motala	Sweden
1,500	200	Droitwich	U.K.
1,435	209	Kiev I	U.S.S.R.
1,376	218	Oslo	Norway
1,322	227	Warsaw I	Poland
1,287	233	Luxembourg I	Luxembourg
1,271	236	Leningrad I	U.S.S.R.
1,224	245	Kalundborg I	Denmark
1,181	254	Lahti	Finland
1,141	263	Moscow II	U.S.S.R.
1,103	272	Prague II	Czechoslovakia
1,068	281	Minsk I	Bielorussia
567	529	Beromunster	Switzerland
557	539	Budapest	Hungary
547	548	A.F.N. (Munich)	Germany
547	548	Moscow II	U.S.S.R.
539	557	Helsinki I	Finland
539	557	Monte Ceneri	Switzerland
530	566	Athlone	Eire
522	575	Leipzig	Germany (G.D.R.)
522	575	Stuttgart	Germany
522	575	Riga	Latvia
514	584	Vienna II	Austria
514	584	Madrid	Spain
506	593	Sundsvall	Sweden
506	593	Frankfurt	Germany
498	602	Regional (Lyons)	France
491	611	Berlin Rundfunk I	Germany (G.D.R.)
484	620	Brussels National	Belgium
477	629	Vigra	Norway
470	638	Prague I	Czechoslovakia
464	647	Third Programme and Network Three	U.K.
457	656	Naples I, etc.	Italy
451	665	Vilnus	Lithuania
451	665	Lisbon I	Portugal
451	665	A.F.N. (Kaiserslautern)	Germany
445	674	Regional (Marseilles I)	France
439	683	Belgrade I	Yugoslavia
439	683	Berlin (R.I.A.S.)	Germany
434	692	Northern	U.K.
422	710	Regional (Rennes I)	France
417	719	" Free Europe " (Munich)	Germany
417	719	Ostersund	Sweden
412	728	Athens	Greece
412	728	Berlin I	Germany (G.D.R.)
407	737	Poznan	Poland
402	746	Hilversum I	Holland

Wavelength (metres)	*Frequency (kc/s)*	*Station or Programme*	*Country*
397	755	Lisbon II	Portugal
393	764	Sottens	Switzerland
388	773	Stockholm	Sweden
388	773	Linz	Austria
384	782	Deutschlandsender	Germany (G.D.R.)
379	791	Regional (Limoges)	France
375	800	Leningrad II	U.S.S.R.
375	800	Munich	Germany
371	809	Scottish	U.K.
367	818	Warsaw II	Poland
367	818	Andorradio	Andorra
363	827	Freiburg	Germany
363	827	Sofia I	Bulgaria
359	836	Regional (Nancy)	France
355	845	Rome II	Italy
351	854	Bucharest I	Roumania
348	863	Regional (Paris I)	France
344	872	Moscow III	U.S.S.R.
344	872	A.F.N. (Frankfurt)	Germany
341	881	Welsh	U.K.
334	899	Milan I	Italy
330	908	London	U.K.
327	917	Ljubljana	Yugoslavia
324	926	Brussels National	Belgium
321	935	Lwow	U.S.S.R.
318	944	Regional (Toulouse)	France
315	953	Prague I	Czechoslovakia
312	962	Turku I	Finland
309	971	N.W.D.R. Network	Germany
306	980	Göteborg	Sweden
303	989	Berlin (R.I.A.S.)	Germany
301	998	Andorra	Andorra
298	1,007	Hilversum II	Holland
295	1,016	Rheinsender	Germany
295	1,016	Madrid	Spain
293	1,025	Graz-Dobl	Austria
288	1,043	Dresden	Germany (G.D.R.)
285	1,052	West	U.K.
283	1,061	Kalundborg II	Denmark
280	1,070	National (Paris II)	France
278	1,079	Katowice	Poland
276	1,088	Midland	U.K.
274	1,097	Bratislava	Czechoslovakia
271	1,106	A.F.N. (Stuttgart)	Germany
269	1,115	Bari II, etc.	Italy
267	1,124	Brussels Regional	Belgium
265	1,133	Zagreb	Yugoslavia
261	1,151	Northern	U.K.
259	1,160	Regional (Strasbourg)	France
257	1,169	Kiev	U.S.S.R.
255	1,178	Hörby	Sweden
253	1,187	Petöfi I	Hungary
251	1,196	V.O.A. (Munich)	Germany
249	1,205	Regional (Bordeaux I)	France
249	1,205	Poznan	Poland
247	1,214	Light Programme	U.K.
245	1,223	Falun	Sweden
244	1,232	Bratislava	Czechoslovakia
242	1,241	National Network	France

Wavelength (metres)	*Frequency (kc/s)*	*Station or Programme*	*Country*
240	1,250	Dublin, etc.	Eire
238	1,259	Stettin	Poland
235	1,277	National (Strasbourg)	France
233	1,286	Prague II	Czechoslovakia
232	1,295	Crowborough (European Service)	U.K.
228	1,313	Stravanger	Norway
227	1,322	Leipzig (Relays Moscow)	Germany (G.D.R.)
225	1,331	Rome I, etc.	Italy
224	1,340	Northern Ireland	U.K.
223	1,349	National Network	France
218	1,376	Regional (Lille)	France
213	1,403	Regional Network	France
211	1,421	Saarbrücken	Germany
210	1,430	Skive, etc.	Denmark
208	1,439	Luxembourg	Luxembourg
207	1,448	Turin II, etc.	Italy
206	1,457	West	U.K.
205	1,466	Monte Carlo	Monaco
203	1,475	Vienna	Austria
202	1,484	International Common Frequency	—
201	1,493	Paris Inter Network	France
199	1,511	Brussels Regional	Belgium
196	1,529	Vatican City	Vatican
195	1,538	Ravensburg, etc.	Germany
194	1,546	Third Programme	U.K.
193	1,554	Paris Inter (Nice)	France
189	1,586	Oldenburg, etc.	Germany
188	1,594	International Common Frequency	—
187	1,602	Nuremburg, etc.	Germany

I.T.A. Television Stations

Channel	*Vision (Mc/s.)*	*Sound (Mc/s.)*	*Station*	*Aerial Polarisation*	*Vision E.R.P. (kW.)*	*Notes*
6	179·75	176·25	—			
7	184·75	181·25	—			
8	189·75	186·25	Lichfield (Midlands)	Vertical	150–475*	
			Burnhope (N.E. England)	Horizontal	100*	
			Strabane (N. Ireland)	Vertical	100*	
			Presely (W. and N. Wales)	Horizontal	5–100*	
9	194·75	191·25	Croydon (London)	Vertical	400*	
			Winter Hill (Lancashire)	Vertical	100	
			Black Mountain (N. Ireland)	Horizontal	100*	
			Stockland Hill (S.W. England)	Vertical	100*	
			Durris (N.E. Scotland)	Horizontal	15–400*	
			Fremont Point (Channel Isles)	Horizontal	10*	
10	199·75	196·25	Emley Moor (Yorkshire)	Vertical	200	
			Black Hill (S. Scotland)	Vertical	150–475*	
			St. Hilary (S. Wales)	Vertical	200	
			Dover	Vertical	100*	
			Arfon (W. and N. Wales)	Horizontal	2·5–10*	
11	204·75	201·25	Chillerton Down (Isle of Wight)	Vertical	100	
			Mendlesham (East Anglia)	Horizontal	200	
			Caldbeck (Carlisle area)	Horizontal	100*	
			Moel-y-Parc (W. and N. Wales)	Vertical	25*	
12	209·75		Caradon Hill (S.W. England)	Vertical	200*	
		206·25	Mounteagle	Horizontal	10–50*	
13	214·75	211·25	Selkirk	Vertical	25*	

* Directional aerial, E.R.P. in optimum direction.

Stations have also been announced for: Isle of Man; Bedford; Oxford/Swindon; Hereford/Gloucester; Grimsby/Boston/Skegness; Scarborough/Bridlington.

B.B.C. Television Stations

Channel	Vision (Mc/s.)	Sound (Mc/s.)	Station	Aerial Polarisation	Vision E.R.P. (kW.)	Notes
1	45	41·5	Crystal Palace	Vertical	200	
			Divis (Belfast)	Horizontal	12	
			Thrumster (Wick)	Vertical	0·25–7*	
			Sheffield	Horizontal	0·05	
			Galashiels (Ashkirk)	Vertical	7·1 *	
			Kinlochleven	Vertical	0·005*	
			Llandrindod Wells	Horizontal	1·3	
			Redruth	Horizontal	10·3 *	
			Llanddona	Vertical	5·7 *	
			Skegness	Horizontal	0·059	
2	51·75	48·25	Holme Moss	Vertical	100	
			North Hessary Tor (S. Devon)	Vertical	1·5–15*	
			Rosemarkie (N. Scotland)	Horizontal	3*	
			Londonderry	Horizontal	0·5–1·5*	
			Dover	Vertical	1·4*	
			Whitehawk Hill (Brighton)	Vertical	0·04–0·4*	
			Ballachulish	Vertical	0·09*	
			Oxford	Horizontal	0·7*	
3	56·75	53·25	Kirk o' Shotts (S. Scotland)	Vertical	100	
			Rowridge (Isle of Wight)	Vertical	100*	
			Tacolneston (Norwich)	Horizontal	2–40*	
			Blaen Plwyf (W. Wales)	Horizontal	1–3*	
			Morecambe Bay	Horizontal	5·3*	
			Swindon	Horizontal	0·17 *	
4	61·75	58·25	Sutton Coldfield	Vertical	100	
			Meldrum (Aberdeen)	Horizontal	4–17*	
			Sandale (Carlisle)	Horizontal	10–28	
			Les Platons (Channel Islands)	Horizontal	1·0	
			Folkestone	Horizontal	0·007 max.*	
			Hastings	Horizontal	0·002–0·01*	
			Manningtree	Horizontal	4·5 *	
			Oban	Vertical	1·6 *	
			Haverford West	Horizontal	4·3 *	
5	66·75	63·25	Wenvoe (Cardiff)	Vertical	100	
			Pontop Pike (Newcastle)	Horizontal	12	
			Douglas (Isle of Man)	Vertical	0·18–2·8 *	
			Orkney	Vertical	4–14*	
			Morborne Hill (Peterborough)	Horizontal	1·0	
			Fort William	Horizontal	1·6	
			Enniskillen	Vertical	3·4 *	

* Directional aerial (power in maximum direction).

Crystal Palace experimental U.H.F. 625-line tests on Channels 44, 34. Channels assigned to London (Stockholm Plan) are 23, 26, 30 and 33.

Plans have been announced for further 405-line stations—mostly low-power relays—to be completed by 1964 at: Barnstaple, Bath, Bedford, Bexhill, Blackpool, Brougham (N. Ireland), Cambridge, Carmarthen, Canterbury, Cheltenham, Dundee, Eastbourne, Forfar, Grantown-on-Spey, Grimsby, Hereford, Kendal, Larne (N. Ireland), Machynlleth, Newry (N. Ireland), Northampton, Okehampton, Perth, Pitlochry, Rothesay, Scarborough, Shetland, Skye, Ventnor, Weardale and Woofferton.

Irish Television Network

(*Telefis Eireann*)

Station	Vision (Mc/s.)	Sound (Mc/s.)	System	Aerial Polarization	Vision E.R.P. (kW.) ‡
Kippure (Dublin)	184·74325	181·23	405-lines *	Horizontal	100
Truskmore (Sligo)	204·75	201·25	405-lines *	Vertical	100
Maghera (Gort)	53·75	59·75	625-lines †	Horizontal	100
Mullaghanish (Cork)	175·30	181·30	625-lines †	Vertical	100
Mt. Leinster (Kilkenny)	191·211	197·211	625-lines †	Vertical	100
Kippure (Dublin)	207·25	213·25	625-lines †	Horizontal	100
Truskmore (Sligo)	215·25	221·25	625-lines †	Vertical	100

* Channel width 5 Mc/s., Video bandwidth 3 Mc/s., Vision positive modulation, Sound amplitude modulation.
† Channel width 8 Mc/s., Video bandwidth 5·5 Mc/s., Vision negative modulation, Sound frequency modulation.
‡ In direction of maximum radiation.

TELEVISION STANDARDS

Details of British 625-Line U.H.F. Transmissions

Channel bandwidth	8 Mc/s
Band IV, Channels 21–34	470–582 Mc/s
Band V, Channels 39–68	614–854 Mc/s
Vision carrier frequency	x * + 1·25 Mc/s
Sound carrier frequency	x * + 7·25 Mc/s
Video bandwidth	5·5 Mc/s
Vision modulation	A.M. negative
Sound modulation	F.M. (peak deviation 50 kc/s pre-emphasis 50 μsec)
Sound carrier relative to vision carrier (intercarrier frequency)	+ 6 Mc/s
Horizontal line frequency	15,625 c/s
Field (frame) frequency	50 c/s
Interlace	2 : 1
Aspect ratio	4 : 3
Blanking and black level	72·5–77·5%
Peak white level	10–12·5%
Synchronising level	100%

* Where x is lower edge of channel.

Comparison of Television Standards

Standard	*British 405-Line*	*British 625-Line*	*American (F.C.C.)*	*European (C.C.I.R.)*
Total width of channel	5 Mc/s	8 Mc/s	6 Mc/s	7 Mc/s
Number of lines	405	625	525	625
Interlacing	2 : 1	2 : 1	2 : 1	2 : 1
Number of lines per second	10,125	15,625	15,750	15,625
Number of pictures (frames) per second	25	25	30	25
Number of frames (fields *) per picture (frame)	2	2	2	2
Number of frames (fields *) per second	50	50	60	50
Modulation	A.M. positive	A.M. negative	A.M. negative	A.M. negative
Black level	30% peak	75% peak	75% peak	75% peak
Aspect ratio	4 : 3	4 : 3	4 : 3	4 : 3
Carrier	Upper sideband suppressed	Lower sideband suppressed	Lower sideband suppressed	Lower sideband suppressed
Approx. width of video channel	3 Mc/s	5·5 Mc/s	4 Mc/s	5 Mc/s
Aerial polarisation	Vertical (main) Horizontal (subsidiary)	Horizontal	Horizontal	Usually horizontal
Sound carrier	3·5 Mc/s below vision carrier	6 Mc/s above vision carrier	4·5 Mc/s above vision carrier	5·5 Mc/s above vision carrier
Sound modulation	A.M.	F.M.	F.M.	F.M.
F.M. deviation (max.)	—	±50 kc/s	±25 kc/s	±50 kc/s
F.M. pre-emphasis	—	50 μsec	75 μsec	50 μsec

* American terminology.

Notes. Other standards include: (1) 819 lines, 13·15 Mc/s channel width, positive video modulation, A.M. sound (used by some stations in France); (2) 625 and 819 lines, both 7 Mc/s channel width, positive video modulation, A.M. sound (used by some stations in Belgium); (3) 625 lines, 8 Mc/s channel width with 6·5 Mc/s separation between sound and vision carriers, negative video modulation, F.M. sound (used by Eastern European O.I.R.T. countries).

SYMBOLS

Symbols for Practical Electrical and Radio Engineering Units

Ampere	A	Watt-hour	Wh
Volt	V	Volt-ampere	VA
Ohm	Ω	Volt-ampere reactive	VAr
Coulomb	C	Ampere-hour	Ah
Joule	J	Cycles per sec.	c/s
Watt	W	Kilocycles per sec.	kc/s
Farad	F	Megacycles per sec.	Mc/s
Henry	H	Gigacycles per sec.	Gc/s

Abbreviated prefixes have the following meanings:

milli- m	= 1/1,000	($\times 10^{-3}$)
giga-G	= 1,000,000,000	($\times 10^{9}$)
tera-T	= 1,000,000,000,000	($\times 10^{12}$)
nano-n	= 1/1,000,000,000	($\times 10^{-9}$)
micro- μ	= 1/1,000,000	($\times 10^{-6}$)
pico- $\mu\mu$ or p	= 1/1,000,000,000,000	($\times 10^{-12}$)
kilo- k	= 1,000	($\times 10^{3}$)
mega- M	= 1,000,000	($\times 10^{6}$)

Examples

Milliampere	mA	Picofarad	$\mu\mu$F or pF
Microampere	μA	Microvolt	μV
Kilovolt-ampere	kVA	Millivolt	mV
Millifarad	mF	Kilovolt	kV
Microfarad	μF	Megavolt	MV
Nanofarad	nF	Gigacycles per sec.	Gc/s

Symbols for Electrodes

Anode	a
Cathode	k
Grid	g
Heater	h
Filament	f
Beam Plates	bp
Fluorescent Screen or Target	t
External Metallisation	M
Internal Metallisation	m
Deflector Electrodes	x or y
Internal Shield	s
Resonator	Res

Note 1. In valves having more than one grid, the grids are distinguished by numbers g_1, g_2, etc., g_1 being the grid nearest the cathode.

Note 2. In multiple valves electrodes of the different sections may be distinguished by adding one of the following letters:

Diode	d	Hexode, Heptode, Octode	h
Triode	t	Rectifier	r
Tetrode	q		
Pentode	p		

Thus the grid of the triode section of a triode-hexode is denoted by g_t.

Note 3. Two or more similar electrodes which cannot be distinguished by any of the above means may be denoted by adding one or more primes to indicate which electrode system the electrode forms part of.

Thus, the anode of the first diode in a double diode valve is denoted a′.

Semiconductor Symbols

b	base	I_{CBO}, etc.	collector-base leakage current
BV_{CBO}	collector-base breakdown voltage	I_e, etc.	total emitter current
BV_{EBO}	emitter-base breakdown voltage	I_f	d.c. forward current
c	collector	I_R	d.c. reverse current
CB	common-base configuration	n-type	semiconductor with donor impurity
C_{cb}, etc.	inter-element capacitance, collector-base etc.	n–p–n, etc.	transistor with two n-type and one p-type elements
CC	common-collector configuration	p-type	semiconductor with acceptor impurity
CE	common-emitter configuration	P_c, etc.	maximum collector dissipation, etc.
C_{ib}, etc.	common-base reverse-bias input capacitance	P_{tot}	total device dissipation
C_{ob}, etc.	common-base output capacitance	rbb′	extrinsic base resistance
e	emitter	T_{amb}	ambient temperature
f_α	alpha cut-off frequency	T_C	case temperature
$f_{\alpha b}$, etc.	common-base alpha cut-off frequency	T_J	junction temperature
f_{max}	maximum frequency of operation	V_c, etc.	collector voltage, etc.
f_T	frequency at which $\|h_{fe}\|$ is unity	V_{cb}, etc.	collector-base voltage, etc.
h	hybrid. For hybrid abbreviations see separate list	V_{eb}, etc.	reverse base-emitter voltage, etc.
h_{fe}	static small signal current gain (β)	α	common-base current gain
h_{FE}	static large signal current gain	β	common-emitter current gain
		γ	emitter efficiency
		θ	thermal resistance between junction and case
		μ_{re}, etc.	see hybrid parameters

Hybrid Parameter Symbols

There is a wide variety of curves and slopes which can be specified for any one transistor, but only four values are necessary to define its operation: these four are of mixed dimensions and are known as the hybrid or " h " parameters. However, different symbols are used by different manufacturers. The final subscript, however, always indicates the " common " terminal.

(1) Variation of input current with input voltage (v_1/i_1). This is the input impedance with output short-circuited, and its value is in ohms.

	h_{ie},	h_{ib},	h_{ic}
or	$h_{11}e$,	$h_{11}b$,	$h_{11}c$
or	$1/r_{11}e$,	$1/r_{11}b$,	$1/r_{11}c$

(2) Variation of output current with input current (i_2/i_1). This is the current gain with output short-circuited, and is a pure number.

$$h_{fe}, \quad h_{fb}, \quad h_{fc}$$
$$\text{or} \quad \alpha_{fe}, \quad \alpha_{fb}, \quad \alpha_{fc}$$
$$\text{or} \quad h_{21}e, \quad h_{21}b, \quad h_{21}c$$

(3) Variation of output voltage with output current (i_2/v_2). This is the output admittance with input open-circuited, and its value is in mhos.

$$h_{oe}, \quad h_{ob}, \quad h_{oc}$$
$$\text{or} \quad h_{22}e, \quad h_{22}b, \quad h_{22}c$$

(4) Variation of output voltage with input voltage (v_1/v_2). This is the voltage feedback ratio with input open-circuited, and is a pure number.

$$h_{re}, \quad h_{rb}, \quad h_{rc}$$
$$\text{or} \quad \mu_{re}, \quad \mu_{rb}, \quad \mu_{rc}$$
$$\text{or} \quad h_{12}e, \quad h_{12}b, \quad h_{12}c$$

Symbols for Electric Magnitudes

Voltages

Direct voltage	V
Alternating voltage (r.m.s.)	$V_{r.m.s.}$
Alternating voltage (mean)	V_{av}
Alternating voltage (peak)	V_{pk}
Peak Inverse voltage	P.I.V.

Current

Direct current	I
Alternating current (r.m.s.)	$I_{r.m.s.}$
Alternating current (mean)	I_{av}
Alternating current (peak)	I_{pk}
No Signal current	I_0

Miscellaneous

Frequency	f
Amplification Factor	μ
Mutual Conductance	g_m
Conversion Conductance	g_c
Distortion	D
Anode Efficiency	η
Sensitivity	S
Brightness	B
Temperature	T
Time	t

	Inside Valve	*Outside Valve*
Resistance	r	R
Reactance	x	X
Impedance	z	Z
Admittance	y	Y
Mutual Inductance	m	M
Capacitance	c	C
Capacitance at working temperature	c_w	—
Power	p	P

Auxiliary Symbols

Battery or other source of supply	b
Inverse (voltage or current)	inv
Ignition (voltage)	ign
Extinction (voltage)	ext
No signal	o
Input	in
Output	out
Total	tot
Centre tap	ct

Complex Symbols

Anode voltage	V_a
Control-grid voltage	V_{g1}
Anode supply voltage	$V_{a(b)}$
Filament voltage	V_f
Heater voltage	V_h
Anode dissipation	p_a
Output power	P_{out}
Drive power	P_{drive}
Anode current (d.c.)	I_a
Anode current (a.c.r.m.s.)	$I_{a(r.m.s.)}$
No signal anode current	$I_{a(o)}$
Control-grid current	I_{g1}
Total distortion	D_{tot}
3rd-harmonic distortion	D_3
Equivalent noise resistance	R_{eq}
Limiting resistor	R_{lim}
Cathode bias resistor	R_k

	Internal	*External*
Anode resistance	r_a	R_a
Insulating resistance (heater to cathode)	r_{h-k}	
Resistance between control-grid and cathode	r_{g1-k}	R_{g1-k}
Capacitance (cold):		
Anode to all other electrodes	c_{a-all}	
Anode to control-grid	C_{a-g1}	
Control grid to cathode at working temperature	$c_{g1-k(w)}$	
Control-grid to all other electrodes except anode (input capacitance)	c_{in}	
Anode to all other electrodes except control-grid (output capacitance)	c_{out}	
Inner amplification factor	μ_{g1-g2}	

Nomenclature of Radio Waves

Below 30 kc/s	Very low frequency (V.L.F.)	Myriametric waves	Above 10,000 m.
30–300 kc/s	Low frequency (L.F.)	Kilometric waves	10,000–1,000 m.
300–3,000 kc/s	Medium frequency (M.F.)	Hectometric waves	1,000–100 m.
3–30 Mc/s	High frequency (H.F.)	Decametric waves	100–10 m.
30–300 Mc/s	Very high frequency (V.H.F.)	Metric waves	10–1 m.
300–3,000 Mc/s	Ultra-high frequency (U.H.F.)	Decimetric waves	100–10 cm.
3–30 Gc/s	Super-high frequency (S.H.F.)	Centimetric waves	10–1 cm.
30–300 Gc/s	Extremely high frequency (E.H.F.)	Millimetric waves	10–1 mm.
300–3,000 Gc/s	—	Decimillimetric waves	1–0·1 mm.

Symbols Used in the Classification of Emissions

According to the International Radio Regulations (Geneva), emissions should be designated according to:

(1) Type of modulation.
(2) Type of transmission.
(3) Supplementary characteristics.

(1) *Types of Modulation*

A	Amplitude
F	Frequency or Phase
P	Pulse

(2) *Types of Transmission*

Absence of any modulation intended to carry information	0
Telegraphy without use of a modulating audio frequency	1
Telegraphy by the on–off keying of a modulating audio frequency or audio frequencies, or by the on–off keying of the modulated emission (special case: an unkeyed modulated emission)	2
Telephony (including sound broadcasting)	3
Facsimile (with modulation of main carrier either directly or by a frequency-modulated sub-carrier)	4
Television (vision only)	5
Four-frequency diplex telegraphy	6
Multichannel voice-frequency telegraphy	7
Cases not covered by the above	9

(3) *Supplementary Characteristics*

Double sideband	(none)
Single sideband:	
Reduced carrier	A
Full carrier	H
Suppressed carrier	J
Two independent sidebands	B
Vestigial sidebands	C
Pulse:	
Amplitude modulated	D
Width (or duration) modulated	E
Phase (or position) modulated	F
Code modulated	G

For the full designation, the group given by the above coding systems should be prefixed by a number indicating the width in kc/s of the total frequency band occupied by the emission.

Examples

Twenty-five-word-per-minute telegraphy (no tone modulation)	0·1A1
Amplitude-modulated telephony (max. freq. 3,000 c/s)	6A3
Frequency-modulated telephony (max. freq. 3,000 c/s, 20,000 c/s deviation)	46F3
Television, 625 lines: video bandwidth 5 Mc/s, total vision bandwidth 6·25 Mc/s, F.M. sound bandwidth including guard bands 0·75 Mc/s, total bandwidth 7 Mc/s	6,2500A5C 750F3

Mathematical Symbols

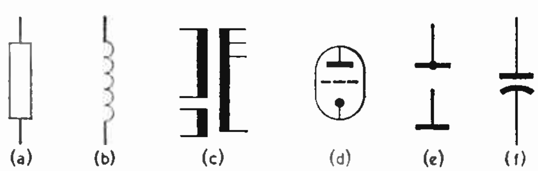
Term	*Symbol or Abbreviation*
Antilogarithm	antilog
Approaches limit	$\rightarrow$
Approximately equal to	$\simeq$
Base of natural logarithms	e
Because	$\because$
Brackets	[{( )}]
Co-ordinates, Cartesian	x, y, z
Co-ordinates, Polar	r, θ, ϕ
Cosecant	cosec
Cosine	cos
Cotangent	cot
Decimal point	· (middle point)
Differential coefficient of y with respect to x	$\frac{dy}{dx}$ or dy/dx
Differential coefficient, nth	$\frac{d^ny}{dx^n}$ or d^ny/dx^n
Differential coefficient, Partial	$\frac{\partial y}{\partial x}$ or $\partial y/\partial x$
Divided by	$\div$ or /
Equal to	$=$
Equal to or greater than	$\geqslant$
Equal to or less than	$\leqslant$
Factorial	! or $\lfloor$
Function	$f(\ )$, $F(\ )$, etc.
Gamma function	Γ
Greater than	$>$
Hyperbolic sine (and similarly for other hyperbolic functions)	sinh
Identical with	$\equiv$
Increment	δ or $\triangle$
Infinity	∞
Integration	$\int$
Inverse sine (and similarly for other functions)	$\sin^{-1}$ or arc sin
Less than	$<$
Logarithm of x to base 10	$\log x$ or $\log_{10} x$
Logarithm of x to base e	$\log_e x$
Magnitude of	$\|\ldots\|$
Minus	$-$
Much greater than	$\gg$
Much less than	$\ll$
Multiplied by	$\times$ or . (low point)
Not equal to	$\neq$
Not greater than	$\ngtr$
Not less than	$\nless$
nth root	$\sqrt[n]{\ }$
Operator $\frac{\partial}{\partial x}$	D
Operator $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}\right)$	∇^2
Parallel	$\parallel$
Perpendicular	$\perp$
Plus	$+$
Plus or minus	$\pm$
Ratio of circumference to diameter of circle	π
Root mean square	r.m.s.
Secant	sec
Sine	sin

Term	*Symbol or Abbreviation*
Square root	$\sqrt{}$
Square root of minus one	i or j (Symbol j preferred in electrical engineering)
Summation	Σ
Tangent	tan
Therefore	$\therefore$
Varies as	$\propto$
Versine	versin

Symbols for Quantities Used in Electrical and Radio Engineering

Acceleration due to gravity	g
Admittance	Y
Aerial current	I_{ae}
Aerial resistance	R_{ae}
Aerial radiation resistance	R_r
Amplification factor (amplifier)	m
Amplification factor (valve)	μ
Angles	θ, ϕ, ψ
Angular velocity	ω
Anode A.C. resistance	r_a
Anode D.C. resistance	R_a
Anode current	I_a or i_a
Capacitance	C
Conductance	G
Coupling coefficient	k
Current	I
Decay coefficient	a
Effective height	h_e
Efficiency	η
Electric force	ξ
Electromotive force (e.m.f.)	E
Electrostatic flux	Ψ
Energy	W
Flux density (electrostatic)	D
Flux density (magnetic)	B
Form factor	K
Frequency	f
Fundamental frequency	f_1
Fundamental wavelength	λ_1
Grid A.C. resistance	r_g
Grid D.C. resistance	R_g
Grid current	I_g or i_g
Grid voltage	E_g or e_g
Impedance	Z
Intensity of magnetisation	J
Magnetic field strength	H
Magnetic flux	Φ
Magnetic flux density	B
Magnetomotive force (m.m.f.)	F
Mutual inductance	M
Natural frequency	f_0
Natural wavelength	λ_0
Period or periodic time	T
Permeability	μ
Permittivity (dielectric constant)	ϵ or k
Phase difference	ϕ
Potential difference, electric (p.d.)	V
Power	P
Power factor	cos ϕ
Quantity of electricity	Q
Radiation efficiency	η_r
Reactance	X
Reluctance	S
Resistance	R
Resistivity	ρ
Revolutions per unit of time	n
Self-inductance	L
Susceptance	B or b
Temperature	t or θ
Temperature (absolute)	T
Wavelength	λ
Wave velocity	v

Common Continental and U.S. Circuit Symbols



(a) *Fixed resistor.* (b) *Coils (note absence of loops).* (c) *Iron-cored transformers.* (d) *Valve (note cathode).* (e) *Connections to chassis (the full chassis line is often omitted).* (f) *U.S. fixed capacitor—curved line indicating connection of outer (earthy) foil.*

Fundamental and Mechanical Units

Quantity	*Symbol*	*Defining Equation*	*British Units*	*Metric Units (c.g.s.)*	*Metric Units (m.k.s.)*	*Conversion*
Length	l	Fundamental	Foot (ft.) Inch (in.)	Centimetre (cm.)	Metre (m.)	1 ft. = 30·48 cm.; 1 in. = 2·54 cm.; 1 m. = 100 cm.
Mass	m	Fundamental	Pound (lb.)	Gram (g.)	Kilogram (kg.)	1 lb. = 453·6 g. = 0·4536 kg.; 1 kg. = 2·205 lb.
Time	t		Minute (min.) Second (sec.)	Second (sec.)	Second (sec.)	1 min. = 60 sec.
Area	a	$a = l_1 l_2$	Square foot (sq. ft.) Square inch (sq. in.)	Square centimetre (cm.^{2})	Square metre (m.^{2})	1 sq. ft. = 929·03 cm.^{2} = 0·0929 m.^{2} 1 sq. in. = 6·45 cm.^{2}; 1 m.^{2} = 10,000 cm.^{2}
Volume	U	$U = l_1 l_2 l_3$	Cubic foot (cu. ft.) Cubic inch (cu. in.)	Cubic centimetre (cm.^{3})	Cubic metre (m.^{2})	1 cu. ft. = 28,317 cm.^{3} = 0·02832 m.^{3} 1 cu. in. = 16·39 cm.^{3}
Angle	α	$\alpha = l_1/l_2$	Degree (°) Minute (′) Second (″)	Radian (rad.) Degree (°) Minute (′) Second (″)	Radian (rad.) Degree (°) Minute (′) Second (″)	1 rad. = 57° 17′ 45″ = 57·296° 1° = 60′ 1′ = 60″
Velocity (linear)	u	$u = \frac{dl}{dt}$	Feet per minute Feet per second	Centimetres per second (cm. per sec.)	Metres per second (m. per sec.)	1 ft. per min. = 0·508 cm. per sec. 1 ft. per sec. = 30·48 cm. per sec. = 0·3048 m. per sec.
Velocity (angular)	ω	$\omega = \frac{d\alpha}{dt}$	Revolutions per second	Radians per second (rad. per sec.)	Radians per second (rad. per sec.)	1 rev. per sec. = 2π rad. per sec.
Acceleration	a	$a = \frac{du}{dt}$	Feet per second per second	Centimetres per second per second (cm. per sec. per sec.)	Metres per second per second (m. per sec. per sec.)	1 ft. per sec. per sec. = 30·48 cm. per sec. per sec. = 0·3048 m. per sec. per sec.
Force		$f = ma$	Pound force	Dyne	Newton or Joule per metre	1 lb. force = 4·448 × 10^5 dynes = 4·448 newtons 1 newton = 10^5 dynes
Torque	M	$M = \frac{W}{\alpha}$	Pound-foot	Dyne-centimetre	Newton-metre	1 lb.-ft. = 1·357 × 10^7 dyne-cm. = 1·357 newton-m.
Energy	W	$W = fut$	Foot-pound	Erg or centimetre-dyne	Joule or Metre-newton	1 J = 10^7 ergs; 1 ft.-lb. = 1·357 × 10^7 ergs = 1·357 J.
Power	P	$P = fa$ $= W/t$	Foot-pound per minute	Erg per sec.	Joule per sec. or Watt (J. per sec., W.)	1 ft.-lb. per min. = 0·0226 W; 1 W. = 10^7 ergs per sec.
Temperature	θ	—	Degree Fahrenheit (° F.)	Degree Centigrade (° C.)	Degree Centigrade (° C.)	1° F. = 5/9° C.; 0° C. = 32° F. on scale

ABBREVIATIONS

A	ampere
a	anode
A1, 2 etc.	types of emission
a.c.	alternating current
ACR	approach control radar
a.d.f.	automatic direction finder
AEW	airborne early warning radar
a.f.	audio frequency
a.f.c.	automatic frequency control
a.g.c.	automatic gain control
AGL	automatic gun-laying radar
Ah	ampere-hour
a.m.	amplitude modulation
a.m.c.	automatic modulation control
amp.	ampere
a.n.l.	automatic noise limiter
ant.	antenna (aerial)
a.p.c.	automatic picture control; automatic phase control
ASMI	airfield surface movement indicator
ASR	air surveillance radar
ASV	air-to-surface vehicle radar
AT	ampere-turn
ATR	anti-transmit/receive switch
a.t.u.	aerial tuning unit
a.v.c.	automatic volume control; automatic vision control
b	base
b.a.	buffer amplifier
BABS	beam approach beacon system
b.c.	bayonet cap
B. & S.	Browne and Sharpe wire gauge (American)
b.f.o.	beat frequency oscillator
b.p.	bandpass filter; beam plates
B.S.	British Standard Specification
C	capacitor
c	collector
CCIF	International Telephone Consultative Committee
CCIR	International Radio Consultative Committee
C.C.S.	continuous commercial service rating
C.C.U.	chart comparison unit
c.f.	cathode follower
c.g.s.	centimetre-gramme-second system of units
ckt	circuit
c.o.	crystal oscillator
coax.	coaxial cable
CODAN	carrier-operated device anti-noise
cp	counterpoise
c.r.o.	cathode-ray oscilloscope
c.r.t.	cathode-ray tube

c/s, c.p.s.	cycles per second (c.p.s. may also denote cathode potential stabilised)
c.t.	centre tap
c.w.	continuous-wave emission, A1 (often used to denote telegraphy)
c.w.v.	crest working voltage
d	diode
D	electric flux density
d.a.g.c.	delayed automatic gain control
dB, db	decibel
dBm	decibel meter (power level referred to 1 mW in 600 ohms)
d.c.	direct current
d.c.c.	double cotton covered wire
DEW	distant early warning (radar)
DME	distance measuring equipment
d.p.d.t.	double pole double throw (switch)
d.p.s.t.	double pole single throw (switch)
d.s.b.	double sideband
d.s.c.	double silk covered wire
e	emitter
E	electric field strength; earth
e.c.o.	electron-coupled oscillator
e.h.f.	extremely high frequency
e.h.t.	extra high tension
EM	electromagnetic
e.m.f.	electromotive force
e.m.u.	electromagnetic unit
enam.	enamelled wire
e.p.r.	equivalent parallel resistor
e.r.p.	effective radiated power
e.s.r.	equivalent series resistor
e.s.u.	electrostatic unit
eV	electron-volt
F	farad (unit of capacitance)
f	frequency
f.c.	frequency-changer
f.d.	frequency-doubler
FDM	frequency division multiplex
f.m.	frequency modulation
FPIS	forward propagation by ionospheric scatter
FPTS	forward propagation by tropospheric scatter
f.s.d.	full scale deflection (of a meter)
f.s.k.	frequency-shift keying
f.t.c.	fast time constant
FTM	frequency time modulation
f.w.	full-wave
g	grid; gramme
gc	conversion conductance of a valve

gm	mutual conductance of a valve
G.B.	gain-bandwidth product; grid bias
GCA	ground-controlled approach
GCI	ground controlled interception radar
g.r.f.	group repetition frequency
GCL	ground controlled landing
H	Henry (unit of inductance)
h	heater; hexode; heptode; hour
h.f.	high frequency
h.p.	high-pass filter; horse power
h.t.	high tension
h.v.	high voltage
h.w.	half-wave
Hz	Hertz (cycles per second)
I	current
i	instantaneous value of current, operator
Ia	Anode current of a valve, etc.
Ig	Grid current of a valve
Ig2	screen-grid current of a valve
Ih	heater current of a valve
i.c.w.	interrupted continuous wave, A2
i.f.	intermediate frequency
IFF	identification friend or foe
i.f.t.	intermediate-frequency transformer
ILS	instrument landing system
i.s.b.	independent sideband
J	Joule
j	operator $\sqrt{(-1)}$
K	Kelvin (absolute) temperature
k	cathode; kilo (× 1000); Boltzmann constant
kc/s	kilocycles per second
kV	kilovolt
kVA	kilovolt-ampere
kVh	kilovolt-hour
kW	kilowatt
kΩ	kilohms
L	inductance
LC	inductance-capacitance product (or ratio)
l.f.	low frequency
l.o.	local oscillator
l.p.	low pass filter
LS	loudspeaker
l.t.	low tension
l.u.h.f.	lowest usable high frequency
l.w.	long wave
M	mega (× 1 million)
m	milli (÷ 1000); metre
mA	milliampere
mA/V	milliamperes per volt
m.c.	moving coil
Mc/s	megacycles per second
m.c.w.	modulated continuous wave, A2
MEW	microwave early warning radar
m.f.	medium frequency
mH	millihenry
mic.	microphone
mix.	mixer
m.k.s.	metre-kilogramme-second system of units
m.m.f.	magneto-motive force; micro-micro-farad
m.o.	master oscillator
mod	modulation
MTI	moving target indicator
m.u.f.	maximum usable frequency
mult.	multiplier
m.w.	medium wave
n	nano (÷ 1,000,000,000)
n.b.c.	noise balancing control
nF	nanofarad
n.f.	noise factor
n.f.m. or n.b.f.m.	narrow-band frequency modulation
NMP	navigational microfilm projector
NTSC	National Television System Committee (often used to denote American system of colour television)
OB	outside broadcast
o/c	open circuit
od.	outside diameter
osc.	oscillator
o.w.f.	optimum working frequency
P	power
p	pentode; plate; pico (÷ 1 million-million)
p.a.	power amplifier; public address
p.a.m.	pulse amplitude modulation
PAR	precision approach radar
p.c.m.	pulse code modulation
p.d.	potential difference; power doubler
p.d.a.	post deflection acceleration
p.c.m.	pulse code modulation
p.e.p.	peak envelope power
p.f.m.	pulse frequency modulation
p.i.v.	peak inverse voltage
p.m.	phase modulation; permanent magnet; pulse modulation
pot.	potentiometer
p.p.	push–pull
p–p	peak-to-peak
p.p.m.	parts per million; pulse position modulation
pri.	primary winding
p.r.f.	pulse repetition frequency
p.t.f.e.	polytetrafluoroethylene
p.t.m.	pulse time modulation

p.t.o.	permeability tuned oscillator
p.u.	pick-up
p.v.c.	polyvinyl chloride covered wire
pwr	power
q	tetrode
Q	*Q*-factor; electric charge quantity
q.a.v.c.	quiescent automatic volume control
q.p.p.	quiescent push-pull
R	resistor
R.A.	receiver attenuation
r.c.c.	resistance-capacitance coupling
rcvr	receiver
RDF	radio direction finding
r.f.	radio frequency
r.f.c.	radio frequency choke
r.f.i.	radio frequency interference
RHI	range height indicator
r.m.s.	root mean square
R/T	radio telephony
R.T.T.	radio telephone terminal
rtty	radioteletype
rx	receiver
S, sec	second
SARAH	search and rescue and homing equipment
SBA	standard beam approach
s/c	short-circuit
s.c.c.	single cotton covered wire
sec.	secondary winding
SECAM	"sequential and memory" colour television system
s.f.	signal frequency
s.g.	screen-grid
s.h.f.	super high frequency
s.p.d.t.	single-pole, double-throw switch
s.p.s.t.	single-pole, single-throw switch
s.s.b.	single sideband
s.s.c.	single silk covered wire
s.s.g.	standard signal generator
SSV	ship to surface vessel radar
s.w.	short waves
s.w.g.	standard wire gauge
s.w.r.	standing wave ratio
T	absolute temperature
t	triode; time; turns
t.a.	transmitter attenuation
t.c.c.	triple cotton covered wire
TDM	time-division multiplex
t.p.i.	turns per inch; threads per inch
t.p.t.g.	tuned-plate, tuned-grid
T/R	transmit-receive
t.r.f.	tuned radio frequency (used to denote " straight " receiver)
TVI	television interference
TWI	tail warning indicator radar
t.w.t.	travelling wave tube
tx	transmitter
u.h.f.	ultra high frequency
u.s.w.	ultra short waves
V	volt
v	valve
VA	volt-ampere
v.d.r.	voltage dependent resistor
v.f.	voice frequency; video frequency
v.f.o.	variable frequency oscillator
v.h.f.	very high frequency
v.l.f.	very low frequency
VOCS	voice operated carrier suppressor
v.o.m.	volt-ohm-mA test meter
VOGAD	voice operated gain adjuster device
vox	voice operated transmit-receive switch
v.v. or v.v.m. or v.v.t.m.	valve voltmeter
vxo	variable crystal oscillator
W	watt
Wb	Weber
W/C	wavechange
Wh	watt-hour
w.p.m.	words per minute
W/T	wireless telegraphy
w.w.	wirewound resistor
X	reactance
xmtr	transmitter
X's	atmospherics
Xtal	crystal
Y	admittance
Z	impedance

AMATEUR RADIO

To operate an amateur station in the United Kingdom it is necessary to obtain a licence from the Postmaster General (Radio Services Department, Radio Branch, General Post Office, London, E.C.1). Applicants must be over fourteen years of age, furnish proof of nationality, and be prepared to take technical and Morse code examinations. Apart from a knowledge of fundamental radio transmitting and receiving theory, the questions require a knowledge of the amateur licence regulations and the ability to send and receive plain language in Morse code at a speed of twelve words per minute. There is a fee of £2 per annum (additional fees are payable for mobile or amateur television facilities). A pamphlet "How to Become a Radio Amateur" can be obtained from the above address. A booklet entitled "A Guide to Amateur Radio" (4*s.* post free) is available from the Radio Society of Great Britain, 28 Little Russell St., London, W.C.1.

The frequencies on which amateurs are permitted to operate in the United Kingdom are as given in the table on page 45.

The use made of these bands may be summarised as follows:

1·8 Mc/s. Used for semi-local (up to about 100 miles) telegraphy and telephony during daylight, and for inter-British Isles working during darkness. In favourable conditions during the winter nights long-distance and Transatlantic contacts are made occasionally, despite the limitation of power. Often used for mobile operation.

3·5 Mc/s. Widely used for inter-British Isles and European communication, and for long-distance communication during favourable propagation conditions. Telegraphy stations generally use from about 15 to 100 watts input. Telephony stations tend to use from 50 to 150 watts.

7 Mc/s. Inter-British Isles communication during periods of peak sunspot activity, mainly inter-European and long-distance communication at other times. Considerable interference is caused to amateurs by broadcast stations operating within this band.

14 Mc/s. The most reliable long-distance band; considerable inter-European working also takes place.

21 Mc/s and 28 Mc/s. These bands are used for long-distance daylight communication during periods when the maximum usable frequency is high, but activity tends to fall sharply at other times.

70 and 144 Mc/s. Used for semi-local communication, and for longer distances (100–1000 miles) during periods of tropospheric bending.

420 Mc/s. Used for u.h.f. and amateur television experiments, with occasionally contacts over several hundred miles when conditions favourable.

Amateur Frequencies

Frequency Bands (in Mc/s)	*Classes of Emission*	*Maximum d.c. Input Power*	*Note No.*
1·8–2·0		10 watts	1
3·5–3·8		150 watts	2
7·0–7·10			—
14·0–14·35			—
21·0–21·45			—
28·0–29·7			—
70·2–70·4	A1, A2, A3, A3A, F1, F2 and F3	50 watts	1 and 3
144–145		150 watts	1 and 4
145–146			—
420–450			1
1,215–1,325			1
2,300–2,450			1
3,400–3,475			1
5,650–5,850			1
10,000–10,500			1
21,000–22,000			—
2,350–2,400	P1D, P2D, P2E, P3D and P3E	25 watts mean power and 2·5 kilowatts peak power.	1
5,700–5,800			1
10,050–10,450			1
21,150–21,850			—

Notes

1. This band is allocated to stations in the Amateur Service on a secondary basis on condition that they shall not cause interference to other services.
2. This band is shared by other services.
3. This band is available to amateurs until further notice provided that frequencies between 70·2–70·3 Mc/s inclusive may not be used on the North-West side of the line Firth of Lorne to the Moray Firth.
4. The following spot aeronautical frequencies must be avoided: 144·0, 144·09, 144·18, 144·27, 144·36, 144·45, 144·54, 144·63, 144·72, 144·81 and 144·9 Mc/s.
5. Amateur television licences are issued separately covering transmissions in the 420-Mc/s band and above.

The lower frequency ends of the h.f. bands are used for Morse (A1) communication.

USEFUL CONSTANTS

$\pi = 3{\cdot}14159 \simeq \frac{22}{7}$. $\frac{1}{\pi} = 0{\cdot}31831$. $\pi^2 = 9{\cdot}8696$. $\log \pi = 0{\cdot}49715$. $e = 2{\cdot}71828$. Velocity of sound in air $\simeq$ 1,130 ft per second. 60 m.p.h. = 88 ft per second.

2π radians = 360°. 1 radian = 57·3°. Radians = degrees × 0·0175.

Relative resistances: copper 1, silver 0·94, aluminium 1·6, brass 4·4, nickel 4·3, eureka 29·3.

AMATEUR RADIO PREFIXES

THE following list, arranged in alphabetical order of prefix, is intended fo the rapid identification of the geographical location of stations.

AC3	Sikkim	FR	Reunion Island
AC4	Tibet	FS7	St. Martin
AC5	Bhutan	FU	New Hebrides
AP	Pakistan	FW	Wallis and Futuna Is.
BV	Formosa	FY	French Guiana
BY	China	G	England
C9	Manchuria	GB	United Kingdom (Exhibition and Special Purposes)
CE	Chile	GC	Channel Islands
CE7Z-CE9	Antarctica	GD	Isle of Man
CE0A	Easter Island	GI	Northern Ireland
CE0Z	Juan Fernandez Is.	GM	Scotland
CM	Cuba (telegraphy)	GW	Wales
CN	Morocco	HA	Hungary
CO	Cuba (telephony)	HB	Switzerland
CP	Bolivia	HC	Ecuador
CR4	Cape Verde Is.	HC8	Galapagos Is.
CR5	Portuguese Guinea, Principe and Sao Thome	HE	Liechtenstein
CR6	Angola	HH	Haiti
CR7	Mozambique	HI	Dominica
CR9	Macau	HK	Colombia
CR10	Timor	HK0	San Andres, Providencia
CT1	Portugal	HL, HM	Korea
CT2	Azores	HP	Panama
CT3	Madeira	HR	Honduras
CX	Uruguay	HS	Siam
DJ	Germany	HV	Vatican City
DL	Germany	HZ	Saudi Arabia
DM	Germany (East Zone)	I	Italy
DU	Philippines	IS	Sardinia
EA	Spain	IT	Sicily
EA6	Balearic Is.	JA	Japan
EA8	Canary Is.	JA0	Bonin and Volcano Is.
EA9	Spanish Morocco, Rio de Oro, Ifni	JT	Mongolia
EA0	Spanish Guinea	JY	Jordan
EI	Eire	JZ	Dutch New Guinea
EL	Liberia	K, KN	U.S.A. (for Districts se under " W ")
EP	Persia (Iran)	KA	Japan (Amer. assigned)
EQ	Persia (Iran)	KB6, WB6*	Baker, Howland and Amer Phoenix Is.
ET2	Eritrea	KC4	Navassa Is., Antarctica
ET3	Ethiopia	KC6	Caroline and Palua Is.
F	France	KG1	Greenland (U.S. assigned)
FB	Glorieuses Is., Comono Is., New Amsterdam and St. Paul Is., Kerguelen Is., Tromelin Is.	KG4	Guantanamo Bay
		KG6	Mariana Islands, Marcu Is.
FC	Corsica	KH6	Hawaiian Islands
FG	Guadeloupe	KJ6	Johnston Island
FK	New Caledonia	KL7, WL6	Alaska
FL	French Somaliland	KM6	Midway Islands
FM	Martinique	KP4, WP4	Puerto Rico
FO	French Oceania (*e.g.*, Tahiti), Clipperton Is.	KP6	Palmyra Group, Jarvis Island
FP	St. Pierre and Miquelon Is.	KR6	Ryukyu Islands (*e.g.*, Okinawa)

* WB6 also used in the U.S.A.

KS4	Swan Islands, Roncador Cay and Serrana Bank
KS6	American Samoa
KV4	Virgin Islands
KW6	Wake Island
KX6	Marshall Islands
KZ5	Panama Canal Zone
LA	Norway, Svalbard (Spitzbergen)
LB	Norway (Special)
LU	Argentina
LX	Luxembourg
LZ	Bulgaria
M1	San Marino
MP4	Kuwait, Qatar, Trucial Oman
MP4B	Bahrein Island
MP4T	Muscat
OA	Peru
OD	Lebanon
OE	Austria
OH	Finland
OH0	Aland Is.
OK	Czechoslovakia
ON	Belgium
OX	Greenland
OY	Faeroes
OZ	Denmark
PA	Holland
PI	Holland (Special)
PJ	Dutch West Indies
PJ2M	St. Maarten
PX	Andorra
PY	Brazil
PY0	Fernando de Noronha, Trindade and Vaz Is.
PZ	Dutch Guiana
SL	Sweden (Special)
SM	Sweden
SP	Poland
ST	Sudan
SU	Egypt
SV	Greece and Crete
SV5	Dodecanese Islands
TA	Turkey
TF	Iceland
TG	Guatemala
TI	Costa Rica
TI9	Cocos Is.
TJ	Cameroons
TL8	Central African Republic
TN8	Congo Republic (Brazzaville)
TR8	Gabon Republic
TT8	Chad Republic
TU2	Ivory Coast
TY	Dahomey Republic
TZ	Mali Republic
UA, UW	
1, 3, 4, 5, 6	European Russian S.F.S.R.
UA2	Kaliningradsk
UA9, 0	Asiatic R.S.F.S.R.
UB5, UT5	Ukraine
UC2	White Russia
UD6	Azerbaijan
UF6	Georgia
UG6	Armenia
UH8	Turkoman
UI8	Uzbek
UJ8	Tadzhiz
UL7	Kazakh
UM8	Kirghiz
UN1	Finno-Karelia
UO5	Moldavia
UP2	Lithuania
UQ2	Latvia
UR2	Estonia
UW	See under UA
VE, VO	Canada
VE1	Maritime Provinces
VE2	Province of Quebec
VE3	Province of Ontario
VE4	Province of Manitoba
VE5	Province of Saskatchewan
VE6	Province of Alberta
VE7	Province of British Columbia
VE8A-L	Yukon Territories
VE8M-Z	N.W. Territories
VO2	Newfoundland
VO6	Labrador
VK0	Heard Is., Macquarrie Is., Cocos Is.
VK1–7	Australia
VK1	Canberra
VK2	New South Wales
VK3	Victoria
VK4	Queensland
VK5	South Australia
VK6	Western Australia
VK7	Tasmania
VK9	New Guinea, Norfolk Is., Papua, Nauru, Cocos-Keeling and Admiralty Islands
VO	See under VE
VP1	British Honduras
VP2	Leeward Is., Windward Is.
VP2A	Antigua and Barbuda
VP2D	Dominica
VP2G	Grenada
VP2H	Anguilla
VP2K	St. Kitts and Nevis
VP2L	St. Lucia
VP2M	Montserrat
VP2S	St. Vincent
VP2V	Brit. Virgin Isles
VP3	British Guiana
VP4	Trinidad and Tobago
VP5, 6Y	Jamaica, Turks and Caicos Is., Cayman Is.
VP6	Barbados
VP7	Bahamas
VP8	Falkland Is., S. Georgia, S. Orkneys, Shetland Is., Sandwich Is., Grahamland
VP9	Bermudas

VQ1	Zanzibar
VQ2	Northern Rhodesia
VQ3	Tanganyika
VQ4	Kenya
VQ5	Uganda
VQ7	Aldabra Is.
VQ8	Mauritius
VQ8B	St. Brandon Is.
VQ8C	Chagos
VQ8R	Rodriques
VQ9	Seychelles
VR1	Gilbert and Ellis Is., Brit. Phoenix Is.
VR2	Fiji
VR3	Fanning Is. (Christmas Is.)
VR4	Solomon Is.
VR5	Tonga (Friendly) Is.
VR6	Pitcairn Is.
VS1	Singapore
VS4	Sarawak
VS5	Brunei
VS6	Hong Kong
VS9	Aden, Kamaran, Socotra Is.
VS9M	Maldive Is.
VS9O	Sultanate of Oman
VU2	India
VU5	Andaman Is., Laccadive Is.
W, WA, WN, WV, K, KN	United States of America
W1	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
W2	New Jersey, New York
W3	Delaware, Pennsylvania, Maryland (inc. Dist. of Columbia)
W4	Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia
W5	Arkansas, Louisiana, Mississippi, New Mexico, Oklahoma, Texas
W6	California
W7	Arizona, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming
W8	Michigan, Ohio, West Virginia
W9	Illinois, Indiana, Wisconsin
W0	Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
XE, XF	Mexico
XE4	Revilla Gigedo
XT2	Upper Volta
XW8	Laos
XZ	Burma
YA	Afghanistan
YI	Iraq
YJ	New Hebrides
YK	Syria
YN	Nicaragua
YO	Roumania
YS	Salvador
YU	Yugoslavia
YV	Venezuela
YV0	Aves Is.
ZA	Albania
ZB1	Malta
ZB2	Gibraltar
ZC5	British North Borneo
ZC6	Palestine
ZD1	Sierra Leone
ZD3	Gambia
ZD6	Nyasaland
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Tristan da Cunha, Gough Is.
ZE	Southern Rhodesia
ZK1	Cook Island
ZK2	Niue
ZL	New Zealand, Chatham Is., Kermadec Is.
ZL5	New Zealand Antarctica
ZM6	Western Samoa
ZM7	Tokelau Is.
ZP	Paraguay
ZS	Union of South Africa, Prince Edward and Marion Is.
ZS3	South West Africa
ZS7	Swaziland
ZS8	Basutoland
ZS9	Bechuanaland
3A2	Monaco
3V8	Tunisia
3W8	Cambodia, Viet Nam
4S7	Ceylon
4W	Yemen
4X4	Israel
5A	Libya
5B4	Republic of Cyprus
5H3	Tanganyika Territory
5N2	Nigeria
5R	Malagasy Republic (Madagascar)
5T	Mauritania
5U7	Niger Republic
5V	Togo
6O2	Somali Republic
6W8	Senegal Republic
6Y	Jamaica
7G1	Republic of Guinea
7X2	Algeria
8J1	Antarctica (also OR4, VK0, ZL5, VP8)
9G	Ghana
9K	Kuwait
9M	Malaya
9N	Nepal
9Q5	Congo Republic
9U5	Rwanda, Burundi

I.F. LIST FOR COMMUNICATIONS RECEIVERS

Short-wave communications receivers were originally developed in the 1930s for amateur-radio enthusiasts but since then have found many other applications. These receivers include single, double and triple conversion superhets, sometimes with a tunable first I.F. in conjunction with a quartz crystal controlled H.F. oscillator.

Many of the receivers in use in the United Kingdom have non-standard intermediate frequencies not readily identifiable, and are frequently of overseas or ex-Government origin.

The following list covers the majority of British, American, Continental and ex-Government receivers in current use.

Type	*Intermediate Frequency*
Collins	
75A1	1·5–2·5 Mc/s. (tunable), 500 kc/s.
75A2	1·5–2·5 Mc/s. (tunable), 455 kc/s.
75A3	1·5–2·5 Mc/s. (tunable), 455 kc/s.
75A4	1·5–2·5 Mc/s. (tunable), 455 kc/s.
75S1	2·955–3·155 Mc/s. (tunable), 455 kc/s.
75S3	2·955–3·155 Mc/s. (tunable), 455 kc/s.
KWM1	3·9–4·0 Mc/s. (tunable), 455 kc/s.
KWM2	2·955–3·155 Mc/s. (tunable), 455 kc/s.
Cosmos	
Bilateral 35	2·2–2·8 Mc/s. (tunable), 455 kc/s.
Cosmosphone 1000	2·2–2·8 Mc/s. (tunable), 455 kc/s.
Denco	
DCR19	1600 kc/s.
Drake	
1–A	2·9–3·5 Mc/s. (tunable), 1100 kc/s., 50 kc/s.
2–A	3·5–4·1 Mc/s. (tunable), 455 kc/s., 50 kc/s.
2–B	3·5–4·1 Mc/s. (tunable), 455 kc/s., 50 kc/s.
Eddystone	
ECR	465 kc/s.
358	450 kc/s.
640	1600 kc/s.
680	450 kc/s.
740	450 kc/s.
750	1620 kc/s., 85 kc/s.
840	450 kc/s.
888	1620 kc/s., 85 kc/s.
Geloso	
G207DR	4·6 Mc/s., 467 kc/s.
G209R	4·6 Mc/s., 467 kc/s.
G.E.C.	
BRT400	455 kc/s.
Gonset	
G63	2065 kc/s., 263 kc/s.
G66	2050 kc/s., 265 kc/s.
G76	2065 kc/s., 262 kc/s.
GR212	1650 kc/s., 455 kc/s.
Communicator	6 Mc/s.
Communicator IV	15–19 Mc/s., 2·3 Mc/s., 455 kc/s.
Hallicrafters	
Sky Buddy (early)	465 kc/s.
Sky Buddy (S19R)	455 kc/s.
Sky Champion (early)	465 kc/s.
Sky Champion (S20R)	455 kc/s.
Sky Challenger (SX15)	465 kc/s.
Sky Challenger II (SX18)	465 kc/s.
Skyrider (SX23)	455 kc/s.
Skyrider Defiant (SX24)	455 kc/s.
Super Skyrider (SX16)	465 kc/s.
S10	1600 kc/s.
S11	465 kc/s.
S12	1600 kc/s.
S17	465 kc/s.
S21	1600 kc/s.
S22	1600 kc/s.
S27	5·25 Mc/s.
SX28	455 kc/s.
S36	5·25 Mc/s.
S37	18 Mc/s.
S38	455 kc/s.
S40	455 kc/s.
SX42	455 kc/s. (FM 10·7 Mc/s.)
SX43	455 kc/s. (10·7 Mc/s. above 44 Mc/s.)
S52	455 kc/s.
S53	2075 kc/s.
SX62A	455 kc/s. (10·7 Mc/s. on V.H.F.)
SX71	2075 kc/s., 455 kc/s.
S72	455 kc/s.
SX73	1·6 Mc/s. (above 7 Mc/s.), 455 kc/s.
S76	1650 kc/s., 50 kc/s.
S77	455 kc/s.
S85	455 kc/s.
S86	455 kc/s.
S94	10·7 Mc/s.
S95	10·7 Mc/s.
SX99	455 kc/s.
SX100	1650 kc/s., 50 kc/s.
SX101	1650 kc/s., 50·5 kc/s.
SX101 Mk. IIIA	1650 kc/s., 50·75 kc/s.
S108	455 kc/s.
SX110	455 kc/s.
SX111	1650 kc/s., 50·75 kc/s.
SX115	6–6·5 Mc/s. (tunable), 1005 kc/s., 50 kc/s.
SX140	1650 kc/s.
SR34	23·25 Mc/s., 1·65 Mc/s.
Hammarlund	
Comet Pro	465 kc/s.
Super Pro (early models)	465 kc/s.
Super Pro (from 400-series)	455 kc/s.
Super Pro (600-series)	3995 kc/s., 455 kc/s.
HC10 (converter)	60 kc/s.
HQ110	3045 kc/s., 455 kc/s.
HQ120	455 kc/s.
HQ129X	455 kc/s.
HQ140	455 kc/s.
HQ145	3035 kc/s., 455 kc/s.
HQ160	3035 kc/s., 455 kc/s.
HQ170	3035 kc/s., 455 kc/s., 60 kc/s.
HQ180	3035 kc/s., 455 kc/s., 60 kc/s.

Type	Intermediate Frequency
Heath	
Comanche	3 Mc/s.
Mohawk	1682 kc/s., 50 kc/s.
Mohican	455 kc/s.
RA1	1620 kc/s.
RX1	1682 kc/s, 50kc/s.
Max Funke	
RX57	1·6 Mc/s.
RX60	1·6 Mc/s., 460 kc/s.
Marconi	
CR100	465 kc/s.
Minimitter	
MR37	1·5 Mc/s., 460 kc/s.
MR38	1·5 Mc/s., 460 kc/s.
MR44	2·1 Mc/s., 460 kc/s.
MR44/II	1565 kc/s., 465 kc/s. or 460 kc/s.
Mosley	
CM–1	3·5–4·1 Mc/s. (tunable), 455 kc/s.
National	
HRO Junior	456 kc/s.
HRO Senior	456 kc/s.
HRO–50	455 kc/s.
HRO–60	1720 kc/s., 455 kc/s.
NC33	455 kc/s.
NC57	455 kc/s.
NC66	455 kc/s.
NC80X	1560 kc/s.
NC81X	1560 kc/s.
NC88	455 kc/s.
NC98	455 kc/s.
NC100X	456 kc/s.
NC101X	456 kc/s.
NC105	455 kc/s.
NC109	455 kc/s.
NC125	455 kc/s.
NC155	2215 kc/s., 230 kc/s.
NC173	455 kc/s.
NC183	1990 kc/s., 455 kc/s.
NC188	455 kc/s.
NC190	2215 kc/s., 230 kc/s.
NC200	455 kc/s.
NC300	2215 kc/s., 80 kc/s.
NC303	2215 kc/s., 80 kc/s.
NC400	1720 kc/s., 455 kc/s.
NC2–40C	455 kc/s.
NC2–40D	455 kc/s.
HFS	10·7 Mc/s.
SW54	455 kc/s.
Racal	
RA17	40 Mc/s. (bandpass ± 650 kc/s.), 2–3 Mc/s. (tunable), 100 kc/s.
Radiovision	
Commander	1600 kc/s., 100 kc/s.
Hambander	1600 kc/s.
R.C.A.	
ACR111	460 kc/s.
AR77	455 kc/s.
AR88	455 kc/s.
AR88D	455 kc/s.
AR88LF	735 kc/s.
R.M.E.	
RME45	455 kc/s.
RME69	465 kc/s.
RME84	455 kc/s.
RME4350	2195 kc/s., 455 kc/s.
RME6900	2195 kc/s., 57 kc/s.
HF30	1550 kc/s.
Tech. Material Corp	
GPR–90	3955 kc/s., 455 kc/s.
Tobe	
Communication series	456 kc/s.

Type	Intermediate Frequency
U.S. Surplus	
ARB	915 kc/s. (high bands), 135 kc/s. (low bands)
ASB	55 Mc/s., 16 Mc/s.
BC224	915 kc/s.
BC312	470 kc/s.
BC342	470 kc/s.
BC348	915 kc/s.
BC406	19·5 Mc/s.
BC433	142 kc/s.
BC453	85 kc/s.
BC454	1415 kc/s.
BC455	2830 kc/s.
BC620	2·88 Mc/s.
BC624	12 Mc/s.
BC645	40 Mc/s.
BC659	4·3 Mc/s.
BC701	30·5 Mc/s.
BC733	6·9 Mc/s.
BC779	465 kc/s. (Super Pro)
BC788	30 Mc/s.
BC794	465 kc/s. (Super Pro)
BC946	85 kc/s.
BC1004	465 kc/s. (Super Pro)
BC1147	455 kc/s.
BC1206	135 kc/s.
BC1335	4·3 Mc/s.
CBY46129	85 kc/s. (BC453)
R23/ARC5	85 kc/s. (BC453)
R25/ARC5	705 kc/s.
R26/ARC5	1415 kc/s. (BC454)
R28/ARC5	6·9 Mc/s.
R44/ARR–5	5·25 Mc/s. (S36A)
R44/ARR–7	455 kc/s. (SX28A)
R100/URR	455 kc/s.
RA10	1630 kc/s.
RAO	455 kc/s. (modified NC100)
RAS	175 kc/s. (modified HRO)
RAW	455 kc/s. (HRO)
RAX–2	915 kc/s.
RAX–3	2·275 Mc/s.
RBG	455 kc/s. (HQ120)
RBK	5·25 Mc/s. (S27D)
RBJ	455 kc/s. (HRO)
RCE	456 kc/s. (HRO)
RC103–A	6·9 Mc/s. (BC733)
RT34/APS13	30 Mc/s.
TBS	5·3 Mc/s.
British and Canadian Surplus	
B2	470 kc/s.
B28	465 kc/s. (CR100)
B34	450 kc/s. (358X)
B36	600 kc/s.
DST100	2 Mc/s., 100 kc/s.
P40	2·9 Mc/s.
R107	465 kc/s.
R208	2 Mc/s.
R209	460 kc/s.
R210	460 kc/s.
R1116	1700 kc/s., 100 kc/s.
R1124A	470 kc/s.
R1132A	12 Mc/s.
R1143	10 Mc/s.
R1147A	25 Mc/s.
R1155	560 kc/s. (b.f.o. 280 kc/s.)
R1224A	465 kc/s.
R1225	9·72 Mc/s.
R1355	7·5 Mc/s.
R3084	30 Mc/s.
R3515	13·5 Mc/s.
R3547	45 Mc/s.
TR1143 (" 19 ")	9·72 Mc/s.
TR1196 (" 25 ")	465 kc/s.
TR1196 (" 73 ")	460 kc/s.
TR1462	9·72 Mc/s.
VRL	1·5 Mc/s., 465 kc/s.
W/S No. 18	465 kc/s.
W/S No. 19	465 kc/s.
W/S No. 48	455 kc/s.
ZC1	465 kc/s.

MATHEMATICAL DATA

Square Roots

THE solution of the formula for the resonance of a tuned circuit, and for a number of other radio-circuit formulæ, requires the extraction of the square roots of large numbers. This process is most simply achieved by means of logarithm tables, or tables of square roots, or by the use of a slide rule. However, where these aids are not available the following method may be used.

EXAMPLE: *To find the square root of* 50,243.

Mark off the complete number into groups of two, starting from the right-hand side, or, if decimals are involved, from the decimal point, *i.e.*, 5′02′43.

Find from the table below the largest square contained in the first group of either one or two figures.

First group .	1–3	4–8	9–15	16–24	25–35	36–48	49–63	64–80	81–99
Largest square .	1	4	9	16	25	36	49	64	81
Root . .	1	2	3	4	5	6	7	8	9

In our example this will be 4, so the root is 2. Proceed as for long division:

```
  2
√5′02′43
 4
 ‾
 1
```

Then bring down the next group of 2 figures—02—and write down to the left of this *twice* the root found for the first group, *i.e.*, 4 in our example. Then find the largest number—in this case 2—which, when written after the 4 and then the resultant number—42—multiplied by it will divide into the remainder. This process is best grasped by reference to the example below:

```
            2 2
          √5′02′43
            4
42 × 2 | 1 02
           84
           ‾‾
           18
```

No.	Square	Cube	Sq. Root	Cu. Root	No.	Square	Cube	Sq. Root	Cu. Root
1	1	1	1·0	1·0	51	2601	132651	7·14143	3·7084
2	4	8	1·41421	1·2599	52	2704	140608	7·21110	3·7325
3	9	27	1·73205	1·4422	53	2809	148877	7·28011	3·7563
4	16	64	2·0	1·5874	54	2916	157464	7·34847	3·7798
5	25	125	2·23607	1·7100	55	3025	166375	7·4162	3·8030
6	36	216	2·44949	1·8171	56	3136	175616	7·48331	3·8259
7	49	343	2·64575	1·9129	57	3249	185193	7·54983	3·8485
8	64	512	2·82843	2·0	58	3364	195112	7·61577	3·8709
9	81	729	3·0	2·0801	59	3481	205379	7·68115	3·8930
10	100	1000	3·16228	2·1544	60	3600	216000	7·74597	3·9149
11	121	1331	3·31662	2·2240	61	3721	226981	7·81025	3·9365
12	144	1728	3·46410	2·2894	62	3844	238328	7·87401	3·9579
13	169	2197	3·60555	2·3513	63	3969	250047	7·93725	3·9791
14	196	2744	3·74166	2·4101	64	4096	262144	8·0	4·0
15	225	3375	3·87298	2·4662	65	4225	274625	8·06226	4·0207
16	256	4096	4·0	2·5198	66	4356	287496	8·12404	4·0412
17	289	4913	4·12311	2·5713	67	4489	300763	8·18535	4·0615
18	324	5832	4·24264	2·6207	68	4624	314432	8·24621	4·0817
19	361	6859	4·35890	2·6684	69	4761	328509	8·30662	4·1016
20	400	8000	4·47214	2·7144	70	4900	343000	8·36660	4·1213
21	441	9261	4·58258	2·7589	71	5041	357911	8·42615	4·1408
22	484	10648	4·69042	2·8020	72	5184	373248	8·48528	4·1602
23	529	12167	4·79583	2·8439	73	5329	389017	8·54400	4·1793
24	576	13824	4·89898	2·8845	74	5476	405224	8·60233	4·1983
25	625	15625	5·0	2·9240	75	5625	421875	8·66025	4·2172
26	676	17576	5·09902	2·9625	76	5776	438976	8·71780	4·2358
27	729	19683	5·19615	3·0	77	5929	456533	8·77496	4·2543
28	784	21952	5·29150	3·0366	78	6084	474552	8·83176	4·2727
29	841	24389	5·38516	3·0723	79	6241	493039	8·88819	4·2908
30	900	27000	5·47723	3·1072	80	6400	512000	8·94427	4·3089
31	961	29791	5·56776	3·1414	81	6561	531441	9·0	4·3267
32	1024	32768	5·65685	3·1748	82	6724	551368	9·05539	4·3445
33	1089	35937	5·74456	3·2075	83	6889	571787	9·11043	4·3621
34	1156	39304	5·83095	3·2396	84	7056	592704	9·16515	4·3795
35	1225	42875	5·91608	3·2711	85	7225	614125	9·21954	4·3968
36	1296	46656	6·0	3·3019	86	7396	636056	9·27362	4·4140
37	1369	50653	6·08276	3·3322	87	7569	658503	9·32738	4·4310
38	1444	54872	6·16441	3·3620	88	7744	681472	9·38083	4·4480
39	1521	59319	6·245	3·3912	89	7921	704969	9·43398	4·4647
40	1600	64000	6·32456	3·4200	90	8100	729000	9·48683	4·4814
41	1681	68921	6·40312	3·4482	91	8281	753571	9·53939	4·4979
42	1764	74088	6·48074	3·4760	92	8464	778688	9·59166	4·5144
43	1849	79507	6·55744	3·5034	93	8649	804357	9·64365	4·5307
44	1936	85184	6·63325	3·5303	94	8836	830584	9·69536	4·5468
45	2025	91125	6·70820	3·5569	95	9025	857375	9·74679	4·5629
46	2116	97336	6·78233	3·5830	96	9216	884736	9·79796	4·5789
47	2209	103823	6·85565	3·6088	97	9409	912673	9·84886	4·5947
48	2304	110592	6·92820	3·6342	98	9604	941192	9·89949	4·6104
49	2401	117649	7·0	3·6593	99	9801	970299	9·94987	4·6261
50	2500	125000	7·07107	3·6840	100	10000	1000000	10·0	4·6416

The same process is then repeated as many times as is necessary:

```
               2  2  4·1
              √5'02'43
               4
     42 × 2  | 1 02
                 84
    444 × 4   | 18 43
                 17 76
   4481 × 1       | 6700
                    4481
```

Thus the square root of 50,243 to the nearest whole number is 224.

Logarithms

The value of the logarithm to the left of the decimal point (the " characteristic ") depends upon the power of ten, as follows:

Values between 0·001 and 0·0099	$= 10^{-3}$	$= \bar{3}$	(negative)
Values between 0·01 and 0·099	$= 10^{-2}$	$= \bar{2}$	
Values between 0·1 and 0·99	$= 10^{-1}$	$= \bar{1}$	
Values between 1·0 and 9·9	$= 10^{0}$	$= 0$	
Values between 10·0 and 99	$= 10^{1}$	$= 1$	(positive)
Values between 100 and 999	$= 10^{2}$	$= 2$	
Values between 1000 and 9999	$= 10^{3}$	$= 3$	
and so on.			

The value to the right of the decimal point, as found from the tables, (the " mantissa ") is always positive. Negative numbers have no logarithm.

Use of Logarithms

To find the product of a series of numbers ($X \times Y \times Z$), add the logs ($\log X + \log Y + \log Z$), and then reconvert by means of antilog tables.

To divide X into Y, subtract the log of X from the log of Y and reconvert. ($\log Y - \log X$)

To find the square root of X, divide the log of X by 2 and reconvert.

To find the square of X, multiply the log of X by 2 and reconvert.

To find the cube root of X, divide the log of X by 3 and reconvert.

To find the cube of X, multiply the log of X by 3 and reconvert.

LOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12	17	21	25	29	33	37
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16	19	23	26	29
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8	11	14	17	20	22	25
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	20	22
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12	14	16	19	21
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11	13	16	18	20
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7

Hyperbolic Logarithms = Common Logarithms × 2·30258.

LOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4

Common Logarithms = Hyperbolic Logarithms × 0·43429.

ANTILOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
·00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1	1	2	2	2
·01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1	1	2	2	2
·02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2
·03	1972	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2
·04	1095	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1	2	2	2	2
·05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1	2	2	2	2
·06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	1	1	2	2	2	2
·07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1	2	2	2	2
·08	1202	1205	1208	1211	1213	1116	1219	1222	1225	1227	0	1	1	1	1	2	2	2	3
·09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	1	1	2	2	2	3
·10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	1	1	2	2	2	3
·11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2	2	2	2	3
·12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	2	2	2	2	3
·13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	1	1	2	2	2	3	3
·14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	1	1	2	2	2	3	3
·15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	1	1	2	2	2	3	3
·16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	1	1	2	2	2	3	3
·17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	1	1	2	2	2	3	3
·18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	1	1	2	2	2	3	3
·19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	1	1	2	2	3	3	3
·20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	2	2	3	3	3
·21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	2	2	2	3	3	3
·22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	2	2	2	3	3	3
·23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	2	2	2	3	3	4
·24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	2	2	2	3	3	4
·25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	1	2	2	2	3	3	4
·26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	2	2	3	3	3	4
·27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	2	2	3	3	3	4
·28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	2	2	3	3	4	4
·29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	2	2	3	3	4	4
·30	1995	2000	2004	2009	2014	2108	2023	2028	2032	2037	0	1	1	2	2	3	3	4	4
·31	2042	2046	1051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
·32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2	3	3	4	4
·33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	2	2	3	3	4	4
·34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	3	3	4	4	5
·35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	3	3	4	4	5
·36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	3	3	4	4	5
·37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	1	2	2	3	3	4	4	5
·38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	3	3	4	4	5
·39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	3	3	4	5	5
·40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	1	2	2	3	4	4	5	5
·41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	3	4	4	5	5
·42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3	4	4	5	6
·43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	3	3	4	4	5	6
·44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	3	3	4	4	5	6
·45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	3	3	4	5	5	6
·46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3	4	5	5	6
·47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	3	3	4	5	5	6
·48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	3	4	4	5	6	6
·49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	3	4	4	5	6	6

ANTILOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
·50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4	4	5	6	7
·51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	2	3	4	5	5	6	7
·52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	2	3	4	5	5	6	7
·53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4	5	6	6	7
·54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4	5	6	6	7
·55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7
·56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8
·57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8
·58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8
·59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8
·60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8
·61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9
·62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9
·63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9
·64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9
·65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9
·66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10
·67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10
·68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10
·69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10
·70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11
·71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11
·72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6	7	9	10	11
·73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11
·74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12
·75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12
·76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12
·77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7	8	10	11	12
·78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13
·79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7	9	10	11	13
·80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13
·81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14
·82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	5	6	8	9	11	12	14
·83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14
·84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15
·85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15
·86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	15
·87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	4	5	7	9	10	12	14	16
·88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9	11	12	14	16
·89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	13	14	16
·90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17
·91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17
·92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17
·93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18
·94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10	12	14	16	18
·95	8913	8933	8954	8974	8995	9016	9034	9057	9078	9099	2	4	6	8	10	12	15	17	19
·96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19
·97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20
·98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11	13	16	18	20
·99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	14	16	18	20

Copper Wire Table

S.W.G.	Dia. (in.)	Yards per Pound (Bare)	Ohms per Yard	Max. Safe Current *	Turns per Inch				Nearest American B. & S.		S.W.G.
					D.S.C.	D.C.C.	Enam.	Enam. & S.S.C.	Gauge	Dia.	
10	0·128	6·67	0·00186	35 A	7·55	7·04	—	—	8	0·1285	10
12	0·104	10·15	0·00283	28 A	9·22	8·47	9·26	—	10	0·102	12
14	0·080	17·21	0·00478	19 A	11·8	10·6	11·9	—	12	0·081	14
16	0·064	26·90	0·00746	13 A	14·7	13·15	14·8	14·2	14	0·064	16
18	0·048	47·80	0·01327	7 A	19·6	16·9	19·7	19·0	17	0·045	18
20	0·036	73·40	0·02359	4 A	25·6	21·3	26·0	24·7	19	0·036	20
22	0·028	140·5	0·03899	2·5 A	32·2	25·6	33·3	31·2	21	0·028	22
24	0·022	227·2	0·06316	1·5 A	40·0	31·2	42·3	39·5	23	0·023	24
26	0·018	340·0	0·09435	1·0 A	48·8	35·7	51·5	48·1	25	0·018	26
28	0·0148	502·8	0·1395	700 mA	57·8	40·3	62·5	57·8	27	0·0142	28
30	0·0124	716·5	0·1988	500 mA	67·1	44·6	74·6	67·0	28	0·0126	30
32	0·0108	945·0	0·2621	400 mA	75·2	48·1	85·5	76·3	29	0·0113	32
34	0 0092	1,300	0·3612	250 mA	85·5	52·0	100	87·7	31	0 0089	34
36	0·0076	1,905	0·5292	150 mA	99·0	60·2	120	102	32	0·0079	36
38	0·0060	3,058	0·8491	100 mA	117	66·6	151	125	34	0·0063	38
40	0·0048	4,780	1·327	70 mA	137	72·5	188	151	36	0·0050	40

* Maximum safe currents listed in this table apply to single circular copper conductors only. For power-transformer windings, etc., maximum safe currents are between, approximately, ¼ (heavy duty, continuous rating) and ½ (normal service) of the values given.

Wire Gauges in Common Use

No.	S.W.G.		B.W.G.		B. & S.		No.	S.W.G.		B.W.G.		B. & S.	
	In.	*Mm.*	*In.*	*Mm.*	*In.*	*Mm.*		*In.*	*Mm.*	*In.*	*Mm.*	*In.*	*Mm.*
4/0	0·400	10·160	0·454	11·532	0·4600	11·684	24	0·022	0·559	0·022	0·559	0·0201	0·511
3/0	0·372	9·449	0·425	10·795	0·4096	10·404	25	0·020	0·508	0·020	0·508	0·0179	0·455
2/0	0·348	8·839	0·380	9·652	0·3648	9·266	26	0·018	0·457	0·018	0·457	0·0159	0·404
0	0·324	8·230	0·340	8·636	0·3249	8·252	27	0·0164	0·417	0·016	0·406	0·0142	0·361
1	0·300	7·620	0·300	7·620	0·2893	7·348	28	0·0148	0·376	0·014	0·356	0·0126	0·320
2	0·276	7·010	0·284	7·214	0·2576	6·543	29	0·0136	0·345	0·013	0·330	0·0113	0·287
3	0·252	6·401	0·259	6·579	0·2294	5·827	30	0·0124	0·315	0·012	0·305	0·0100	0·254
4	0·232	5·893	0·238	6·045	0·2043	5·189	31	0·0116	0·295	0·010	0·254	0·0089	0·226
5	0·212	5·385	0·220	5·588	0·1819	4·620	32	0·0108	0·274	0·009	0·229	0·0079	0·203
6	0·192	4·877	0·203	5·156	0·1620	4·115	33	0·0100	0·254	0·008	0·203	0·0071	0·180
7	0·176	4·470	0·180	4·572	0·1443	3·665	34	0·0092	0·234	0·007	0·178	0·0063	0·160
8	0·160	4·064	0·165	4·191	0·1285	3·264	35	0·0084	0·213	0·005	0·127	0·0056	0·142
9	0·144	3·658	0·148	3·759	0·1144	2·906	36	0·0076	0·193	0·004	0·102	0·0050	0·127
10	0·128	3·251	0·134	3·404	0·1019	2·588	37	0·0068	0·173	—	—	0·0045	0·114
11	0·116	2·946	0·120	3·048	0·0907	2·304	38	0·0060	0·152	—	—	0·0040	0·102
12	0·104	2·642	0·109	2·769	0·0808	2·052	39	0·0052	0·132	—	—	0·0035	0·090
13	0·092	2·337	0·095	2·413	0·0720	1·829	40	0·0048	0·122	—	—	0·0031	0·079
14	0·080	2·032	0·083	2·108	0·0641	1·628	41	0·0044	0·112	—	—	0·0028	0·071
15	0·072	1·829	0·072	1·829	0·0571	1·450	42	0·0040	0·102	—	—	0·0025	0·063
16	0·064	1·626	0·065	1·651	0·0508	1·290	43	0·0036	0·091	—	—	0·0022	0·056
17	0·056	1·422	0·058	1·473	0·0453	1·151	44	0·0032	0·081	—	—	0·0020	0·051
18	0·048	1·219	0·049	1·245	0·0403	1·024	45	0·0028	0·071	—	—	0·0018	0·046
19	0·040	1·016	0·042	1·067	0·0359	0·912	46	0·0024	0·061	—	—	0·00157	0·040
20	0·036	0·914	0·035	0·889	0·0320	0·813	47	0·0020	0·051	—	—	0·00140	0·036
												0·00124	0·031
21	0·032	0·813	0·032	0·813	0·0285	0·724	48	0·0016	0·041	—	—	0·00099	0·025
22	0·028	0·711	0·028	0·711	0·0253	0·643	49	0·0012	0·030	—	—	0·00088	0·022
23	0·024	0·610	0·025	0·635	0·0226	0·574	50	0·0010	0·025	—	—	—	—

I.E.E. Current Ratings * for Rubber, P.V.C. or Polyethylene Insulated Cables
(13th Edition, 1st September 1955)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Nominal Cross-sectional Area of Conductor	*No. and Diameter of Wires*	*Two Single-core Cables d.c. or Single-phase a.c.*		*Three or four Single-core Cables*	*Four Single-core Cables*	*One Twin Cable*	*One Three-core or Four-core Cable*	*Two Single-core Cables without Metal Sheath*		*Three Single-core Cables without Metal Sheath*		*Two Single-core Cables Lead or Aluminium Sheathed*		*Three Single-core Cables Lead or Aluminium Sheathed*	
		D.c.	*A.c.*	*Balanced Three-phase a.c.*	*D.c. or Single-phase a.c.*	*D.c. or Single-phase a.c.*	*Balanced Three-phase a.c.*	*D.c. or Single-phase a.c.*		*Balanced Three-phase a.c.*		*D.c. or Single-phase a.c.*		*Balanced Three-phase a.c.*	
								D.c.	*A.c.*	*Flat Formation*	*Trefoil Formation*	*D.c.*	*A.c.*	*Flat Formation*	*Trefoil Formation*
sq. in.		*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
0·0015	1/0·044	5	5	5	5	5	5								
0·002	3/0·029	10	10	10	10	10	8								
0·003	3/0·036	15	15	13	13	15	10								
0·0045	7/0·029	20	20	15	15	20	15								
0·007	7/0·036	28	28	25	22	28	20								
0·01	7/0·044	36	36	32	29	36	25	Rubber insulated cables only				Rubber insulated cables only			
0·0145	7/0·052	43	43	39	34	43	30								
0·0225	7/0·064	53	53	48	42	53	37								
0·03	19/0·044	62	62	56	50	62	43								
0·04	19/0·052	74	74	67	59	74	52					†	†	†	†
0·06	19/0·064	97	97	88	78	97	68								
0·10	19/0·083	—	—	—	—	140	98	160	160	155	140	165	165	160	140
0·15	37/0·072	—	—	—	—	180	126	205	205	200	185	215	210	205	180
0·20	37/0·083	—	—	—	—	218	153	250	250	245	220	260	255	250	220
0·30	37/0·103	—	—	—	—	284	199	335	335	325	295	345	335	325	290
0·40	61/0·093	—	—	—	—	342	240	425	425	425	360	445	415	410	355
0·50	61/0·103	—	—	—	—	394	276	485	480	480	410	500	465	460	400
0·75	91/0·103	—	—	—	—	—	—	630	610	610	520	650	570	560	500
1·00	127/0·103	—	—	—	—	—	—	780	740	735	630	800	650	640	600
		Cables bunched and enclosed in one conduit, troughing or casing, or bunched in free air or in an open trench.				Cables in free air or in an open trench as defined on page 107 of the I.E.E. Regulations									

† See below—rating factors for aluminium sheathed cables.

* Above current ratings are extracted from the I.E.E. Regulations for the Electrical Equipment of Buildings—Thirteenth Edition, issued 1st September, 1955.

1. The current rating of a fittings wire (3/0·020) is 3 A.

2. For two or three cables having conductors of cross-sectional area exceeding 0·06 sq. in. (19/0·064) bunched in troughing or casing, the rating given in columns 9, 10 and 12 (non-metal sheathed cables) or columns 13 to 16 (inclusive) for metal sheathed cables apply, subject to a rating factor of 0·9. For four such cables so installed the ratings given in columns 9 and 10 or 13 and 14 shall be reduced by a factor of 0·9 and by a further factor (for grouping) of 0·8. For larger numbers the ratings given in columns 9 and 10 or 13 and 14 shall be reduced by a factor of 0·9 and by the further factor for larger groups set out below:

Groupings of Cables, Columns 3 and 4, d.c. or Single Phase a.c.

No. of circuits (pairs of cables)	3	5	10
Rating factor (applicable to columns 3 and 4)	0·7	0·6	0·5

Grouping of Cables, Column 5, Balanced Three-phase a.c.

No. of circuits (three cables per circuit or four cables where one is neutral)	2	3	4	6
Rating factor (applicable to column 5)	0·8	0·65	0·6	0·55

Rating Factor for Ambient Temperature.

Ambient air temperature	25° C (77° F)	35° C (95° F)	40° C (104° F)	45° C (113° F)
Rating factor	1·13	0·86	0·69	0·47

Grouping of Cables, columns 7 and 8.

Number of cables	2	3	4	5
Rating factor	0·8	0·7	0·65	0·6

Columns 9, 10, 11 and 12.—The ratings for three cables also apply to four cables in a three-phase four-wire system. For two or more circuits, each installed as defined on page 107 of the I.E.E. Regulations, no reduction in rating need be applied, providing that there is a clearance of at least 6 inches between circuits and that, if the number of circuits exceeds four, they are installed in a horizontal plane. Dispositions of groups of cables in closed trenches or in proximity to metalwork are dealt with in Appendix G of the I.E.E. ratings.

† For Aluminium-sheathed cables (a.c.).‡

Cross-sectional Area of Conductor	0·1 & 0·15 in^2	0·2 & 0·3 in^2	0·4 & 0·5 in^2	0·75 & 1·0 in
Rating factor:				
Two or three cables in flat formation	0·97	0·92	0·84	0·81
Three cables in trefoil formation	1·00	0·96	0·92	0·84

‡ For d.c. circuits, the ratings appropriate to lead-sheathed tables may be applied to aluminium-sheathed cables.

VALVE, PICTURE-TUBE, BATTERY AND TRANSISTOR DATA

THIS section gives technical data on valves, picture-tubes and transistors.

The recommended electrode letter symbols of the British Standards Institution, listed in B.S. 1409, have, where possible, been followed. Those used in the tables are explained below:

a	anode
k	cathode
g	grid
h	heater
f	filament
bp	beam plates
s	internal shield
t	target (tuning indicator)

In cases where a valve has more than one electrode system of the same type, electrodes of the same type are distinguished by the addition of "primes". The example below is for a double diode with separate cathodes:

k′ a″ h h k″ s a′

In the case of multiple valves using different electrode systems, the respective electrodes are distinguished by the addition of the following subscripts:

d	diode
t	triode
q	tetrode
p	pentode
h	hexode, heptode, etc.

For example, in the case of a double-diode triode with common cathode, the following symbols would be used:

g k h h a′d a″d at

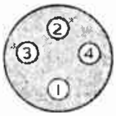
Subscripts are omitted wherever confusion is not likely to rise, for example in the case of the grids in the pentode system of a diode pentode.

Notes on Picture-tube Data Table

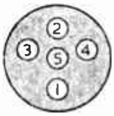
(1) The following abbreviations are used:

Al.	Tube with aluminised screen
E.C.	Tube with external conductive coating
E.S.	Tube with electrostatic focusing
I.T.	Tube fitted with ion trap
T.P.	Twin panel bonded safety glass

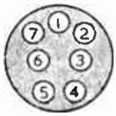
(2) The number given in brackets in the "Base" column indicates the appropriate base connection diagram, see page 63.



BRITISH 4 PIN (A Base)

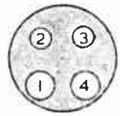


BRITISH 5 PIN (O Base)

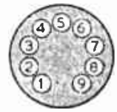


BRITISH 7 PIN (M Base)

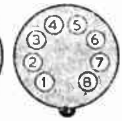
SIDE CONTACT (P Base)



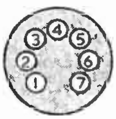
U.X. 4 PIN



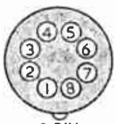
NOVAL (B9A)



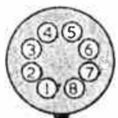
MAZDA OCTAL (MO)



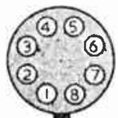
7 PIN MINATURE (B7G)



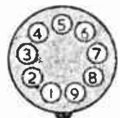
8 PIN MINATURE (B8A)



LOCTAL (B8G)



OCTAL (K Base)

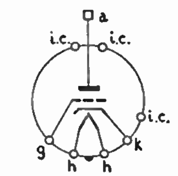


9 PIN ALL GLASS (B9G)

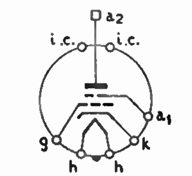
B3G

SPECIAL 1

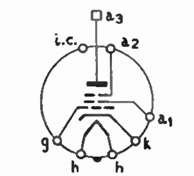
SPECIAL 2



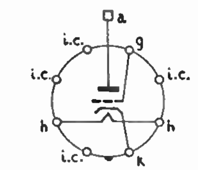
DUODECAL B12A TRIODE CONNECTIONS (1)



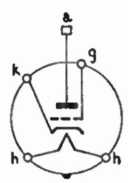
DUODECAL B12A TETRODE CONNECTIONS (2)



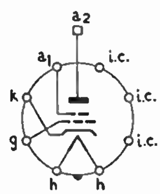
DUODECAL B12A PENTODE CONNECTIONS (3)



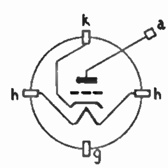
INTERNATIONAL OCTAL K (4)



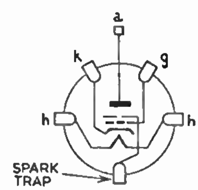
MAZDA OCTAL (5)



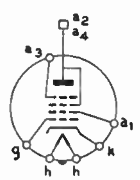
LOCTAL B8G (6)



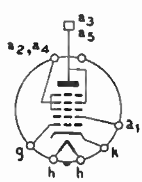
4-CLIP (7)



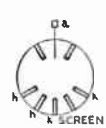
SIDE CONTACT (8)



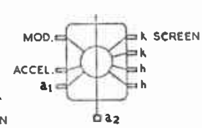
DUODECAL B12A HEXODE CONNECTIONS (9)



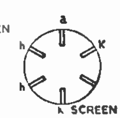
DUODECAL B12A HEPTODE CONNECTIONS (10)



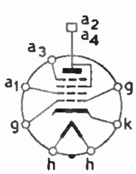
SIDE WIRE
TYPES 3/3, 3/4, 3/5, 3/6A



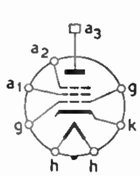
7-PIN SPLIT BASE
TYPES 6/5, 6/6



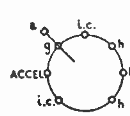
SIDE WIRE
TYPES 3/1, 3/2



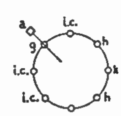
B8H HEXODE CONNECTION (11)



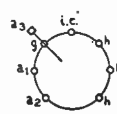
B8H PENTODE CONNECTION (12)



7-PIN (1)



7-PIN (2)



7-PIN (3)

EMISCOPE TUBES

Type	*Size (in.)*	*Gun*	*Heater*		*Base*	*Notes*	*Near Equivalents*
			V.	*A.*			
Brimar							
A47–13W	19	Hexode	6·3	0·3	B8H(11)	T.P., E.S., Al., E.C. (110°)	CME1906
AW47–91	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME1903
A59–13W	23	Hexode	6·3	0·3	B8H(11)	T.P., E.S., Al., E.C. (110°)	CME2306
AW59–91	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2303
C9A	9	Triode	2·0	1·4	MO(5)	Obsolete	CRM92
C9B	9	Triode	2·0	2·5	K(4)	Obsolete, Al.	
C12A	12	Triode	2·0	1·4	MO(5)	Obsolete	CRM121
C12B	12	Triode	2·0	2·5	K(4)	Al.	
C12D	12	Triode	2·0	2·5	K(4)	Obsolete, Al.	
C12E	12	Triode	6·3	0·6	K(4)	Obsolete	
C12FM	12	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	MW31–16, 121K, 12XP4, C12/1
C14BM	14	Triode	6·3	0·6	B12A(1)	E.C., Al.	
C14FM	14	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al. (70°)	CRM144
C14GM	14	Hexode	12·6	0·3	B12A(9)	E.S., I.T., E.C., Al. (70°)	
C14JM	14	Hexode	6·3	0·6	B12A(9)	E.S., I.T., E.C., Al. (70°)	
C14LM	14	Hexode	6·3	0·3	B12A(9)	E.S., E.C., Al. (70°)	
C14PM	14	Hexode	6·3	0·3	B12A(9)	E.S., I.T., E.C., Al (70°)	C14/3A, SE14/70 AW36–20
C15B	15	Triode	2·0	2·5	K(4)	Obsolete, Al.	15MW3A
C17AA	17	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	AW43–88
C17AF	17	Pentode	4·0	0·3	B8H(12)	E.S., Al., E.C. (110°)	
C17BM	17	Triode	6·3	0·6	B12A(1)	E.C., Al. (70°)	
C17FM	17	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al. (70°)	
C17GM	17	Hexode	12·6	0·3	B12A(9)	E.S., I.T., E.C., Al. (70°)	
C17HM	17	Tetrode	6·3	0·6	B12A(2)	I.T., E.C., Al.	
C17JM	17	Hexode	6·3	0·6	B12A(9)	E.S., I.T., E.C., Al. (70°)	
C17LM	17	Hexode	6·3	0·3	B12A(9)	E.C., Al. (70°)	
C17PM	17	Hexode	6·3	0·3	B12A(9)	E.S., E.C., I.T., Al. (70°)	
C17SM	17	Hexode	6·3	0·3	B12A(9)	E.S., E.C., Al. (90°)	
C19AH	19	Pentode	4·0	0·3	B8H(12)	E.S., Al., E.C. (110° short neck)	
C19AK	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	AW47–90, CME1902
C21AA	21	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	AW53–88
C21AF	21	Pentode	4·0	0·3	B8H(12)	E.S., Al., E.C. (110° short neck)	
C21HM	21	Tetrode	6·3	0·6	B12A(2)	I.T., E.C., Al. (70°)	
C21KM	21	Pentode	6·3	0·3	B12A(3)	I.T., E.C., Al.	C21/1A, 212K, TR21/22, MW53–80
C21NM	21	Pentode	6·3	0·3	B12A(3)	I.T., E.C., Al.	
C21SM	21	Hexode	6·3	0·3	B12A(9)	E.S., E.C., Al. (90°)	
C21TM	21	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al.	CRM212, 7502A
C23AG	23	Pentode	4·0	0·3	B8H(12)	E.S., Al., E.C. (110°)	
C23AK	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2302, AW59–90
C24KM	24	Pentode	6·3	0·3	B12A(3)	E.C., Al.	MW61–80
23SP4	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	
***Cathodeon* ***							
C12/1	12	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	C12FM, 121K, 12XP4A, MW31–74
C14/3	14	Hexode	6·3	0·3	B12A(9)	E.S., I.T., E.C.	
C14/3A	14	Hexode	6·3	0·3	B12A(9)	E.S., I.T., E.C., Al. (70°)	C14PM,SE14/70, AW36–20
C17/1	17	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (70°)	171K, 17ASP4, 17AXP4, TR17/21, MW43–64
C17/1A	17	Tetrode	6·3	0·3	B12A(2)	I.T., E.C., Al. (70°)	MW43–69, TR17/2,
C17/4A	17	Tetrode	6·3	0·3	B12A(2)	I.T., E.C., Al. (70°)	MW43–80
C17/5A	17	Hexode	6·3	0·3	B12A(9)	I.T., E.C., E.S., Al. (90°)	AW43–80
C17/6A	17	Hexode	6·3	0·6	B8H(11)	E.S., Al., E.C. (110°)	
C17/7A	17	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	AW43–88
C19/7A	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	
C21/1A	21	Tetrode	6·3	0·3	B12A(2)	I.T., E.C., Al. (90°)	C21KM, 212K, TR21/22, MW53–80
C21/7A	21	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	AW53–88
C23/7A	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	
C27/1A	27	Tetrode	6·3	0·3	B12A(2)	I.T., Al., E.C.	
C36/24	14	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (70°)	141K, 14KP4A, 14LP4, MW36–24, TR14/21
C36/24A	14	Tetrode	6·3	0·3	B12A(2)	I.T.	

Note: Brimar twin panel, bonded shield tubes are coded with suffix: T, standard glass; U anti-glare coated glass; W, " Diakon " bonded shield. E.g. C23AGU is C23AG with anti-glare coated glass twin panel.

* In the corresponding series of Cathodeon " Popular " tubes, the type references are the same except that the prefix " X " is used throughout in place of " C ". Details are identical for both series of tubes.

Type	Size (in.)	Gun	Heater V.	Heater A.	Base	Notes	Near Equivalents
Cossor							
65K/2	15	Triode	4	1·1	4-clip (7)	I.T. (45°)	
75K	10	Triode	6·3	0·55	4-clip (7)	I.T. (52°)	
85K	15	Triode	6·3	0·55	4-clip (7)	I.T. (52°)	
108K	10	Triode	6·3	0·55	4-clip (7)	I.T. (50°)	
112K	12	Tetrode	6·3	0·3	B12A(2)	Obsolete	MW31–18
121K	12	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C. (60°)	C12FM, MW31–74, 12XP4, 12XP4A, C12/1
141K	14	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C. (70°)	MW36–24, 14KP4A, 14LP4, 14KP4, C36–24
171K	17	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C. (70°)	17ASP4, 17ARP4, 17AXP4, C17/1, TR17/21, MW43–64
172K	17	Pentode	6·3	0·3	B12A(3)	Obsolete, I.T., E.C. (70°)	MW43–64
173K	17	Pentode	6·3	0·3	B12A(3)	Obsolete, I.T., E.C., Al. (70°)	MW43–69
212K	21	Pentode	6·3	0·3	B12A(3)	I.T., E.C., Al. (90°)	MW53–80
AW43–80	17	Heptode	6·3	0·3	B12A(9)	E.S., I.T., Al., E.C. (90°)	C17/5A
AW43–88	17	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	C17/7A
AW47–90	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	C19AK
AW47–91	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME1903
AW53–88	21	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	C21AA
AW59–90	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	C23AK
AW59–91	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2303
CRM141	14	Tetrode	12·6	0·3	B12A(2)	I.T., Al. (67°)	
CRM142	14	Tetrode	12·6	0·3	B12A(2)	I.T., Al. (67°)	
CRM171	17	Tetrode	12·6	0·3	B12A(2)	I.T., Al. (69°)	
CRM172	17	Tetrode	12·6	0·3	B12A(2)	I.T., Al., E.C. (69°)	7404A
MW31–74	12	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (63°)	121K, C12FM, 12XP4
MW36–44	14	Pentode	6·3	0·3	B12A(3)	I.T., E.C.(70°)	
MW43–69	17	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C.(70°)	172K, 173K, C17–2
MW53–80	21	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C. (90°)	C21/1A, C21KM, 212K, TR21/22
Emiscope *							
AW36–20	14	Heptode	6·3	0·3	B12A(10)	E.S., I.T., E.C., Al.	
AW43–80	17	Heptode	6·3	0·3	B12A(9)	E.S., I.T., E.C. (90°)	C17/5A, 17BTP4
AW43–88	17	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	C17/7A, C17AA, 17CVP4
MW36–44	14	Pentode	6·3	0·3	B12A(3)	I.T., E.C. (70°)	
MW43–69	17	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C. (70°)	173K, C17–2, 172K, P17A
MW53–80	21	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C. (90°)	C21/1A, C21KM, 212K
SE14/70	14	Hexode	6·3	0·3	B12A	I.T., Al., E.C.	C14PM, C14/3A
SE17/70	17	Hexode	6·3	0·3	B12A	I.T., Al., E.C.	C17PM
TA10	10	Tetrode	4·0	1·0	7-pin (1)	Al.	
TA15	15	Tetrode	4·0	1·0	7-pin (1)	Al.	
3/1	5	Triode	4·0	1·3	Side-wire	Obsolete	
3/2	7	Triode	4·0	1·3	Side-wire	Obsolete	
3/3	9	Triode	4·0	1·3	Side-wire	Obsolete	
3/4	10	Triode	4·0	1·3	Side-wire	Obsolete	
3/5	14	Triode	4·0	1·3	Side-wire	Obsolete	
3/6A	15	Triode	4·0	1·3	Side-wire	Obsolete	
3/16	10	Triode	*8·5	0·3	7-pin (2)	Al.	
3/18	12	Triode	*8·5	0·3	7-pin (2)	Al.	
3/20	10	Triode	11·5	0·3	4-clip (7)	Obsolete, I.T.	
3/31	12	Triode	*8·5	0·3	7-pin (2)	Al.	
3/32	15	Triode	*8·5	0·3	7-pin (2)	Al.	
4/13	21	Tetrode	*8·5	0·3	7-pin (3)	Obsolete, Al.	
4/14	14	Tetrode	*8·5	0·3	7-pin (3)	Al.	
4/14G	14	Tetrode	*8·5	0·3	7-pin (1)	Al., E.C.	
4/15	17	Tetrode	*8·5	0·3	7-pin (3)	Al.	
4/15G	17	Tetrode	*8·5	0·3	7-pin (1)	Al., E.C.	
5/2	14	Pentode	8·5	0·3	7-pin (3)	Obsolete, E.S., Al., E.C.	
5/2T	14	Pentode	8·5	0·3	7-pin (3)	E.S., Al., E.C.	
5/3	17	Pentode	8·5	0·3	7-pin (3)	Obsolete, E.S., Al., E.C.	
5/3T	17	Pentode	8·5	0·3	7-pin (3)	E.S., Al., E.C.	
6/5	9	Hexode	4·0	1·3	7-pin split	E.S.	
6/6	12	Hexode	4·0	1·3	7-pin split	E.S.	
6506A	9	Triode	6·3	0·3	K(4)	Al.	
6802A	14	Triode	6·3	0·3	K(4)	Al. (55°)	
6901A	16	Triode	6·3	0·3	B12A(1)	Al. (70°)	

* Emiscope heater voltages were progressively reduced from 13·3 volts to 8·5 volts over a period of several years. The current rating of 0·3 amp. remains the same. Emiscope now supply domestic tube types previously marketed by G.E.C. (M.O. Valve Co.).

Type	Size (in.)	Gun	Heater V.	Heater A.	Base	Notes	Near Equivalents
Emiscope *							
7101A	12	Triode	6·3	0·3	K(4)	E.C., Al.	
7102A	12	Triode	6·3	0·3	K(4)	E.C., Al. (55°)	
7201A	14	Triode	6·3	0·3	B12A(1)	E.C., Al. (70°)	
7203A	14	Triode	6·3	0·3	B12A(1)	E.C., Al. (70°)	
7204A	14	Tetrode	12·6	0·3	B12A(2)	E.C., Al.	CRM144
7205A	14	Hexode	12·6	0·3	B12A(9)	E.S., I.T., E.C., Al.	CRM1402
7401A	17	Triode	6·3	0·3	B12A(1)	E.C., Al. (70°)	
7404A	17	Tetrode	12·6	0·3	B12A(2)	E.C., Al.	CRM172
7405A	17	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME1703
7406A	17	Pentode	12·6	0·3	B8H(12)	E.S., Al., E.C. (110°)	CME1705
7501A	21	Triode	6·3	0·3	B12A(1)	E.C., Al.	
7502A	21	Tetrode	12·6	0·3	B12A(2)	E.C., Al.	CRM212
7503A	21	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2101
7504A	21	Pentode	12·6	0·3	B8H(12)	E.S., Al., E.C. (110°)	CME2104
7601A	19	Hexode	12·6	0·3	B8H(11)	E.S., A.R., E.C. (110°)	CME1901
7701A	23	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2301
Emitron							
12XP4	12	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C. (60°)	C12FM, MW31-16, 121K
12XP4A	12	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	MW31-74, 121K (near)
14KP4	14	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	MW36-24, 141K
14KP4A	14	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C. (70°)	MW36-24, 141K
14LP4	14	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (70°)	MW36-24, 141K
15EP4	15	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (52°)	
17ASP4	17	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C.	171K
17AXP4	17	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (70°)	171K (near)
85K	15	Triode	6·3	0·55	4-clip (7)	Obsolete, I.T. (52°)	85K
108K	10	Triode	6·3	0·55	4-clip (7)	Obsolete, I.T. (50°)	108K
English Electric							
T901	16	Tetrode	6·3	0·6	B12A(2)	Obsolete, I.T., Metal cone	
T901A	16	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., Metal cone (70°)	16GP4
T906	14	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C., Al.	
T908	17	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C.	
T909	21	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., Metal cone	
T911	17	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C., Al.	
Ferranti							
T9/2	9	Triode	4·0	1·0	K(4)	Obsolete	
T9/3	9	Triode	4·0	1·0	K(4)	Obsolete	
T9/5	9	Triode	4·0	1·0	K(4)	Obsolete E.C.	
T12/2	12	Triode	4·0	1·0	K(4)	Obsolete	C12D
T12/44	12	Triode	4·0	0·95	K(4)	Obsolete	
T12/46	12	Triode	6·3	0·6	K(4)	Obsolete	
T12/54	12	Triode	4·0	0·95	K(4)	Obsolete, E.C.	
T12/56	12	Triode	6·3	0·6	K(4)	Obsolete, E.C.	
T12/71U	12	Triode	8·0	0·3	K(4)	Obsolete, E.C.	
T12/72U	12	Triode	8·0	0·3	K(4)	E.C.	
T12/81U	12	Triode	8·0	0·3	K(4)	Obsolete, Al.	
T12/82U	12	Triode	8·0	0·3	K(4)	Obsolete, E.C., Al.	
T12/91	12	Triode	2·0	1·5	K(4)	Obsolete	
T12/92	12	Triode	2·0	1·5	K(4)	Obsolete E.C.	
T12/100	12	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	
T12/404	12	Triode	4·0	0·95	K(4)	Obsolete, Al.	
T12/449	12	Triode	4·0	0·95	K(4)	Obsolete	
T12/504	12	Triode	4·0	0·95	K(4)	Obsolete, Al., E.C.	
T12/549	12	Triode	4·0	0·95	K(4)	E.C.	
TR14/1	14	Triode	4·0	0·95	K(4)	Obsolete, Al.	
TR14/2	14	Triode	4·0	0·95	K(4)	Obsolete, E.C. Al.	
TR14/4	14	Triode	6·3	0·3	K(4)	Obsolete, E.C., Al.	
TR14/8	14	Triode	6·3	0·3	B12A(1)	Obsolete, E.C., Al.	
TR14/12	14	Tetrode	6·3	0·3	B12A(2)	Obsolete, Al.	
TR14/13	14	Tetrode	6·3	0·3	B12A(2)	Obsolete, E.C., Al.	
TR14/15	14	Tetrode	6·3	0·3	B12A(2)	Obsolete, E.C., Al.	
TR14/21	14	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C.	
TR14/22	14	Tetrode	6·3	0·3	B12A(2)	I.T., E.C., Al.	
TR17/1	17	Triode	4·0	0·95	K(4)	Obsolete, Al.	
TR17/2	17	Triode	4·0	0·95	K(4)	Obsolete, E.C., Al.	
TR17/7	17	Tetrode	6·3	0·3	B12A(2)	Obsolete, Al.	

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Type	*Size (in.)*	*Gun*	*Heater*		*Base*	*Notes*	*Near Equivalents*
			V.	*A.*			
Ferranti							
TR17/8	17	Tetrode	6·3	0·3	B12A(2)	Obsolete, E.C., Al.	
TR17/10	17	Tetrode	6·3	0·3	B12A(2)	Obsolete, E.C., Al.	
TR17/21	17	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C.	MW43-64
TR17/22	17	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C., Al. (65°)	
TR21/21	21	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (85°)	
TR21/22	21	Tetrode	6·3	0·3	B12A(2)	I.T., E.C., Al. (85°)	
MW31-74	12	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	
MW36-24	14	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	
MW36-44	14	Pentode	6·3	0·3	B12A(3)	I.T., E.C.	
MW43-64	17	Pentode	6·3	0·3	B12A(3)	Obsolete, I.T., E.C.	
MW43-69	17	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C.	
MW53-80	21	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C. (90°)	
G.E.C.							
6501	9	Triode	6·3	0·3	K(4)	Obsolete	
6502	9	Triode	6·3	0·3	K(4)	Obsolete	
6503	9	Triode	10·5	0·3	K(4)	Obsolete	
6504	9	Triode	6·3	0·5	K(4)	Obsolete	
6504A	9	Triode	6·3	0·5	K(4)	Obsolete, E.C., Al.	
6505	9	Triode	10·5	0·3	K(4)	Obsolete, E.C.	
6505A	9	Triode	10·5	0·3	K(4)	Obsolete, E.C., Al.	
6506A	9	Triode	6·3	0·3	K(4)	Al.	
6703A	12	Triode	6·3	0·5	K(4)	Obsolete, E.C., Al.	
6704A	12	Triode	10·5	0·3	K(4)	Obsolete, E.C., Al.	
6705A	12	Triode	6·3	0·5	K(4)	Obsolete, E.C., Al.	
6706A	12	Triode	10·5	0·3	K(4)	Obsolete, E.C., Al.	
6801A	14	Triode	6·3	0·5	K(4)	Obsolete, Al.	
6802A	14	Triode	6·3	0·3	K(4)	Al. (55°)	
6901A	16	Triode	6·3	0·3	B12A(1)	Al. (70°)	
7101A	12	Triode	6·3	0·3	K(4)	E.C., Al.	
7102A	12	Triode	6·3	0·3	K(4)	E.C., Al. (55°)	
7201A	14	Triode	6·3	0·3	B12A(1)	E.C., Al. (70°)	
7203A	14	Triode	6·3	0·3	B12A(1)	E.C., Al. (70°)	
7204A	14	Tetrode	12·6	0·3	B12A(2)	E.C., Al.	CRM144
7205A	14	Hexode	12·6	0·3	B12A(9)	E.S., I.T., E.C., Al.	CME1402
7401A	17	Triode	6·3	0·3	B12A(1)	E.C., Al. (70°)	
7404A	17	Tetrode	12·6	0·3	B12A(2)	E.C., Al.	CRM172
7405A	17	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME1703
7406A	17	Pentode	12·6	0·3	B8H(12)	E.S., Al., E.C. (110°)	CME1705
7502A	21	Tetrode	12·6	0·3	B12A(2)	E.C., Al.	CRM212
7503A	21	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2101
7504A	21	Pentode	12·6	0·3	B8H(12)	E.S., Al., E.C. (110°)	CME2104
7601A	19	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME1901
7701A	23	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2301
Lifeguard							
L14-70	14	refer to equivalents					MW36-24
L14-70E	14	refer to equivalents					AW36-21
L14-70T	14	refer to equivalents					7201A, C14BM
L17-70	17	refer to equivalents					MW43-69
L17-70T	17	refer to equivalents					7401A, C17BM
L17-90E	17	refer to equivalents					AW43-80
L17-90T	17	refer to equivalents					MW43-80
L17-110	17	refer to equivalents					AW53-88
L21-80	21	refer to equivalents					MW53-80
L21-80A	21	refer to equivalents					AW53-80
L21-110	21	refer to equivalents					
Mazda							
A47-13W	19	Hexode	6·3	0·3	B8H(11)	T.P., E.S., Al., E.C. (110°)	CME1906
A59-13W	23	Hexode	6·3	0·3	B8H(11)	T.P., E.S., Al., E.C. (110°)	CME2306
AW47-90	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME1902
AW47-91	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME1903
AW47-97	19	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME1901
AW59-90	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2302
AW59-91	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2303
AW59-95	23	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2301
CME141	14	Hexode	12·6	0·3	B12A(9)	E.S., I.T., E.C., Al. (70°)	
CME1402	14	Hexode	12·6	0·3	B12A(9)	E.S., I.T., E.C., Al. (90°)	7205A
CME1702	17	Hexode	12·6	0·3	B12A(9)	E.S., E.C., Al. (90°)	
CME1703	17	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	7405A
CME1705	17	Pentode	12·6	0·3	B8H(12)	E.S., Al., E.C. (110°)	7406A
CME1901	19	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	7601A, AW47-90

Type	Size (in.)	Gun	Heater V.	Heater A.	Base	Notes	Near Equivalents
Mazda							
CME1902	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	AW47-90
CME1903	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	AW47-91
CME1906	19	Hexode	6·3	0·3	B8H(11)	T.P., E.S., Al., E.C. (110°)	A47-13W
CME2101	21	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	7503A
CME2104	21	Pentode	12·6	0·3	B8H(12)	E.S., Al., E.C. (110°)	7504A
CME2301	23	Hexode	12·6	0·3	B8H(11)	E.S., Al., E.C. (110°)	7701A, AW59-95
CME2302	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	AW59-90
CME2303	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	AW59-91
CME2306	23	Hexode	6·3	0·3	B8H(11)	T.P., E.S., Al., E.C. (110°)	A59-13W
CRM71	7	Triode	2·0	1·4	—	Obsolete	MW18-2
CRM91	9	Triode	2·0	1·4	MO(5)	Obsolete (64°)	C9A
CRM92	9	Triode	2·0	1·4	MO(5)	Obsolete, (57°)	C9A
CRM92A	9	Triode	2·0	1·4	MO(5)	Obsolete (57°)	C9A
CRM93	9	Tetrode	12·6	0·3	B12A(2)	Obsolete I.T., Al.	
CRM121	12	Triode	2·0	1·4	MO(5)	Obsolete, (57°)	C12A
CRM121A	12	Triode	2·0	1·4	MO(5)	Obsolete, (57°)	
CRM121B	12	Triode	2·0	1·4	MO(5)	(57°)	
CRM122	12	Triode	7·3	0·3	MO(5)	(57°)	
CRM123	12	Triode	2·0	1·4	MO(5)	Al. (57°)	
CRM124	12	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al. (57°)	
CRM141	14	Tetrode	12·6	0·3	B12A(2)	I.T., Al. (67°)	
CRM142	14	Tetrode	12·6	0·3	B12A(2)	I.T., Al. (67°)	
CRM143	14	Tetrode	12·6	0·3	B12A(2)	I.T., Al. (70°)	
CRM144	14	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al. (70°)	7204A
CRM151	15	Triode	2·0	1·4	MO(5)	Al. (51°)	
CRM152A	15	Triode	2·0	1·4	B12A(1)	Obsolete, Al. (67°)	
CRM152B	15	Triode	2·0	1·4	B12A(1)	Al. (67°)	
CRM153	15	Tetrode	12·6	0·3	B12A(2)	I.T., Al. (67°)	
CRM171	17	Tetrode	12·6	0·3	B12A(2)	I.T., Al. (69°)	
CRM172	17	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al. (69°)	7404A
CRM173	17	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al. (90°)	
CRM211	21	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al. (70°)	
CRM212	21	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al. (90°)	7502A
CRM241	24	Tetrode	12·6	0·3	B12A(2)	I.T., E.C., Al. (90°)	
MW53-20	21	Pentode	6·3	0·3	B12A(3)	I.T., E.C., Al. (70°)	
Mullard							
MW6-2	2½	Triode	6·3	0·3	S.C.(8)	Projection tube, E.C., Al.	3NP4
MW22-7	9	Tetrode	6·3	0·6	B8G(6)	Obsolete	
MW22-14	9	Tetrode	6·3	0·3	B8G(6)	Obsolete	
MW22-14C	9	Tetrode	6·3	0·3	B8G(6)	Obsolete	
MW22-16	9	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (60°)	
MW22-17	9	Tetrode	6·3	0·3	B12A(2)	Obsolete	
MW22-18	9	Tetrode	6·3	0·3	B12A(2)	Obsolete, E.C.	
MW31-7	12	Tetrode	6·3	0·6	B8G(6)	Obsolete	
MW31-14	12	Tetrode	6·3	0·3	B8G(6)	Obsolete, E.C.	
MW31-14C	12	Tetrode	6·3	0·3	B8G(6)	Obsolete	
MW31-16	12	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C.	C12FM, 121K ,MW31-74, 12XP4
MW31-17	12	Tetrode	6·3	0·3	B12A(2)	Obsolete	
MW31-18	12	Tetrode	6·3	0·3	B12A(2)	Obsolete, E.C.	112K
MW31-20	12	Tetrode	6·3	0·3	B8G(6)	Obsolete	
MW31-21	12	Tetrode	6·3	0·3	B8G(6)	Obsolete, E.C.	
MW31-22	12	Tetrode	6·3	0·3	B12A(2)	Obsolete	
MW31-23	12	Tetrode	6·3	0·3	B12A(2)	Obsolete, E.C.	
MW31-74	12	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (60°)	12XP4A, 121K, C12FM
MW36-22	14	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C.	MW36-24
MW36-24	14	Tetrode	6·3	0·3	B12A(2)	Obsolete, I.T., E.C. (70°)	14KP4A, 14LP4, 141K
MW36-44	14	Pentode	6·3	0·3	B12A(3)	I.T., E.C. (70°)	
MW41-1	16	Tetrode	6·3	0·3	B12A(2)	L.T., Met. (70°)	T901, T901A
MW43-43	17	Pentode	6·3	0·3	B12A(3)	I.T., Met. (70°)	
MW43-64	17	Pentode	6·3	0·3	B12A(3)	Obsolete, I.T., E.C. (70°)	172K, MW43-69
MW43-69	17	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C. (70°)	173K, C17-2, 172K, P17A
MW43-80	17	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C. (90°)	
MW53-20	21	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C. (70°)	
MW53-80	21	Pentode	6·3	0·3	B12A(3)	I.T., Al., E.C. (90°)	C21/1A, C21KM, 212K, TR21/22
AW36-20	14	Heptode	6·3	0·3	B12A(10)	E.S., I.T., E.C., Al.	
AW36-21	14	Heptode	6·3	0·3	B12A(9)	E.S., I.T., E.C. (70°)	
AW36-80	14	Heptode	6·3	0·3	B12A(10)	E.S., I.T., E.C., Al. (90°)	
AW43-80	17	Heptode	6·3	0·3	B12A(9)	E.S., I.T., E.C. (90°)	C17/5A
AW43-88	17	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	C17/7A, C17AA

Type	Size (in.)	Gun	Heater V.	Heater A.	Base	Notes	Near Equivalents
Mullard							
AW43-89	17	Pentode	6·3	0·3	B8H(12)	E.S., Al., E.C. (110°)	
AW47-90	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	C19AK
AW47-10	19	Hexode	6·3	0·3	B8H(11)	T.P., E.S., Al., E.C. (110°)	
AW47-91	19	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME1903
AW53-80	21	Heptode	6·3	0·3	B12A(9)	E.S., I.T., E.C. (90°)	
AW53-88	21	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	C21AA
AW53-89	21	Pentode	6·3	0·3	B8H(12)	E.S., Al., E.C. (110°)	
AW59-10	23	Hexode	6·3	0·3	B8H(11)	T.P., E.S., Al., E.C. (110°)	
AW59-90	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	
AW59-91	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	CME2303
Pinnacle							
P12	12	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	MW31-74, MW31-16, T12/100, C12FM, 12XP4A, 121K
P14	14	Triode	6·3	0·3	B12A(1)	Obsolete, I.T., E.C.	C14BM, TR14/13, 7201A
P14ES	14	Heptode	6·3	0·3	B12A(9)	E.S., I.T., E.C. (70°)	AW36-21
P17	17	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	MW43-64, TR17/21, 17ASP4, 172K
P17A	17	Tetrode or Pentode	6·3	0·3	B12A(2) or (3)	I.T., Al., E.C.	MW43-69
P17AM	17	Tetrode	12·6	0·3	B12A(2)	I.T., Al., E.C. (69°)	CRM172
P17EH	17	Hexode	6·3	0·3	B8H(11)	Obsolete, E.S., Al., E.C. (110°)	AW43-88
P17EN	17	Heptode	6·3	0·3	B12A(9)	Obsolete, E.S., I.T., E.C. (90°)	AW43-80
P17M	17	Tetrode	6·3	0·3	B12A(2)	I.T., E.C. (70°)	
P17MN	17	Pentode	6·3	0·3	B12A(3)	Obsolete, I.T., Al., E.C. (90°)	MW43-80
P141	14	Tetrode	6·3	0·3	B12A(2)	I.T., E.C.	141K, 14KP4, 14KPA, MW36-22, MW36-24, MW36-44
Sylvania							
23SP4	23	Hexode	6·3	0·3	B8H(11)	E.S., Al., E.C. (110°)	

Germanium Diode Comparison Table

The following diodes are approximately equivalent, and can usually be interchanged:

CG5C, CG12E, GD3, GEX33, GEX35, OA60, WG4A
CG7C, GD4, GEX44, WG5A
CG1E, CG4E, CG6E, GD5, GEX33, GEX55, OA61, WG6A
CG6E, GD6, GEX34, GEX45/1, OA70, WG5B, 1N87
CG4E, CG10E, CG44H, GD8, GEX34, GEX45/1, GEX54, OA71, WG7D
CG42H, GD9, OA81, OA85, OA86, GEX58, 1N476
GD11, GEX39, WG4B
CG12E, GD12, GEX35, OA70, OA73, WG4A

Basic Transistor Circuits

Characteristics	*Common emitter*	*Common base*	*Common collector*
Voltage gain	High	High	Less than one
Current gain	High	Less than one	High
Power gain	High	Medium	Low
Frequency limits	Low	High	Low
Phase shift	180°	Nil	Nil
Input impedance	Medium	Very low	High
Output impedance	Medium	High	Low

Obsolete Picture-tube Replacement Table

Original Tube	*Suggested Replacement*	*Notes*
Cathodeon		
C17/2	C17/1 or X17/1	—
C17/6A	C17/7A or X17/7A	Remove 0·6-amp. heater transformer, insert tube heater in series heater chain
Cossor		
65K	65K/2	Fit ion trap
112K	MW31–74	Fit ion trap
121K	MW31–74	—
141K	MW36–44	Ensure that any connections to pin 7 are removed and anchored elsewhere. Then connect pin 7 to pin 11
171K	MW43–69	See note on 141K
172K	MW43–69	
173K	MW43–69	
Emiscope		
3/3	TA10	Makers' modification kit AE351
3/4	TA10/J	Makers' modification kit AE321
3/5	TA15/J	Makers' modification kit AE313
3/6A	TA15/J	Makers' modification kit AE313
3/20	3/16	Makers' modification kit AE312
5/2T	SE14/70	Makers' modification kit AE386
5/3T	SE17/70	Makers' modification kit AE386
Ferranti		
T9/2	T9/3	—
T12/2	T12/44	Change mask. T12/44 has a flat face
T12/46	T12/44	Insert 2·5-ohm, 2·5-w. resistor in series with one heater lead
T12/54	T12/549	—
T12/56	T12/549	Insert 2·5-ohm, 2·5-w. resistor in series with one heater lead
T12/71U	T12/72U	Earth external conductive coating
T12/81U	T12/72U	Earth external conductive coating
T12/82U	T12/72U	—
T12/404	T12/44	—
T12/449	T12/44	—
T12/504	T12/549	—
TR14/2	TR14/8	Refer to manufacturers for modification data
TR14/4	TR14/8	Change valveholder to duodecal type
TR14/15	TR14/13	—
TR17/2	TR17/21	Refer to manufacturers for modification data
TR17/8	TR17/10	—
G.E.C.		
6703A	7101A	Note differences in heater ratings
6704A	7101A	Note differences in heater ratings
6705A	7102A	Note differences in heater ratings
6706A	7102A	Note differences in heater ratings
Mazda		
CRM71	—	No replacement
CRM91	—	No replacement
CRM92	—	No replacement
CRM92A	—	No replacement
CRM121	CRM121B or CRM123	Aluminised tube CRM123 may be fitted provided E.H.T. exceeds 7·5 kV
CRM121A	CRM121B or CRM123	See CRM121
CRM141	CRM141/CRM142	—
CRM142	CRM141/CRM142	—
CRM152A	CRM152B	Aluminised tube CRM152B has a grey face
Mullard		
MW22–7	MW22–16	Change base, earth external coating; Fit ion-trap magnet type IT6 *
MW22–14	MW22–16	Change base; Fit ion-trap magnet type IT6 *
MW22–14C	MW22–16	Change base, earth external coating; Fit ion-trap magnet type IT6 *
MW22–17	MW22–16	Earth external coating; Fit ion-trap magnet type IT6 *
MW22–18	MW22–16	—; Fit ion-trap magnet type IT6 *
MW31–7	MW31–74	Change base, earth external coating; Fit ion-trap magnet type IT6 *
MW31–14	MW31–74	Change base; Fit ion-trap magnet type IT6 *
MW31–14C	MW31–74	Change base, earth external coating; Fit ion-trap magnet type IT6 *
MW31–16	MW31–74	—
MW31–17	MW31–74	Earth external coating; Fit ion-trap magnet type IT6 *
MW31–18	MW31–74	Fit ion-trap magnet type IT6 *
MW31–20	MW31–74	Change base, earth external coating; Fit ion-trap magnet type IT6 *
MW31–21	MW31–74	Change base; Fit ion-trap magnet type IT6 *
MW31–22	MW31–74	Change base, earth external coating; Fit ion-trap magnet type IT6 *
MW31–23	MW31–74	Change base; Fit ion-trap magnet type IT6 *
MW36–22	MW36–44	Connect pin 7 (a2) to pin 11 (k)
MW43–64	MW43–69	—

Transistor Data

Following are transistors from the " entertainment " ranges of British manufacturers:

Type	*Description*	*Connections*	*Comparative Types* *
Brimar			
TK1001	Package of A.F. driver and output pair		
TK1000	Package of mixer and two I.F. transistors		
TS1	pnp small signal A.F. transistor (superseded)		
TS2	pnp small signal A.F. transistor (superseded)		
TS3	pnp small signal A.F. transistor (superseded)		
TS7	pnp R.F./I.F. transistor (fα 5·5 Mc/s.)		
TS8	pnp R.F. transistor (fα 11 Mc/s.)	Lead arrangement: emitter-base–collector reading anti-clockwise with white spot indicating collector	XA101, GET873, OC45, V6/R4
TS13	pnp A.F. transistor (replaces TS3)		XA102, GET874, OC44, V6/R8
TS14	pnp A.F. transistor (replaces TS1, TS2)		
TS17	pnp large signal A.F. transistor		
TK23C	pnp large signal A.F. transistor		
TK40C	pnp large signal A.F. transistor		
TK41C	pnp large signal A.F. transistor		
TK42C	pnp large signal A.F. transistor		
***Ediswan Mazda*†**			
XA101	pnp I.F. amplifier transistor (fα 5 Mc/s.)		GET873, OC45, V6/R4, TS7, NKT153/25
XA102	pnp Mixer/oscillator R.F. transistor (fα 8 Mc/s.)	"Base" centre lead with white spot near collector	GET874, OC44, V6/R8, TS8, NKT152
XA103	pnp I.F. amplifier transistor (fα 2 Mc/s.)		NKT143
XA104	pnp Mixer/oscillator R.F. transistor (fα 4 Mc/s.)		NKT143
XA111	pnp I.F. amplifier transistor (fα 5 Mc/s.)	B E–C	GET873, NKT143
XA112	pnp Mixer/oscillator R.F. transistor (fα 8 Mc/s.)		GET874, NKT142
XA121	pnp drift I.F. amplifier transistor		
XA122	pnp drift mixer/oscillator R.F. transistor		
XA123	pnp drift H.F. mixer transistor (fα 30 Mc/s.)	E–B–M––C (M metallising)	
XA124	pnp drift H.F. frequency changer transistor (fα 30 Mc/s.)		
XA126	pnp drift H.F. amplifier transistor (fα 30 Mc/s.)		
XA131	pnp drift V.H.F. amplifier transistor (fα 100 Mc/s.)	B E–C red dot near collector	2N384
XB102	pnp A.F. amplifier-transistor	"Base" centre with white spot near collector	NKT224
XB103	pnp A.F. amplifier or driver transistor		NKT262
XB104	pnp A.F. amplifier or driver transistor		
XB112	pnp A.F. amplifier or driver transistor	B E–C	GET103, NKT224
XB113	pnp A.F. amplifier or driver transistor	B E–C	GET113, NKT262
XC101	pnp A.F. output transistor	"Base" centre lead with white spot near collector	NKT252, NKT262
XC121	pnp A.F. output transistor	B E–C	GET103, NKT251, NKT261
XC131	pnp A.F. output transistor		
XC141	pnp A.F. power transistor		2N301, GET572, NKT404
XC142	pnp A.F. power transistor	B–E when pins towards upper circumference with collector to flange	2N301A, NKT404
XC155	pnp A.F. power transistor		
XC156	pnp A.F. power transistor		
G.E.C.			
GET7	pnp A.F. power transistor		V15/30P
GET8	pnp A.F. power transistor		OC16, V30/30P
GET9	pnp A.F. power transistor		
GET102	pnp M.F. high gain transistor (fα 1·5 Mc/s.)		OC75, NKT221
GET103	pnp M.F. general purpose transistor (fα 1 Mc/s.)	Three leads reading clockwise: collector; emitter; base. The collector coded with white mark on sleeve. Red sleeve indicates emitter. Green sleeve indicates base	OC70, OC71, OC72, TS13, TS14, TS17, XC101, XB102, XB103
GET105	pnp medium power transistor (fα 0·9 Mc/s.)		
GET106	pnp low noise M.F. transistor (fα 1 Mc/s.)		NKT246
GET113	pnp high gain M.F. transistor (fα 1·5 Mc/s.)		
GET114	pnp general purpose M.F. transistor (fα 1 Mc/s.)		GT1, GT2, GT3, V10/30A, V10/50B, XB104, NKT252
GET115	pnp general purpose medium power transistor (fα 1 Mc/s.)		NKT303

† Manufacture of the A.E.I. Radio and Electronic Components Division's range of transistors has been discontinued.

Type	*Description*	*Connections*	*Comparative Types**
G.E.C.			
GET116	pnp general purpose medium power transistor (f_α 1 Mc/s.)	Three leads reading clockwise: collector; emitter; base. The collector coded with white mark on sleeve. Red sleeve indicates emitter. Green sleeve indicates base	NKT302
GET691	pnp H.F. drift transistor (f_α 30 Mc/s.)		
GET692	pnp H.F. drift transistor		
GET873	pnp I.F. amplifier transistor (f_α 6 Mc/s.)		GT11, GT12, OC45, TS7, V6/R4, XA101, NKT33
GET874	pnp Mixer/oscillator transistor (f_α 15 Mc/s.)		GT13, OC44, TS8, V6/R8, XA102, NKT32
Mullard			
AC107	pnp low-noise A.F. pre-amplifier transistor	E–B–C with red spot near collector	
AF102	pnp alloy-diffused V.H.F. transistor for use to about 200 Mc/s.		
AF114	pnp alloy diffused V.H.F. transistor for use up to 100 Mc/s.		
AF115	pnp alloy-diffused V.H.F. transistor for use to about 100 Mc/s.	E–B–M– –C (M metal case)	
AF116	pnp alloy-diffused H.F. transistor for 10·7 Mc/s. I.F. amplifiers		
AF117	pnp alloy diffused M.F. transistor for use on M.W./L.W. receivers		
AF118	pnp alloy diffused video amp. transistor		
AF127	pnp alloy-diffused miniature transistor for M.W./L.W. receivers	B–E–C–M (M shield) reading clockwise from locating tab	2G417
OC16W	pnp A.F. power transistor	Emitter blue, base yellow collector side tab	NKT453, 2N115
OC19	pnp A.F. car radio power transistor	B–E when pins towards upper circumference with collector to flange	NKT453
OC26	pnp A.F. car radio power transistor		NKT452
OC44	pnp R.F. frequency changer transistor (f_α 15 Mc/s.)		GET874, NKT32, NKT42
OC45	pnp I.F. amplifier transistor (f_α 6 Mc/s.)		GET873, NKT33, NKT43
OC65	pnp A.F. subminiature transistor		
OC66	pnp A.F. subminiature transistor		
OC70	pnp A.F. transistor		2N279
OC71	pnp A.F. transistor	E–B–C with red spot near collector	NKT244, 2N280
OC72	pnp large signal A.F. transistor		NKT243, 2N281
OC75	pnp small-signal A.F. transistor		
OC78	pnp large signal A.F. transistor		GET114
OC81	pnp large signal A.F. transistor		GET114, NKT251, NKT252
OC82	pnp large-signal A.F. transistor		
OC170	pnp alloy diffused H.F. transistor (f_1 70 Mc/s.)	E–B–M– –C (M metal case)	
OC171	pnp alloy diffused V.H.F. transistor (f_1 70 Mc/s.)		
Newmarket			
V6/R2	pnp I.F. transistor (f_α 3 Mc/s.)	E–B– –C	NKT134
V6/R4	pnp R.F./I.F. transistor (f_α 5·5 Mc/s.)	E–B– –C	XA101, TS7, GET873, OC45, NKT133
V6/R8	pnp R.F. transistor (f_α 10 Mc/s.)	E–B– –C	XA102, TS8, GET874, OC44, NKT132
V10/15A	pnp A.F. transistor	E–B– –C	NKT205
V10/30A	pnp A.F. transistor	E–B– –C	NKT204
V10/50B	pnp M.F. transistor (f_α 1·2 Mc/s.)	E–B– –C	
V15/10P	pnp A.F. power transistor	Collector 0BA screw, emitter left	
V15/20IP	pnp A.F. intermediate power transistor	—	NKT351
V15/20P	pnp A.F. power transistor	as V15/10P	
V15/20R	pnp H.F. drift transistor (f_α 20 Mc/s.)	—	
V15/30P	pnp A.F. power transistor	as V15/10P	
V30/10P	pnp A.F. power transistor	as V15/10P	
V30/20IP	pnp A.F. intermediate power transistor	—	NKT351
V30/20P	pnp A.F. power transistor	as V15/10P	
V30/30P	pnp A.F. power transistor	as V15/10P	
NKT32	pnp H.F. amplifier-mixer ($f_{\infty} > 7·5$ Mc/s.	E–B–C reading clockwise from tab (SO12B)	OC44
NKT33	pnp I.F. amplifier ($f_{\infty} > 3$ Mc/s.)		OC45
NKT52–54	pnp radio R.F./I.F. package	E–B–C reading clockwise from tab (SO12B)	
NKT62–64	pnp radio R.F./I.F. package	E–B–C reading clockwise from tab (TO5)	
NKT151	pnp mixer-oscillator (M.W./S.W.)	E–B– –C	
NKT152	pnp mixer-oscillator (M.W.)	E–B– –C	
NKT153	pnp high-gain I.F. amplifier (470 kc/s.)	E–B– –C	

Type	*Description*	*Connections*	*Comparative Types* *
Newmarket			
NKT154	pnp medium-gain I.F. amplifier	E–B– –C	
NKT155	pnp detector	E–B– –C	
NKT161–5	As NKT151–5 but different shape	E–B–C reading clockwise from tab (TO5)	
NKT223	pnp High-gain A.F. amplifier	E–B–C reading clockwise from tab (TO5)	
NKT224	pnp Medium high-gain A.F. amplifier	E–B–C reading clockwise from tab (TO5)	
NKT225	pnp Medium gain A.F. amplifier	E–B–C reading clockwise from tab (TO5)	
NKT226	pnp Low-noise A.F. amplifier	E–B–C reading clockwise from tab (TO5)	
NKT231	pnp Extra high gain, small-signal A.F. amplifier	E–B–C reading clockwise from tab (TO5)	
NKT232	pnp Extra high gain, large-signal A.F. amplifier	E–B–C reading clockwise from tab (TO5)	
NKT251	pnp high-gain A.F. output	E–B– –C	
NKT252	pnp medium-gain A.F. driver	E–B– –C	
NKT253	pnp medium-gain A.F. output	E–B– –C	
NKT254	pnp high-gain A.F. driver	E–B– –C	
NKT255	pnp low-noise A.F. preamplifier	E–B– –C	
NKT261–5	As NKT 251–5 but different shape	E–B–C reading clockwise from tab (TO5)	
NKT351	pnp intermediate power output	B E–C White spot near collector	
NKT451	pnp extra high-gain power output		
NKT452	pnp high-gain power output	B–E when pins towards upper circumference with collector to flange	
NKT453	pnp medium-gain power output	B–E when pins towards upper circumference with collector to flange	
NKT454	pnp TV line output	B–E when pins towards upper circumference with collector to flange	
NKT751	npn A.F. output	E–B–C reading clockwise from tab (SO12B)	
NKT752	npn A.F. driver	E–B–C reading clockwise from tab (SO12B)	
Texas Instruments			
2G240	pnp alloy diffused H.F., high current transistor for TV line scan circuits, etc.	B–E when pins towards upper circumference with collector connected to flange	
2G301	pnp alloy junction medium speed switching transistor	B E–C	OC45
2G302	pnp alloy junction medium speed switching transistor	B E–C	OC44
2G339	npn alloy junction transistor for use in medium power complementary symmetry output stages and sync. separators	E–B–C reading clockwise from tab. Base connected to case	AC127
2G371	pnp alloy junction A.F. transistor	—	OC71
2G381 2G382	pnp alloy junction medium power transistor intended for Class B output stages, etc.	B E–C	OC81
2G401	pnp alloy diffused H.F. transistor for I.F. amplifiers up to 10 Mc/s.	E–B(1)–C–B(2) reading clockwise from tab	OC170
2G402	pnp alloy diffused V.H.F. transistor for amplifier/oscillator circuits to 40 Mc/s.	E–B(1)–C–B(2) reading clockwise from tab	OC171
2G417	pnp alloy diffused transistor for R.F., I.F. mixer/oscillator use in M.W./L.W. receivers	E–B(1)–C–B(2) reading clockwise from tab	AF117

Note. GET103 replaces GET3; GET105 replaces GET5; GET106 replaces GET6; GET110 replaces GET10, GET115 replaces GET15. These are electrically similar but the earlier range had connections coded: collector (white) then clockwise base; emitter.

* Comparative types indicated are only approximately equivalent in electrical characteristics and manufacturers' data should be consulted before interchanging them.

Pye " Circle " Transistor Equivalents

NKT Range	*" Circle " Range*
NKT151	Orange 1, Violet 1
NKT152	Black 1, Green 1, Red 1, White 1, Yellow 1
NKT153	Black 2, Brown 2, Green 2, Orange 2, Red 2, Violet 2, White 2, Yellow 2
NKT154	Black 3, Brown 3, Green 3, Orange 3, Red 3, Violet 3, White 3, Yellow 3
NKT253	Green 6, Orange 6, Violet 5, White 5, Yellow 5
NKT254	Black 5, Brown 5, Green 5, Orange 5, Violet 4, White 4, Yellow 4
NKT255	Black 4, Brown 4, Green 4, Orange 4
NKT351	Black 6, Brown 6

For example, a Violet Circle No. 1 transistor is equivalent to the NKT151.

Foreign Transistor Chart

The following selected list of foreign transistor type numbers will be found useful when dealing with imported receivers fitted with Japanese or American transistors. It should be noted that types grouped in this chart are not equivalents and may not prove interchangeable without circuit changes (this may often include different value neutralising capacitors and a change of bias). The British types shown are intended as an indication of the general category of the transistors concerned rather than as a definite replacement type—though in practice such replacement should often prove possible if the original type is unobtainable. Note that many Sony transistors are n–p–n types; n–p–n types are also commonly used in American designs.

General Category	*Selected U.S. Types*	*Selected Japanese Types*
R.F. p–n–p fα about 10 Mc/s. (OC44)	2N219, 2N411, 2N412, 2N1058, 2N136, 2N137	2SA15, 2S30, HJ23D, HJ55, 2S52, HJ60, 2S146, HJ57, 2T201, 2SA84, 2SA30, 2SA254
R.F. p–n–p fα about 6·5 Mc/s. (OC45)	2N218, 2N410, 2N409, 2N139	2SA12, 2S45, HJ56, 2S31, 2S36, 2S53, HJ22D, 2SA31, 2SA255, 2SA13
A.F. p–n–p (OC71)	2N405, 2N406, 2N217, 2N280, 2N34, 2N105, 2N107, 2N240	2SB75, 2S32, 2S159, 2S44, HJ17D, 2SB32, 2SB261, 2SB33
A.F. p–n–p (OC72)	2N270, 2N408, 2N407, 2N281	2S38, 2S33, 2S56, 2S34, HJ51, 2SB77, 2S24, 2S163, HJ34, HJ34A, 2S91, 2T323
A.F. p–n–p small signal	2N175, 2N220	2S39, 2SB39
R.F. p–n–p fα about 30 Mc/s. (OC170)	2N140, 2N219, 2N370, 2N371, 2N372, 2N373, 2N374, 2N247	2S35, HJ37, HJ71, 2S141, 2S109, HJ32, HJ70, 2S43, 2SA43, 2SA112, 2SA259, 2SA269
A. F. Power p–n–p	2N301, 2N301A, 2N376	2S41, 2S42, HJ35, 2SB41, 2SB84, 2SB131
A.F. n–p–n	2N366, 2N228, 2N228, 2N649, 2N35	2T64, 2T65, 2T85, 2SD65, 2SD33
R.F./mixer n–p–n	2N212, 2N193, 2N194, 2N314, 2N293, 2N147, 2N168A	2SC73, 2T76, 2T73, 2T74
I.F. n–p–n	2N216, 2N313, 2N482, 2N483, 2N145, 2N146, 2N148, 2N169	2SC76, 2T51, 2T52, 2T53, 2T71, 2T72
R.F. p–n–p fα about 100 Mc/s.	2N346, 2N384, 2N1177, 2N1225, 2N1396, 2N1517	2SA116, 2SA117, 2SA118, 2SA121, 2SA123, 2SA124, 2T201, 2T203, 2T204, 2T205
A.F. p–n–p medium power	2N254, 2N255, 2N256, 2N257, 2N1038, 2N1042, 2N1183, 2N1184	2SB180, 2SB181

Voltage	*Type* *	*Contacts*	*Drydex*	*Ever Ready*	*G.E.C.*	*Oldham*	*Siemens*	*Vidor*
	H.T. Batteries							
175	166 v. H.T. + 9 v. G.B.	Wander plugs	H1066	Port. 32	BB337	K664	1182	L5008
144	135 v. H.T. + 9 v. G.B.	Wander plugs	H1107	Port. 40	BB366	K634	1264	L5023
136	124½ v. H.T. + 12 v. G.B.	Wander plugs	H1180	Port. 75	—	K776	1523	L5017
129	120 v. H.T. + 9 v. G.B.	Wander plugs	H1071	Port. 34	—	K661	1192	—
129	120 v. H.T. + 9 v. G.B.	Wander plugs	H1070	Port. 33	BB338	—	1193	L5037
126	114 v. H.T. + 12 v. G.B.	Wander plugs	H1136	Winner 126GB	BB375	K743	1312	L5030
120	Standard battery	Wander plugs	H1006	Winner 120	BB720	Green Band 120	H120	L5038
120	Triple capacity battery	Wander plugs	H2015	PP120	BB1203	—	V8	L5080
120	111 v. H.T. + 9 v. G.B.	Wander plugs	H1118	Winner 120GB	BB729	K675	HG120	L5045
120	114 v. H.T. + 6 v. G.B.	Wander plugs	H1050	Port. 30	BB334	K540	1153	—
108	—	Wander plugs	H1044	Winner 108	—	Green Band 108	H108	—
90	Standard battery	Wander plugs	H1146	Port. 61	BB372	—	1340	L5039
	H.T. Layer Batteries							
90	Small layer (1–10 mA.)	2 press studs	531	B131	—	KL31	—	L5547
90	Large layer (5–15 mA.)	3-pin socket	D538	B138	BB538	KL38	8138	L5536
90	Large layer (7–15 mA.)	3-pin socket	507	B107	BB502	KL7	8107	L5508
90	Large layer (7–15 mA.)	2 press studs	517	B117	BB517	KL17	8117	L5515
90	Small layer (1–10 mA.)	3-pin socket	526	B126	BB526	KL26	8126	L5512
85½	Large layer (5–15 mA.)	3-pin socket	DM529	B129	BB529	KL29	8129	L5529
67½	Small layer (1–10 mA.)	2 press studs	501	B101	BB501	KL1	8101	L5500
45	Large layer (5–15 mA.)	3-pin socket	504	B104	BB500	KL4	8104	L5528
45	—	3-pin socket	H1156	AD2	BB390	K757	1431	—
45	—	2 press studs	502	B102	—	KL2	8102	—
	Combined H.T./L.T. Batteries							
90 + 1½	Standard —	4-pin socket	H1157	AD3	BB395	K748	1438	L5054
90 + 1½	Large layer (7–15 mA.; 200–350 mA.)	4-pin socket	503	B103	BB503	KL3	8103	L5507
90 + 1½	Small layer —	4-pin socket	525	B125	—	—	—	L5509
90 + 1½	Large layer (7–15 mA.; 100–200 mA.)	4-pin socket	536	B136	BB536	KL36	8136	L5537
90 + 1½	Large layer (10–25 mA.; 100–350 mA.)	4-pin socket	537	B137	—	KL37	—	—
90 + 1½	Large layer (7–15 mA.; 75–150 mA.)	4-pin socket	541	B141	BB541	KL41	—	L5552
90 + 1½	Small layer (7–15 mA.; 50–150 mA.)	4-pin socket	547	B147	BB547	KL47	—	L5551
90 + 7½	Small layer (5–10 mA.; 15–50 mA.)	8-pin socket	548	B148	BB548	KL48	—	L5550
90 + 7½ + 9	Large layer (5–15 mA.; 30–75 mA.)	8-pin socket	—	B135	—	—	—	L5553
69 + 1½	Small layer (1–7·5 mA.; 50–250 mA.)	4-pin socket	514	B114	BB514	KL14	8114	L5504
	Transistor Batteries							
9	Layer (15–150 mA.)	2 press studs	DT10	PP10	BB30	—	TR10	T6010
9	Layer (5–20 mA.)	2 press studs	DT7	PP7	BB27	—	TR7	T5007
9	Layer (0–5 mA.)	2 press studs	DT3	PP3	BB23	—	TR3	T6003
9	Layer (0–7·5 mA.)	2 press studs	DT4	PP4	BB24	—	TR4	T6004
9	Layer (2·5–15 mA.)	2 press studs	DT6	PP6	BB26	—	TR6	T6006
9	Layer (5–50 mA.)	2 press studs	DT9	PP9	BB29	—	TR9	T6009
6	Layer (5–50 mA.)	2 press studs	DT1	PP1	BB21	—	TR1	T6001
6	Layer (20–150 mA.)	2 press studs	DT8	PP8	BB28	—	TR8	T6008
4½ + 4½ 4½ + 4½	Layer (5–50 mA. at 9 v.) Layer (10–100 mA. at 4·5 v.)	4-pin socket	DT11	PP11	BB31	—	TR11	T6011
	Grid Bias Batteries							
	Standard	Wander plugs	H1001	Winner 9	BB9	Green Band 9GB	CG2	L5059
	L.T. Batteries							
7½	5 cells (20–100 mA.)	2-pin socket	H1191	AD43	BB413	K796	1540	L5060
7½	5 cells	2-pin socket	H1189	AD40	—	K787	—	—
7½	5 cells (15–60 mA.)	2-pin socket	H1187	AD38	BB408	K782	1535	L5048
7½	5 cells (25–125 mA.)	2-pin socket	H1186	AD39	BB409	K783	1536	L5055
7½	5 cells	2-pin socket	H1190	AD42	—	K788	—	L5058
7½	5 cells (25–125 mA.)	2-pin socket	H1177	AD31	BB401	K769	1518	L5042
4½	3 cells (30–125 mA.)	2-pin socket	H1176	AD28	BB398	K786	1538	L5043
1½	2 cells (50–250 mA.)	2 pin socket	H1184	AD35	BB405	K779	1529	L5040
1½	4 cells (100–250 mA.)	2-pin socket	H1158	AD4	BB391	K768	1436	L5041
1½	8 cells (100–250 mA.)	2-pin socket	H1178	AD32	BB402	K771	1517	L5049
1½	8 cells (150–300 mA.)	2-pin socket	H1183	AD34	BB404	K778	1533	L5050
1½	8 cells (100–250 mA.)	2-pin socket	H1155	AD1	BB389	K756	1432	—
1½	6 cells (100–250 mA.)	2-pin socket	H1168	AD14	BB391	K785	1470	L5071
1½	—	2-pin socket	H1182	AD33	BB396	K777	—	—
1½	—	2-pin socket	H1185	AD37	—	K781	1534	—
	Miscellaneous							
1½	Torch cell (25–100 mA.)	Cap and zinc	T20	U2	BA6103	K532	T1	V0002
1½	Baby torch cell (20–60 mA.)	Cap and zinc	T15	U11	BA6104	K763	T12	V0011
1½	Leakproof torch cell (25–100 mA.	Cap and zinc	T21	LPU2	BA6123	LP532	T1LP	V0009
1½	Penlight cell (1–30 mA.)	Cap and zinc	T5	U12	BA6102	K770	T13	V0028
1½	Penlight cell (1–7 mA.)	Cap and zinc	T3	U16	BA6107	K795	T18	V0036
1½	One cell L.T. (25–125 mA.)	Cap and zinc	T25	U17	—	—	—	V0007
3	Penlight battery	Cap and zinc	2T5	1915	BA6106	K773	T7	V0003
3	Baby torch battery	Cap and zinc	2T15	1839	BA6114	K612	T10	V0012
3	Bijou torch battery (1–30 mA.)	Cap and zinc	2T10	8	BA6105	K609	T8	V0004
3	Cycle	Strip and spring	C60	800	BA6112	—	P1	V0001
4½	Pocket torch	Strip and spring	F40	1289	BA6108	—	P3	V0005
4½	Box battery	2 screw	H30	126	BA6110	K766	B6	V0008
6	Lantern battery	Strip and spring	L15	R996	BA6120	K767	1400	V0016
12	Recorder Motors (15–75 mA.)	End contacts	—	B1578	—	—	—	—

* Suggested current range, where given, is that recommended by The Ever Ready Co. (G.B.) Ltd. Note that some batteries are no longer available, but these have been retained in the chart to assist location of a suitable replacement.

Type	Description	Heater		Pin Connections										Base	Equivalents	Type
		Volts	Amp.	1	2	3	4	5	6	7	8	9	Cap			
AZ31	Full-wave rectifier	4·0	1·1	—	f	—	a′	—	a″	—	f	—	—	K	U143	AZ31
AZ41	Full-wave rectifier	4·0	0·72	i.c.	a″	i.c.	i.c.	i.c.	a′	f	f	—	—	B8A		AZ41
B36	Double triode	12·6	0·3	g′	a′	k′	g″	a″	k″	h	h	—	—	K	12SN7GT	B36
B65	Double triode	6·3	0·6	g′	a′	k′	g″	a″	k″	h	h	—	—	K	6SN7GT	B65
B109	V.H.F. double triode	26·0	0·1	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A	UCC85, 10L14	B109
B152	Double triode	12·6 c.t.	0·15	a″	g″	k″	h	h	a′	g′	k′	h tap	—	B9A	ECC81, B309, 12AT7	B152
B309	Double triode	{ 6·3 12·6	0·3 0·15 }	a″	g″	k″	h	h	a′	g′	k′	h tap	—	B9A	ECC81, 12AT7	B309
B319	Double triode	7·0	0·3	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A	PCC84, 7AN7, 30L1	B319
B329	Double triode	12·6 c.t.	0·15	a″	g″	k″	h	h	a′	g′	k′	h tap	—	B9A	12AU7, ECC82	B329
B339	Double triode	{ 6·3 12·6	0·3 0·15 }	a″	g″	k″	h	h	a′	g′	k′	h tap	—	B9A	ECC83, 12AX7, 6L13	B339
B349	Double triode	7·0	0·3	k″	g″, s	a″	h	h	g′	k′, in	k′, out	a′	—	B9A		B349
B719	Double triode	6·3	0·45	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A	6AQ8, ECC85, 6L12	B719
B729	Double triode	6·3	0·3	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A	6–30L2	B729
CBL31	Double diode output pentode	44	0·2	s	h	ap	a′	a″	g2	h	k, g3	—	g1	K		CBL31
CCH35	Triode hexode frequency changer	7	0·2	s	h	ah	g2, 4	gt, 3	at	h	k	—	g1	K	OM10	CCH35
CL33	Output pentode	33	0·2	—	h	a	g2	g1	—	h	k, g3	—	—	K	332 Pen	CL33
CY31	Half-wave rectifier	20	0·2	—	h	—	—	a	—	h	k	—	—	K	OM1, U201	CY31
D1	Diode	4·0	0·2	h	k	h	—	—	—	—	—	—	a	B3G	T4D	D1
D77	Double diode	6·3	0·3	k′	a″	h	h	k″	s	a′	—	—	—	B7G	DD6, 6AL5, 6D2, EB91	D77
D152	Douhle diode	6·3	0·3	k′	a″	h	h	k″	s	a′	—	—	—	B7G	DD6, 6AL5, EB91, D77	D152
DAC32	Diode triode	1·4	0·05	s	f	at	—	ad	—	f	—	—	g	K	1H5G, HD14	DAC32
DAF91	Diode A.F. pentode	1·4	0·05	f, g3	—	ad	g2	ap	g1	f	—	—	—	B7G	ZD17, 1FD9, 1S5	DAF91
DAF96	Diode A.F. pentode	1·4	0·025	f, g3	—	ad	g2	ap	g1	f	—	—	—	B7G	1AH5, 1FD1, ZD25	DAF96
DD41	Double diode	4·0	0·5	h	k′	a′	s	a″	M	k″	h	—	—	MO		DD41
DF33	Vari-mu R.F. pentode	1·4	0·05	s	f	a	g2	—	—	f, g3	—	—	g1	K	1N5GT	DF33
DF91	Vari-mu R.F. pentode	1·4	0·05	s, f, g3	a	g2	—	f, g3	g1	f	—	—	—	B7G	W17, 1F3, 1T4	DF91
DF92	R.F. pentode	1·4	0·05	f, g3	a	g2	—	f, g3	g1	f	—	—	—	B7G	1F2, 1L4	DF92
DF96	R.F. pentode	1·4	0·025	s, f, g3	a	g2	—	f, g3	g1	f	—	—	—	B7G	1F1, 1AJ4, W25	DF96
DF97	Vari-mu R.F. pentode	1·4	0·025	f, s	a	g2	g3	f, s	g1	f	—	—	—	B7G		DF97
DH63	Double diode triode	6·3	0·3	s	h	at	a′	a″	—	h	k	—	g	K	6Q7G	DH63
DH76	Double diode triode	13	0·16	s	h	at	a′	a″	—	h	k	—	g	K	12Q7G	DH76
DH77	Double diode triode	6·3	0·3	g	k	h	h	a′d	a″d	at	—	—	—	B7G	EBC90, 6AT6	DH77
DH81	Double diode triode	6·3	0·3	h	a	g	i.c.	a″d	a′d	k	h	—	—	B8G	7B6	DH81
DH101	Double diode triode	19	0·1	h	a	g	i.c.	a″d	a′d	k	h	—	—	B8G		DH101
DH107	Double diode triode	19	0·1	g	k	h	h	a′	a″	at	—	—	—	B7G		DH107
DH109	Triple diode triode	28·0	0·1	a‴, d	a″, d	k″d	h	h	a′, d	k, s	g	a	—	B9A	UABC80, 10LD12	DH109
DH118	Double diode triode	14·0	0·1	h	a	g	s	a″d	a′d	k	h	—	—	B8A	10LD3, DH142, UBC41, 141DDT	DH118
DH119	Double diode triode	13·0	0·1	a	g	k	h	h	a′d	s	a″d	i.c.	—	B9A	UBC81, 10LD13	DH119
DH142	Double diode triode	14	0·1	h	at	g	s	a′d	a″d	k	h	—	—	B8A	UBC41, 10LD3, DH118, 141DDT	DH142
DH147	Double diode triode	6·3	0·2	s	h	at	a′	a″	—	h	k	—	g	K	EBC33, OM4, 6Q7G	DH147
DH149	Double diode triode	6·3	0·15	h	at	g	k	a′	a″	k	h	—	—	B8G	7C6	DH149
DH150	Double diode triode	6·3	0·225	h	at	g	s	a′d	a″d	k	h	—	—	B8A	EBC41, 62DDT, 6LD3	DH150
DH718	Double diode triode	6·3	0·23	h	at	g	s	a′d	a″d	k	h	—	—	B8A	EBC41, DH150, 62DDT, 6LD3, 6CV7	DH718

DH719	Triple diode triode	6·3	0·45	a'''d	a''d	k''d	h	h	a'd	kt, k'd, k'''d, s	g	at	—	B9A	EABC80, 6AK8, 6T8, 6LD12	DH719
DK32	Heptode frequency changer	1·4	0·05	s	f	a	g3, 5	g1	g2	f	—	—	g4	K	1A7GT X14	DK32
DK91	Heptode frequency changer	1·4	0·05	f, g5	a	g2, 4	g1	f, g5	g3	f	—	—	—	B7G	1R5, 1C1, X17	DK91
DK92	Heptode frequency changer	1·4	0·05	f	a	g2	g1	g4	g3	f, g5	—	—	—	B7G	1AC6, 1C2, X18	DK92
DK96	Heptode frequency changer	1·4	0·025	f	a	g2	g1	g4	g3	f, g5	—	—	—	B7G	1C3, 1AB6, X25	DK96
DL35	Output pentode	1·4	0·1	s	f	a	g2	g1	—	f, g3	—	—	—	K	1C5G, N14	DL35
DL92	Output pentode *	2·8 / 1·4	0·05 / 0·1	f	a	g1	g2	f c.t., g3	a	f	—	—	—	B7G	N17, 1P10, 3S4	DL92
DL94	Output pentode *	2·8 / 1·4	0·05 / 0·1	f	a	g2	—	f c.t., g3	g1	f	—	—	—	B7G	3V4, 1P11, N19	DL94
DL96	Output pentode *	1·4	0·05	f	a	g2	—	f c.t., g3	g1	f	—	—	—	B7G	1P1, 3C4, N25	DL96
DL145	Double diode triode	15	0·1	h	at	g	s	a'd	a''d	k	h	—	—	B8A	10LD11	DL145
DM70	Tuning indicator	1·4	0·025	g	—	—	h	h	—	—	a	—	—	B8D	1M1, 1M3, Y25	DM70
DM71	Tuning indicator	1·4	0·025	g	i.c.	n.c.	f	f	n.c.	n.c.	a	—	—	B8D	DM70	DM71
DN143	Double diode output pentode	6·3	0·8	h	ap	g1	g2	a'	a''	k, g3	h	—	—	B8G	EBL21	DN143
DY86	E.H.T. rectifier	1·4	0·55	h, k, s	h	n.c.§	h, k, s	h	h, k, s	n.c.§	h	h, k, s	a	B9A	1S2	DY86
EA50	Diode	6·3	0·15	h	k	h	—	—	—	—	—	—	a	B3G	SD61, 6D1	EA50
EABC80	Triple diode triode	6·3	0·45	a'	a''	k''	h	h	a'''	k, s	g	at	—	B9A	6AK8, DH719, 6T8, 6LD12	EABC80
EAC91	Single diode triode	6·3	0·3	ad	kd	h	h	kt	g	at	—	—	—	B7G		EAC91
EAF41	Diode vari-mu R.F. tetrode	6·3	0·2	h	at	ad	k	g2	g1	k	h	—	—	B8A		EAF41
EAF42	Diode vari-mu R.F. pentode	6·3	0·2	h	ap	ad	g3	g2	g1	k, s	h	—	—	B8A	6CT7, WD150	EAF42
EB34	Double diode ‡	6·3	0·2	s	h	a'	k'	a''	—	h	k''	—	—	K	6H6GT	EB34
EB41	Double diode ‡	6·3	0·3	h	—	k'	a'	s	a''	k''	h	—	—	B8A		EB41
EB91	Double diode ‡	6·3	0·3	k'	a''	h	h	k''	s	a'	—	—	—	B7G	D77, D152, DD6, 6AL5, 6D2	EB91
EBC33	Double diode triode	6·3	0·2	s	h	at	a'd	a''d	—	h	k	—	g	K	DH147, OM4, 6Q7G	EBC33
EBC41	Double diode triode	6·3	0·23	h	at	g	s	a'd	a''d	k	h	—	—	B8A	DH150, 62DDT, 6LD3, 6CV7	EBC41
EBC81	Double diode triode	6·3	0·23	a	g	k	h	h	a'd	s	a''d	i.c.	—	B9A	6LD13, 6BD7A	EBC81
EBC90	Double diode triode	6·3	0·3	g	k	h	h	a''d	a'd	a	—	—	—	B7G	6AT6, DH77	EBC90
EBC91	Double diode triode	6·3	0·3	g	k	h	h	a''d	a'd	a	—	—	—	B7G	6AV6	EBC91
EBF80	Double diode vari-mu R.F. pentode	6·3	0·3	g2	g1	k	h	h	ap	a'd	a''d	g3	—	B9A	ZD152, WD709, 6N8	EBF80
EBF83	Car radio, double diode, vari-mu R.F. pentode	6·3	0·3	g2	g1	k, s	h	h	a	a'd	a''d	g3	—	B9A	6DR8	EBF83
EBF89	Double diode vari-mu R.F. pentode	6·3	0·3	g2	g1	k, s	h	h	ap	a'd	a''d	g3	—	B9A	6DC8, 6FD12	EBF89
EBL21	Double diode output pentode	6·3	0·8	h	ap	g1	g2	a'	a''	k, g3	h	—	—	B8G	DN143	EBL21
EBL31	Double diode output pentode	6·3	1·2	s	h	ap	a'	a''	g2	h	k, g3	—	g1	K		EBL31
EC88	U.H.F. triode	6·3	0·165	g	k	g	h	h	g	g	a	g	—	B9A		EC88
EC90	R.F. power triode	6·3	0·15	a	i.c.	h	h	a	g	k	—	—	—	B7G	6C4, L77	EC90
EC91	V.H.F. triode	6·3	0·3	g, s	k	h	h	k	g, s	a	—	—	—	B7G	6L34, 6AQ4	EC91
EC92	V.H.F. triode	6·3	0·15	a	s	h	h	i.c.	g	k	—	—	—	B7G	6AB4	EC92
ECC33	Double triode	6·3	0·4	g'	a'	k'	g''	a''	k''	h	h	—	—	K		ECC33
ECC34	Double triode	6·3	0·95	g'	a'	k'	g''	a''	k''	h	h	—	—	K		ECC34
ECC35	Double triode (sep. cath.)	6·3	0·4	g'	a'	k'	g''	a''	k''	h	h	—	—	K	6SL7GT	ECC35
ECC40	Double triode ‡	6·3	0·6	h	a'	g'	k'	a''	g''	k''	h	—	—	B8A		ECC40
ECC81	Double triode	12·6 c.t.	0·15	a'	g'	k'	h	h	a''	g''	k''	h tap	—	B9A	12AT7, B152, B309	ECC81
ECC82	Double triode	12·6 c.t.	0·15	a'	g'	k'	h	h	a''	g''	k''	h tap	—	B9A	12AU7, B329	ECC82

* Centre-tapped filament or heater. ‡ Separate cathodes. § Do not earth.

Type	Description	Heater Volts	Heater Amp.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Cap	Base	Equivalents	Type
ECC83	Double triode †	12·6 / 6·3	0·15 / 0·3	a″	g″	k″	h	h	a′	g′	k′	h tap	—	B9A	12AX7, B339, 6L13	ECC83
ECC84	Double triode	6·3	0·34	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A	6CW7, 6L16	ECC84
ECC85	Double triode †	6·3	0·435	a′	g′	k′	h	h	a″	g″	k″	s	—	B9A	6AQ8, B719, 6L12	ECC85
ECC88	Double triode †	6·3	0·3	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A	6DJ8	ECC88
ECC91	Double triode	6·3	0·45	a″	a′	h	h	g′	g″	k	—	—	—	B7G	6J6	ECC91
ECC189	Double triode	6·3	0·365	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A		ECC189
ECC804	General purpose double triode	6·3	0·3	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A	6/30L2, B729, 6GA8	ECC804
ECC807	Low noise A.F. double triode	6·3	0·32	k′	g″	a″	h	h	k″	s	a′	g′	—	B9A		ECC807
ECF80	Triode pentode	6·3	0·43	at	g1	g2	h	h	ap	kp, g3, s	kt	gt	—	B9A	6BL8, 6C16	ECF80
ECF82	Triode pentode	6·3	0·45	at	g1	g2	h	h	ap	kp, g3, s	kt	gt	—	B9A	6U8	ECF82
ECF804	Triode-pentode	6·3	0·45	at	g1	g2	h	h	ap	kp, s g3	kt	gt	—	B9A		ECF804
ECH21	Triode heptode freq. changer	6·3	0·33	h	ah	at	gt	g2, 4	g1	g3	h	—	k, g5	B8G	X143	ECH21
ECH35	Triode hexode freq. changer	6·3	0·225	s	h	ah	g2, 4	gt, 3	at	h	k	—	g1	K	X147, X61M, OM10	ECH35
ECH42	Triode hexode frequency changer	6·3	0·23	h	ah	at	gt, 3	g2, 4	g1	k	h	—	—	B8A	6C10, X150, 62TH, 6CU7	ECH42
ECH81	Triode heptode frequency changer	6·3	0·3	g2, 4	g1	s, k, g5	h	h	ah	g3	at	gt	—	B9A	6AJ8, X719, 6C12	ECH81
ECH83	Car radio triode-heptode (12 v. H.T.)	6·3	0·3	g2, g4	g1	k, g5, s	h	h	ah	g3	at	gt	—	B9A	6DS8	ECH83
ECH84	Triode-heptode sync. separator	6·3	0·3	g3	g1	k, g5, s	h	h	ah	g2, g4	at	gt	—	B9A		ECH84
ECL80	Triode output pentode	6·3	0·3	at	gt	k	h	h	ap	g3	g2	g1	—	B9A	6AB8, LN152, 63TP	ECL80
ECL82	Triode output pentode (sep. cathodes)	6·3	0·78	gt	kp, s g3	g1p	h	h	ap	g2p	kt	at	—	B9A	6BM8	ECL82
ECL83	Triode pentode (sep. cathodes)	6·3	0·6	at	gt	kt	h	h	ap	kp, g3	g2	g1	—	B9A		ECL83
ECL86	A.F. triode-pentode	6·3	0·7	gt	kt	g2	h	h	ap	kp, g3, s	g1	at	—	B9A		ECL86
EF22	Vari-mu R.F. pentode	6·3	0·2	h	a	g2	g3, s	—	g1	k	h	—	—	B8G	W143	EF22
EF37	Vari-mu R.F. pentode	6·3	0·2	s	h	a	g2	g3	—	h	k	—	g1	K	EF37A	EF37
EF37A	Low hum, low microphony A.F. pentode	6·3	0·2	s	h	a	g2	g3	—	h	k	—	g1	K	OM5B	EF37A
EF39	Vari-mu R.F. pentode	6·3	0·2	s	h	a	g2	g3	—	h	k	—	g1	K	W147, OM6, 6K7GT	EF39
EF40	Low microphony A.F. pentode	6·3	0·2	h	a	—	g3	g1	g2	s, k	h	—	—	B8A		EF40
EF41	Vari-mu R.F. pentode	6·3	0·2	h	a	i.c.	i.c.	g2	g1	k, g3	h	—	—	B8A	W150, 62VP, 6F15, 6CJ5	EF41
EF42	R.F. pentode	6·3	0·33	h	a	s	g3	g2	g1	k	h	—	—	B8A	Z150, 6F13 (near)	EF42
EF50	R.F. pentode	6·3	0·3	h	g2	a	g3	s	k	g1	s	h	—	B9G	63SPT, Z90	EF50
EF80	High slope R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	6BX6, Z152, Z719, 64SPT	EF80
EF85	Vari-mu R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	6BY7, W719, 6F19	EF85
EF86	Low-microphony A.F. pentode	6·3	0·2	g2	s	k	h	h	a	s	g3	g1	—	B9A	Z729, 6267, 6F22	EF86
EF89	R.F. pentode	6·3	0·2	s	g1	k	h	h	s	a	g2	g3	—	B9A	6DA6	EF89
EF91	R.F. pentode	6·3	0·3	g1	k	h	h	a	s, g3	g2	—	—	—	B7G	6AM6, 6F12, Z77, SP6, 8D3	EF91
EF92	Vari-mu R.F. pentode	6·3	0·2	g1	k	h	h	a	g3, s	g2	—	—	—	B7G	W77, 6CQ6, 9D6, VP6, 6F21	EF92
EF93	Vari-mu R.F. pentode	6·3	0·3	g1	g3, s	h	h	a	g2	k	—	—	—	B7G	6BA6, W727	EF93
EF95	V.H.F. pentode	6·3	0·175	g1	k, g3, s	h	h	a	g2	k, g3, s	—	—	—	B7G	6AK5, DP61	EF95

EF98	Car radio A.F. driver	6·3	0·3	g1	k, s	h	h	a	g2	g3	—	—	—	B7G	6ET6	EF98
EF183	Vari-mu R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	6EH7, 6F29	EF183
EF184	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	6EJ7, 6F30	EF184
EF804	Low noise A.F. pentode	6·3	0·2	g3	s	k	h	h	s	a	g2	g1	—	B9A		EF804
EH90	Dual control heptode	6·3	0·3	g1	k, g5	h	h	a	g2, g4	g3	—	—	—	B7G		EH90
EK90	Heptode frequency changer	6·3	0·3	g1	k, g5	h	h	a	g2, g4	g3	—	—	—	B7G	6BE6, X727, X77	EK90
EL33	Output pentode	6·3	0·9	—	h	a	g2	g1	—	h	k, g3	—	—	K	6AG6G	EL33
EL34	Output pentode	6·3	1·5	g3	h	a	g2	g1	—	h	k	—	—	K	6CA7	EL34
EL37	Output pentode	6·3	1·4	—	h	a	g2	g1	—	h	k, g3	—	—	K	KT66	EL37
EL38	Output pentode	6·3	1·4	g3	h	—	g2	g1	—	h	k	—	a	K	6CN6	EL38
EL41	Output pentode	6·3	0·7	h	a	i.c.	i.c.	g2	g1	k, g3	h	—	—	B8A	67PT, N150, 6CK5	EL41
EL42	Output pentode	6·3	0·2	h	a	i.c.	i.c.	g2	g1	k, g3	h	—	—	B8A	N151	EL42
EL81	Output pentode	6·3	1·05	i.c.	g1	k	h	h	i.c.	i.c.	g2	g3	a	B9A	6CJ6	EL81
EL83	Output pentode	6·3	0·71	g2	g1	k	h	h	g3	a	s	i.c.	—	B9A	6CK6	EL83
EL84	Output pentode	6·3	0·76	i.c.	g1	g3, k	h	h	i.c.	a	i.c.	g2	—	B9A	6BQ5, N709, 6P15	EL84
EL85	Output pentode	6·3	0·2	g1	g1	k	h	h	g3	a	g3	g2	—	B9A	N155, 6BN5	EL85
EL86	Output pentode	6·3	0·76	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A		EL86
EL90	Output pentode	6·3	0·45	g1	k, g3	h	h	a	g2	g1	—	—	—	B7G	6AQ5, N727	EL90
EL91	Output pentode	6·3	0·2	g1	k, g3	h	h	a	n.c.	g2	—	—	—	B7G	6P17, N77, N144, 6AM5	EL91
EL95	Output pentode	6·3	0·2	g1	k, g3	h	h	a	g2	g1	—	—	—	B7G	6DL5	EL95
EL820	Line output pentode	6·3	1·0	i.c.	g1	k	h	h	i.c.	i.c.	g2	g3	a	B9A		EL820
EL821	Video output pentode	6·3	0·75	i.c.	g1	k	h	h	i.c.	a	g2	g3	—	B9A	6CH6	EL821
EL822	Video output pentode	6·3	0·75	i.c.	g1	k	h	h	i.c.	a	g2	g3	—	B9A	6DLS	EL822
ELL80	Double output pentode	6·3	0·55	g'2	g'1	a'	h	h	g''1	k, g3, s	a''	g''2	—	B9A		ELL80
EM34	Tuning indicator (dual sensitivity)	6·3	0·2	—	h	a'	g	t	a''	h	k, g'	—	—	K	64ME, 6M2, 6CD7	EM34
EM35	Dual sensitivity tuning indicator	6·3	0·2	i.c.	h	a''	g	t	a'	h	k	—	—	K	6M2	EM35
EM71	Tuning indicator	6·3	0·3	h	t	gt	i.c.	a	g	k	h	—	—	B8G		EM71
EM80	Tuning indicator	6·3	0·3	g	k	i.c.	h	h	i.c.	a	i.c.	t	—	B9A	65ME, 6BR5	EM80
EM81	Tuning indicator	6·3	0·3	g	k, g'	i.c.	h	h	i.c.	a	i.c.	t	—	B9A	6DA5	EM81
EM84	Tuning indicator	6·3	0·21	g	i.c.	k, g'	h	h	t	def. el.	i.c.	a	—	B9A	6FG5	EM84
EM840	Tuning indicator	6·3	0·25	gt	i.c.	k, g'	h	h	t	def. el.	i.c.	a	—	B9A		EM840
EM85	Tuning indicator	6·3	0·3	g	i.c.	k, g'	h	h	t	def. el.	i.c.	a	—	B9A		EM85
EM87	Voltage level indicator	6·3	0·3	g	i.c.	k, g'	h	h	tar.	def. el.	i.c.	a	—	B9A		EM87
EY51	E.H.T. rectifier	6·3	0·09	Special Base										Spec. 1	6X2, U43, U151, SU61, R12	EY51
EY83	Boost rectifier	6·3	1·0	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A		EY83
EY86	E.H.T. rectifier	6·3	0·09	h, k, s	h	—**	h, k, s	h	h, k, s	—**	h	h, k, s	a	B9A	6S2	EY86
EY91	Half-wave rectifier	6·3	0·42	a	k	h	h	a	—	—	—	—	—	B7G		EY91
EZ35	Full-wave rectifier §	6·3	0·6	—	h	a'	—	a''	—	h	k	—	—	K	6X5GT, U147	EZ35
EZ40	Full-wave rectifier §	6·3	0·6	h	a'	i.c.	i.c.	i.c.	a''	k	h	—	—	B8A	66KU, U150, UU9, 6BT4	EZ40
EZ41	Full-wave rectifier §	6·3	0·4	h	a'	i.c.	i.c.	i.c.	a''	k	h	—	—	B8A		EZ41
EZ80	Full-wave rectifier §	6·3	0·6	a'	i.c.	k	h	h	i.c.	a''	i.c.	i.c.	—	B9A	6V4	EZ80
EZ81	Full-wave rectifier §	6·3	1·0	a'	i.c.	k	h	h	i.c.	a''	i.c.	i.c.	—	B9A	U709, UU12, 6CA4	EZ81
EZ90	Full-wave rectifier §	6·3	0·6	a'	n.c.	h	h	n.c.	a''	k	—	—	—	B7G	U78, 6X4	EZ90
FC2A	Octode frequency changer	2·0	0·13	g2	g1	g3, 5	h	h	g6, M	a	—	—	g4	M	VHT2A, K80B, VO2	FC2A
FW4-500	Full-wave rectifier	4·0	3·0	a'	a''	f	f	—	—	—	—	—	—	A	U18/20, 451U	FW4-500
GZ30	Full-wave rectifier §	5·0	2·0	—	h	—	a'	—	a''	—	k, h	—	—	K	5Z4GT, R52	GZ30
GZ32	Full-wave rectifier §	5·0	2·3	—	h	—	a'	—	a''	—	h, k	—	—	K	54KU, 5V4G	GZ32
GZ33	Full-wave rectifier §	5·0	2·8	n.c.	h	n.p.	a'	n.p.	a''	n.p.	h, k	—	—	K		GZ33
GZ34	Full-wave rectifier §	5·0	1·9	i.c.	h	n.p.	a'	n.p.	a''	n.p.	h, k	—	—	K	5AR4	GZ34

† Separate cathodes. § Indirectly heated. ** Pins 3 and 7 of EY86 must not be earthed.

Type	Description	Heater		Pin Connections										Base	Equivalents	Type
		Volts	Amp.	1	2	3	4	5	6	7	8	9	Cap			
HABC80	Triple diode triode	19·0	0·15	a′	a″	k″	h	h	a‴	k, s	g	at	—	B9A		HABC80
HBC90	Double diode triode	12·6	0·15	g	k	h	h	a′	a″	at	—	—	—	B7G	12AT6	HBC90
HBC91	Double diode triode	12·6	0·15	g	k	h	h	a″d	a′d	a	—	—	—	B7G	12AV6	HBC91
HD21	Double diode triode	2·0	0·1	at	a′	f, M	f	a″	—	—	—	—	g	O		HD21
HD24	Double diode triode	2·0	0·1	at	a′	f, M	f	a″	—	—	—	—	g	O	210DDT, K23B, TDD2A	HD24
HF93	Vari-mu R.F. pentode	12·6	0·15	g1	s, g3	h	h	a	g2	k	—	—	—	B7G	12BA6	HF93
HK90	Heptode frequency changer	12·6	0·15	g1	k, g5	h	h	a	g2, 4	g3	—	—	—	B7G	12BE6	HK90
HL23DD	Double diode triode	2·0	0·05	h	—	at	—	a′	s	a″	h	—	g	MO		HL23DD
HL41	Triode	4·0	0·65	h	k	a	—	g	s	—	h	—	—	MO		HL41
HL41DD	Double diode triode	4·0	0·65	h	k	at	—	a′	—	a″	h	—	g	MO		HL41DD
HL42DD	Double diode vari-mu triode	4·0	0·65	h	k	at	—	a′	—	a″	h	—	g	MO		HL42DD
HL92	Output pentode	50	0·15	k, g3	g1	h	h	g1	g2	a	—	—	—	B7G	50C5	HL92
HN309	Triode pentode	12·6	0·3	at	gt	kt	h	h	ap	kp, g3	g2	g1	—	B9A	PCL82	HN309
HVR2	E.H.T. rectifier	4·0	0·65	—	—	k, h	h	—	—	—	—	—	a	A		HVR2
HY90	Half-wave rectifier	35	0·15	—	—	h	h	a	h c.t.	k	—	—	—	B7G	35W4	HY90
IW4/350	Full-wave rectifier §	4·0	2·0	a′	a″	k, h	h	—	—	—	—	—	—	A	R2, R42, 1867, MU14	IW4/350
KBC32	Double diode triode	2·0	0·05	s	f	at	a′	a″	—	f	—	—	g	K		KBC32
KF35	Vari-mu R.F. pentode	2·0	0·05	s	f	a	g2	g3	—	f	—	—	g1	K		KF35
KK32	Octode frequency changer	2·0	0·13	s	f	a	g3, 5	g1	g2	k, g6	—	—	g4	K		KK32
KL35	Output pentode	2·0	0·15	s	f	a	g2	g1	—	f, g3	—	—	—	K		KL35
KLL32	Double output pentode	2·0	0·3	—	f	a′	g′1	g1″	a″	f, g3′, g3″	g2′, g2″	—	—	K		KLL32
KT2	Output tetrode	2·0	0·2	a	g1	f	f	g2	—	—	—	—	—	O	PT2, 220OT, Pen 220 PM22A	KT2
KT33C	Output tetrode *	{13 25	0·6 0·3	} h c.t.	h	a	g2	g1	—	h	k	—	—	K		KT33C
KT36	Output tetrode	26·0	0·3	—	h	—	g2	g1	—	h	k	—	a	K		KT36
KT44	Output tetrode	4·0	2·0	—	g1	—	h	h	k	g2	—	—	a	M		KT44
KT61	Output tetrode	6·3	0·95	M	h	a	g2	g1	—	h	k	—	—	K	6AG6G, 6P25, N147	KT61
KT63	Output tetrode	6·3	0·7	s	h	a	g2	g1	—	h	k, bp	—	—	K	6F6G	KT63
KT66	Output tetrode	6·3	1·27	s	h	a	g2	g1	—	h	k, bp	—	—	K	EL37, 6L6G	KT66
KT71	Output tetrode	48	0·16	M	h	a	g2	g1	—	h	k	—	—	K	50L6	KT71
KT74	Output triode	15	0·16	M	h	a	g2	g1	—	h	k	—	—	K		KT74
KT76	Output tetrode	15	0·16	M	h	a	g2	g1	—	h	k	—	—	K		KT76
KT81	Output tetrode	6·3	0·95	h	a	g2	n.c.	i.c.	g1	k	h	—	—	B8G	7C5 (near)	KT81
KT101	Output triode	80	0·1	h	a	g2	n.c.	i.c.	g1	k	h	—	—	B8G		KT101
KTW61	Vari-mu R.F. pentode	6·3	0·3	—	h	a	g2	g3	—	h	k	—	g1	K		KTW61
KTW61M	Vari-mu R.F. pentode	6·3	0·3	M	h	a	g2	g3	—	h	k	—	g1	K		KTW61M
L63	Triode	6·3	0·3	s	h	a	—	g	—	h	k	—	—	K	6J5G	L63
L77	Triode	6·3	0·15	a	i.c.	h	h	a	g	k	—	—	—	B7G	EC90, 6C4	L77
LN119	Triode pentode (sep. cath.	50	0·1	gt	kp, g3, s	g1	h	h	ap	g2	kt	at	—	B9A	UCL82 (near), 10PL12	LN119
LN152	Triode pentode	6·3	0·3	at	gt	k	h	h	ap	g3	g2	g1	—	B9A	6AB8, ECL80, 63TP	LN152
LN309	Triode output pentode	13·0	0·3	at	gt	kt	h	h	ap	kp, g3	g2	g1	—	B9A	PCL83	LN309
LN319	Triode-output tetrode	13·0	0·3	at	gt	kt	h	h	ap	kp, g3	g2	g1	—	B9A	30PL1	LN319
LN329	Triode-tetrode (field output)	16·0	0·3	gt	kq, s	g1	h	h	aq	g2	kt	at	—	B9A	30PL14, PCL88	LN329
LZ319	Triode pentode	9·0	0·3	at	g1	g2	h	h	ap	kp, g3 s	kt	gt	—	B9A	8A8, 9A8, PCF80, 30C1	LZ319
LZ329	Triode pentode F.C.	9·0	0·3	at	g1	g2	h	h	a	k, g3, s	kt	gt	—	B9A	PCF80, 30C1, LZ319	LZ329

F

LZ339	Triode-pentode (freq. changer)	9·0	0·3	kp	g2	ap	h	h	at	gt	k, g3, s	g1	—	B9A	30C15, PCF800, 9EN7	LZ339
ME41	Tuning indicator	4·0	0·5	h	k	a	—	g	—	t	h	—	—	MO		ME41
N17	Output pentode *	1·4 2·8	0·1 0·05	f	a	g1	g2	f c.t., g3	a	f	—	—	—	B7G	3S4, DL92, 1P10	N17
N18	Output pentode *	1·4 2·8	0·1 0·05	f	a	g1	g2	f c.t., g3	a	f	—	—	—	B7G	3Q4	N18
N19	Output pentode *	1·4 2·8	0·1 0·05	f	a	g2	—	f c.t., g3	g1	f	—	—	—	B7G	3V4, DL94, 1P11	N19
N25	Output pentode	2·8 1·4	0·025 0·05	f —	a	g2	—	f tap, g3	g1	f+	—	—	—	B7G	DL96, 1P1, 3C4	N25
N37	Output pentode	13·0	0·3	g1	k, g3	h	h	a	i.c.	g2	—	—	—	B7G		N37
N78	Output pentode	6·3	0·64	g1	k, g3	h	h	a	i.c.	g2	—	—	—	B7G	6BJ5	N78
N108	Output pentode	40	0·1	g1	k, g3	h	h	a	i.c.	g2	—	—	—	B7G		N108
N118	Output tetrode	40	0·1	h	a	i.c.	i.c.	g2	g1	k	h	—	—	B8A	10P13	N118
N119	Output pentode	45	0·1	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	UL84, 10P18	N119
N142	Output pentode	45·0	0·1	h	a	g3, k	i.c.	g2	g1	k	h	—	—	B8A	UL41, 451PT, 45A5	N142
N144	Output pentode	6·3	0·2	g1	k, g3	h	h	a	n.c.	g2	—	—	—	B7G	EL91, N77, 6AM5, 6P17	N144
N145	Output pentode	40·0	0·1	h	a	i.c.	i.c.	g2	g1	k, g3	h	—	—	B8A	10P13	N145
N147	Output pentode	6·3	0·9	—	h	a	g2	g1	—	h	k, g3	—	—	K	6AG6G, EL33	N147
N148	Output tetrode	6·3	0·45	h	a	g2	—	—	g1	k	h	—	—	B8G	7C5	N148
N150	Output pentode	6·3	0·7	h	a	g3, k	i.c.	g2	g1	k	h	—	—	B8A	EL41, 67PT, 6CK5	N150
N151	Output pentode	6·3	0·2	h	a	g3, k	i.c.	g2	g1	k	h	—	—	B8A	EL42	N151
N152	Output pentode	21·5	0·3	i.c.	g1	k	h	h	i.c.	i.c.	g2	g3	a	B9A	21A6, PL81, N359	N152
N153	Output pentode	15·0	0·3	g2	g1	k	h	h	g3	a	s	—	—	B9A	15A6, N309, PL83	N153
N154	Output pentode	16·5	0·3	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	N329, PL82, 16A5, 30P16	N154
N155	Output pentode	6·3	0·2	g1	g1	k	h	h	g3	a	g3	g2	—	B9A	EL85	N155
N308	Line output tetrode	25	0·3	—	h	i.c.	g2	g1	—	h	k	—	a	K	30P4	N308
N309	Output pentode	15·0	0·3	g2	g1	k	h	h	g3	a	s	—	—	B9A	15A6, PL83, N153	N309
N329	Output pentode	16·5	0·3	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	16A5, PL82, N154, 30P16	N329
N339	Output pentode	20·0	0·3	i.c.	g1	k	h	h	i.c.	i.c.	g2	g3	a	B9A	PL81, 21A6, N152	N339
N359	Line output pentode	21·5	0·3	i.c.	g1	k	h	h	i.c.	i.c.	g2	g3	a	B9A	PL81, N152, 21A6	N359
N369	Line output tetrode	12·6	0·3	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	30P12	N369
N379	Frame output pentode	15	0·3	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	PL84, 30P18, 15CW5	N379
N 389	Line-output tetrode	25·0	0·3	n.c.	h	i.c.	g2	g1	—	h	k	—	a	K	30P19, PL302	N389
N709	Power pentode	6·3	0·76	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	6BQ5, EL84, 6P15	N709
N727	Output pentode	6·3	0·45	g1	k, g3	h	h	a	g2	g1	—	—	—	B7G	6AQ5, EL90	N727
OM1	Half-wave rectifier §	30·0	0·2	—	h	a	—	a	—	h	k	—	—	K	CY31, U201	OM1
OM4	Double diode triode	6·3	0·2	s	h	at	a′	a″	—	h	k	—	g	K	EBC33, DH147	OM4
OM6	R.F. pentode	6·3	0·2	s	h	a	g2	g3	—	h	k	—	g1	K	EF39, W147	OM6
OM10	Frequency changer	6·3	0·2	s	h	ah	g2, 4	gt3	at	h	k	—	g1	K	X147, CCH35 or ECH35	OM10
OZ4	Cold cathode full-wave rectifier	—	—	—	—	a′	—	a″	—	—	k	—	—	K		OZ4
PABC80	Triple diode triode	9·5	0·3	a‴d	a″d	k″d	h	h	a′d	k, s	g	a	—	B9A	9AK8	PABC80
PC86	U.H.F. freq. changer triode	3·8	0·3	a	g	k	h	h	g	k	g	a	—	B9A		PC86
PC88	U.H.F. triode	3·8	0·3	g	k	g	h	h	g	g	a	g	—	B9A		PC88
PC95	V.H.F. beam triode	3·6	0·3	k	g	h	h	a	s	k	—	—	—	B7G		PC95
PC97	V.H.F. beam triode	4·5	0·3	k	g	h	h	a	s	k	—	—	—	B7G	4FY5	PC97
PC900	V.H.F. beam triode	4·0	0·3	g	k	h	h	a	bp	k	—	—	—	B7G		PC900
PCC84	Double triode	7·0	0·3	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A	7AN7, B319 30L1	PCC84
PCC85	V.H.F. double triode	9·0	0·3	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A	9AQ8	PCC85
PCC88	Doub' triode	7·0	0·3	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A		PCC88
PCC89	Double triode	7·5	0·3	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A	7FC7	PCC89
PCC189	V.H.F. double triode	7·6	0·3	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A		PCC189
PCC805	V.H.F. double triode	7·0	0·3	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A	30L15, 7EK7	PCC805
PCC806	Double triode (frame grid)	7·2	0·3	k″	g″, s1	a″	h	h, s2	g′	k′ in	k′ out	a′	—	B9A	30L17	PCC806

* Centre-tapped filament or heater.

§ Indirectly heated.

Type	Description	Heater		Pin Connections										Base	Equivalents	Type
		Volts	Amp.	1	2	3	4	5	6	7	8	9	Cap			
PCF80	Frequency changer	9·0	0·3	at	g1	g2	h	h	ap	kp, s g3	kt	gt	—	B9A	8A8, 9A8, LZ319, 30C1, LZ329	PCF80
PCF82	Triode pentode	9·5	0·3	at	g1	g2	h	h	ap	kp, s, g3	kt	gt	—	B9A	9U8	PCF82
PCF84	Triode pentode	9·0	0·3	g2	ap	at	h	h	gt	k, g3, s	g1	k, g3, s	—	B9A		PCF84
PCF86	Triode-pentode	8·0	0·3	k, g3, s	g1	k, g3, s	h	h	gt	at	ap	g2	—	B9A	8HG8	PCF86
PCF87	Freq. changer (frame-grid)	7·4	0·3	k, g3, s	g2	ap	h	h	at	gt	k, s, g3	g1	—	B9A	30C17	PCF87
PCF800	Triode-pentode freq. changer	9·0	0·3	kp	g2	ap	h	h	at	gt	k, g3, s	g1	—	B9A	30C15, LZ339, 9EN7	PCF800
PCF801	Triode frame-grid pentode	8	0·3	k, g3, s	g1	k, g3, s	h	h	ap	g2	at	gt	—	B9A		PCF801
PCF805	Triode frame-grid pentode	7·4	0·3	at	g2	ap	h	h	kt, g3, s	g1	kp *	gt	—	B9A	30C18	PCF805
PCF806	Triode-pentode	8·0	0·3	k, g3, s	g1	k, g3, s	h	h	ap	g2	at	gt	—	B9A		PCF806
PCL82	Triode output pentode	16·0	0·3	gt	kp, g3 s	g1	h	h	ap	g2	kt	at	—	B9A	16A8	PCL82
PCL83	Triode output pentode	12·6	0·3	at	gt	kt	h	h	ap	kp, g3,	g2	g1	—	B9A	LN309	PCL83
PCL84	Triode video output pentode	15·0	0·3	gt	at	kt	h	h	ap	kp, g3,	g1	g2	—	B9A	15DQ8	PCL84
PCL85	Frame output pentode-triode	18·0	0·3	at	gt	kt	h	h	ap	g2	kp, g3, s	g1	—	B9A	18GV8	PCL85
PCL86	Triode-pentode	14·5	0·3	gt	kt	g2	h	h	ap	kp, g3, s	g1	at	—	B9A		PCL86
PCL87	Triode-pentode	—	0·3	gt	kp, g3	g1	h	h	ap	g2	kt	at	—	B9A		PCL87
PCL88	Triode beam tetrode (field output)	16·0	0·3	gt	kq, bp, s	g1	h	h	aq	g2	kt	at	—	B9A	30PL14, LN329	PCL88
PEN DD4020	Double diode output pentode	40·0	0·2	a′	ap	a″	h	h	k, g3	g2	—	—	g1	M		PEN DD4020
PEN25	Output pentode	2·0	0·15	f, g3	—	a	g2	g1	—	—	f	—	—	MO		PEN25
PEN44	Output tetrode	4·0	2·1	h	k	a	g2	g1	M	—	h	—	—	MO		PEN44
PEN45	Output tetrode	4·0	1·75	h	k	a	g2	g1	M	—	h	—	—	MO		PEN45
PEN45DD	Double diode output tetrode	4·0	2·0	h	k, g3	a	g2	a′	M	a″	h	—	g1	MO		PEN45DD
PEN46	Output tetrode	4·0	1·75	h	k	—	g2	g1	—	—	h	—	a	MO		PEN46
PL33	Output pentode	19·0	0·3	—	h	a	g2	g1	—	h	g3, k	—	—	K		PL33
PL36	Output pentode	25·0	0·3	i.c.	h	i.c.	g2	g1	—	h	k, g3	—	a	K	25E5, N308	PL36
PL38	Output pentode	30·0	0·3	g3	h	s	g2	g1	—	h	k	—	a	K		PL38
PL81	Output pentode	21·5	0·3	i.c.	g1	k	h	h	i.c.	i.c.	g2	g3	a	B9A	21A6, N152, N359	PL81
PL82	Output pentode	16·5	0·3	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	16A5, 30P16, N154, N329	PL82
PL83	Video pentode	15·0	0·3	g2	g1	k	h	h	g3	a	s	i.c.	—	B9A	15A6, N153, N309	PL83
PL84	Frame output pentode	15·0	0·3	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	15CW5, 30P18, N379	PL84
PL302	Beam tetrode line output	25·0	0·3	n.c.	h	i.c.	g2	g1	n.p.	h	k	—	a	K	30P19, N389	PL302
PL500	Line output pentode	27·0	0·3	g1	g1	k, g3	h	h	g2	g2	k, g3	i.c.	a	B9D		PL500
PL820	Output pentode	21·5	0·3	i.c.	g1	k	h	h	i.c.	i.c.	g2	g3	a	B9A		PL820
PP3/250	Directly heated output triode	4·0	1·0	a	g	f	f	—	—	—	—	—	—	A	PX4, ACO44, 4XP	PP3/250
PX4	Directly heated output triode	4·0	1·0	a	g	f	f	—	—	—	—	—	—	A	PP3/250, 4XP, LP4	PX4
PX25	Directly heated output triode	4·0	2·0	a	g	f	f	—	—	—	—	—	—	A	PP5/400	PX25
PY31	Half-wave rectifier §	17·0	0·3	—	h	—	—	a	—	h	k	—	—	K		PY31
PY32	Half-wave rectifier §	29·0	0·3	—	h	a **	—	a **	i.c.	h	k	—	—	K	U291	PY32
PY33	H.T. rectifier	29	0·3	n.p.	h	a **	n.p.	a **	n.p.	h	k	—	—	K		PY33
PY80	Boost diode	19·0	0·3	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	19X3, U152, U309	PY80
PY81	Boost diode	17·0	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A	17Z3, U153, U329	PY81

PY82	Half-wave rectifier §	19·0	0·3	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	19Y3, U154, U319, 19SU, U192	PY82
PY83	Boost diode	20·0	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A		PY83
PY88	Boost diode	30	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A		PY88
PY800	Boost diode	19	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A		PY800
PY801	Efficiency diode	19·0	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A	U193, U349	PY801
PZ30	Full-wave rectifier §	52·0 c.t.	0·3	—	h	a′	k′	a″	h tap	h	k″	—	—	K	R14	PZ30
QP25	Double pentode	2·0	0·2	f +	g2″, g2′	a″	g1″	g1′	a′	f—, g3″,g3′	—	—	—	M		QP25
R2	Full-wave rectifier	4·0	2·5	a′	a″	k, h	h	—	—	—	—	—	—	A	IW4-350, R42, MU14, UU5, 1867	R2
R12	E.H.T. rectifier	6·3	0·09	Special Base										Spec. 1	EY51, 6X2, U43, U151, SU61	R12
R16/1T2	E.H.T. rectifier	1·4	0·14	Special Base										Spec. 2	1T2, U37	R16/1T2
R19	Half-wave rectifier	1·25	0·2	s, h	h	i.c.	s, h	h	h	i.c.	h	h	a	B9A		R19
R52	Full-wave rectifier	5·0	2·0	—	h	—	a′	—	a″	—	k, h	—	—	K	GZ30, 5Z4GT	R52
SD6	Diode	6·3	0·15	s	a	h	h	k	s	s	—	—	—	B7G		SD6
SP6	R.F. pentode	6·3	0·3	g1	k	h	h	a	s, g3	g2	—	—	—	B7G	6AM6, 8D3, EF91, Z77	SP6
SP41	R.F. pentode	4·0	0·95	h	k	a	g2	g3	M	—	h	—	g1	MO		SP41
SP61	V.H.F. pentode	6·3	0·6	h	k	a	g2	g3	m	n.p.	h	—	g1	MO		SP61
SU61	E.H.T. rectifier	6·3	0·09	Special Base										Spec. 1	EY51, R12, 6X2, U43, U151	SU61
SU2150	E.H.T. rectifier	2·0	1·15	—	—	h, k	h	—	—	—	—	—	a	A		SU2150
T41	Gas triode	4·0	1·5	h	k	a	—	g	M	—	h	—	—	MO		T41
TH41	Triode heptode frequency changer	4·0	1·3	h	k, g5	ah	at	g3, gt	M	g2, 4	h	—	g1	MO		TH41
TP25	Triode pentode	2·0	0·2	f	—	ap	at	g3, gt	M	g2	h	—	g1	MO		TP25
TY86F	E.H.T. rectifier	7·4	0·077	h, k, s	h	n.c.	h, k, s	h	h, k, s	n.c.	h	h, k, s	a	B9A		TY86F
U10	Full-wave rectifier	4·0	1·0	a′	a″	f	f	—	—	—	—	—	—	A	UU5, 506BU, DW2, R41	U10
U22	E.H.T. rectifier	2·0	2·0	h, k, s	—	—	—	—	—	—	h	—	a	MO		U22
U24	E.H.T. rectifier	2·0	0·15	—	h	—	—	—	—	h, k	s	—	a	K		U24
U25	E.H.T. rectifier	2·0	0·2	Special Base										Spec. 1	U47	U25
U26	Half-wave rectifier	2·0	0·35	s, h	h	i.c.	s, h	h	h	.c.	h	h	a	B9A	U49, R20	U26
U31	Half-wave rectifier	26·0	0·3	—	h	—	—	a	—	h	k	—	—	K	25Z4G	U31
U33	E.H.T. rectifier	2·0	1·0	—	—	f	f	—	—	—	—	—	a	A		U33
U35	E.H.T. rectifier	1·4	0·12	i.c.	f	—	—	—	—	—	f	—	a	K		U35
U37	E.H.T. rectifier	1·4	0·14	Special Base										Spec. 2	1T2, R16	U37
U43	E.H.T. rectifier	6·3	0·09	Special Base										Spec. 1	SU61, R12, EY51, 6X2	U43
U45	Half-wave rectifier	6·3	0·12	Special Base										Spec. 1		U45
U47	E.H.T. rectifier (IH)	2·0	0·2	Special Base										Spec. 1	U25	U47
U49	E.H.T. rectifier (IH)	2·0	0·35	i.c.	i.c.	—	h, k	h	i.c.	—	i.c.	i.c.	a	B9A	U26	U49
U50	Full-wave rectifier	5·0	2·0	—	h	—	a′	—	a″	—	h	—	—	K	5Y3G	U50
U52	Full-wave rectifier	5·0	3·0	—	h	—	a′	—	a″	—	h	—	—	K	5U4G	U52
U70	Full-wave rectifier	6·3	0·6	—	h	a′	—	a″	—	h	k	—	—	K	6X5GT, EZ35, U147	U70
U76	Half-wave rectifier	30·0	0·16	—	h	—	—	a	—	h	k	—	—	K	35Z4GT	U76
U78	Full-wave rectifier	6·3	0·6	a′	—	h	h	—	a″	k	—	—	—	B7G	6X4, EZ90	U78
U107	Half-wave rectifier	40·0	0·1	h	a	k	—	—	a	h	—	—	—	B7G		U107
U118	Half-wave rectifier	40	0·1	h	a	—	i.c.	i.c.	i.c.	k	h	—	—	B8A	U404, U145	U118
U119	Half-wave rectifier	38·0	0·1	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	UY85, U381, 38A3	U119
U142	Half-wave rectifier	31·0	0·1	h	a	—	i.c.	i.c.	i.c.	k	h	—	—	B8A	UY41, 31A3, 311SU	U142
U143	Full-wave rectifier	4·0	1·1	—	h	—	a′	—	a″	—	h	—	—	K	AZ31	U143
U145	Half-wave rectifier	40·0	0·1	h	a	—	i.c.	i.c.	i.c.	k	h	—	—	B8A	U404	U145
U147	Full-wave rectifier	6·3	0·6	—	h	a′	—	a″	—	h	k	—	—	K	6X5GT, EZ35, U70	U147

* Joined to pin 6 but should be used for purpose stated. § Indirectly heated.

** Pins 3 and 5 of PY32 PY33 must be connected in circuit through appropriate limiting resistor.

Type	Description	Heater		Pin Connections										Base	Equivalents	Type
		Volts	Amp.	1	2	3	4	5	6	7	8	9	Cap			
U149	Full-wave rectifier	6·3	0·5	h	—	a′	—	—	a″	k	h	—	—	B8G	7Y4, U82	U149
U150	Full-wave rectifier	6·3	0·6	h	a′	i.c.	i.c.	i.c.	a″	k	h	—	—	B8A	66KU, EZ40, U718	U150
U151	E.H.T. rectifier	6·3	0·09	Special Base										Spec. 1	U43, EY51, R12, SU61, 6X2	U151
U152	Boost diode	19·0	0·3	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	19X3, PY80	U152
U153	Booster diode	17·0	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A	17Z3, PY81, U329	U153
U154	Half-wave rectifier	19·0	0·3	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	19Y3, PY82, U319, 19SU	U154
U191	Booster diode	19·0	0·3	—	i.c.	i.c.	—	a	—	h	h	—	k	K	U339, 19CS4	U191
U192	Half-wave rectifier	19	0·3	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	PY82, U154, U319, 19Y3	U192
U193	Rectifier	19·0	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A	PY801, U349	U193
U251	Booster diode	25·0	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A	U329, PY81, 17Z3	U251
U281	Boost diode	28·0	0·2	—	h	—	—	a	—	h	k	—	—	K		U281
U282	Boost diode	28·0	0·2	—	—	k	—	—	—	h	h	—	a	K		U282
U291	Half-wave rectifier	29	0·3	—	h	a	—	a	i.c.	h	k	—	—	K	PY32	U291
U301	Boost diode	30·0	0·2	—	i.c.	i.c.	—	a	—	h	h	—	—	K		U301
U309	Boost diode	20·0	0·3	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	PY80	U309
U319	Half-wave rectifier	20·0	0·3	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	19Y3, PY82, 19SU, U192	U319
U329	Boost rectifier	25·0	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A	PY81, 17Z3, U251	U329
U339	Booster diode	19	0·3	—	i.c.	i.c.	—	a	—	h	h	—	—	K	U191, 19CS4	U339
U381	Half-wave rectifier	38	0·1	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	UY85, U119	U381
U403	Half-wave rectifier	40·0	0·2	h	—	k	—	a	M	—	h	—	—	MO		U403
U404	Half-wave rectifier	40·0	0·1	h	a	—	i.c.	i.c.	i.c.	k	h	—	—	B8A	U145, U118	U404
U709	Half-wave rectifier	6·3	0·95	a′	i.c.	k	h	h	i.c.	a″	i.c.	i.c.	—	B9A	EZ81, UU12, 6CA4	U709
U718	Full-wave rectifier	6·3	0·63	h	a′	i.c.	i.c.	i.c.	a″	k	h	—	—	B8A	EZ40, UU9	U718
U801	Half-wave rectifier	80·0	0·2	kd1	h	a′d1	a″d1	a′d2	a″d2	h	kd2	—	—	K		U801
UABC80	Triple diode triode	28·0	0·1	a‴d	a″d	k″d	h	h	a′d	kt, k′d, k‴d, s	g	a	—	B9A	DH109, 10LD12	UABC80
UAF41	Diode vari-mu R.F. pentode	12·6	0·1	h	at	ad	k	g2	g1	k, s	h	—	—	B8A		UAF41
UAF42	Diode vari-mu R.F. pentode	12·6	0·1	h	ap	ad	g3	g2	g1	k, s	h	—	—	B8A	WD142, 12S7	UAF42
UB41	Double diode	19·0	0·1	h	—	k′	a′	s	a″	k″	h	—	—	B8A		UB41
UBC41	Double diode triode	14·0	0·1	h	at	g	s	a′d	a″d	k	h	—	—	B8A	10LD3, DH142, 141DDT, DH118	UBC41
UBC81	Double diode triode	14	0·1	a	g	k	h	h	a′d	s	a″d	i.c.	—	B9A	DH119, 10LD13	UBC81
UBF80	Double diode R.F. pentode	17·0	0·1	g2	g3	k	h	h	ap	a′	a″	g1	—	B9A	171DDP, 17C8	UBF80
UBF89	Double diode, vari-mu pentode	19	0·1	g2	g1	k, s	h	h	a	a′d	a″d	g3	—	B9A	10FD12, WD119, 19FL8	UBF89
UBL21	Double diode output pentode	55·0	0·1	h	ap	g1	g2	a′	a″	k, g3	h	—	—	B8G		UBL21
UC92	V.H.F. triode	9·5	0·1	a	s	h	h	i.c.	g	k	—	—	—	B7G		UC92
UCC84	Double triode	21·0	0·1	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A		UCC84
UCC85	V.H.F. double triode	26·0	0·1	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A	10L14, B109	UCC85
UCF80	Triode pentode	27·0	0·1	at	g1	g2	h	h	ap	kp, g3, s	kt	gt	—	B9A		UCF80
UCH21	Triode heptode frequency changer	20·0	0·1	h	ah	at	gt	g2, 4	g1	g3	h	—	k, g5††	B8G		UCH21
UCH41	Triode hexode frequency changer	12·6	0·1	h	ah	at	gt, 3	g2, 4	g1	k	h	—	—	B8A		UCH41
UCH42	Triode hexode frequency changer	14·c	0·1	h	ah	at	gt, 3	g2, 4	g1	k	h	—	—	B8A	141TH, X142, 14K7	UCH42
UCH81	Triode heptode frequency changer	19·0	0·1	g2, g4	g1	k, g5, s	h	h	ap	g3	at	gt	—	B9A	19D8, 10C14, X119	UCH81

UCL82	Triode-pentode (sep. cath.)	50	0·1	gt	kp, s, g3	g1	h	h	ap	g2	kt	at	—	B9A	10PL12, LN119, 50BM8	UCL82
UCL83	Output pentode with triode	38	0·1	at	gt	kt	h	h	ap	kp, g3	g2	g1	—	B9A		UCL83
UF41	Vari-mu R.F. pentode	12·6	0·1	h	a	g3, k	i.c.	g2	g1	k	h	—	—	B8A	W142, 121VP, 12AC5	UF41
UF42	High slope R.F. pentode	21·0	0·1	h	a	s	g3	g2	g1	k	h	—	—	B8A	Z142	UF42
UF80	R.F. pentode	19·0	0·1	k	g1	k	h	h	s	a	g2	g3	—	B9A		UF80
UF85	Vari-mu R.F. pentode	19·0	0·1	k	g1	k	h	h	s	a	g2	g3	—	B9A		UF85
UF86	Low noise A.F. pentode	12·6	0·1	g2	s	k	h	h	a	s	g3	g1	—	B9A		UF86
UF89	Vari-mu R.F. pentode	12·6	0·1	s	g1	k	h	h	s	a	g2	g3	—	B9A		UF89
UL41	Output pentode	45·0	0·1	h	a	g3, k	i.c.	g2	g1	k	h	—	—	B8A	N142, 451PT, 45A5	UL41
UL44	Output pentode	45·0	0·1	h	—	—	g3	g2	g1	k	h	—	a	B8A		UL44
UL46	Low microphony output pentode	45·0	0·1	h	a	g3, k	i.c.	g2	g1	k, g3	h	—	—	B8A		UL46
UL84	Output pentode	45·0	0·1	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	45B5, 10P18, N119	UL84
UM4	Tuning indicator (dual sensitivity)	12·6	0·1	h	—	a2	t	g	a1	k, g′	h	—	—	K		UM4
UM34	Tuning indicator	12·6	0·1	—	h	a′	g	t	a″	h	k	—	—	K	10M2	UM34
UM35	Tuning indicator (dual sensitivity)	12·6	0·1	h	i.c.	a″	t		a′	k	h	—	—	K	10M2	UM35
UM80	Tuning indicator	19	0·1	g	k, g′	i.c.	h	h	i.c.	a	i.c.	t	—	B9A	Y119, 19BR5	UM80
UU5	Full-wave rectifier	4·0	2·3	a′	a″	h, k	h	—	—	—	—	—	—	A	1W4-500, R3, 43IU	UU5
UU6	Full-wave rectifier	4·0	1·4	h, k	—	a′	—	a″	M	—	h	—	—	MO		UU6
UU7	Full-wave rectifier	4·0	2·3	h, k	—	a′	—	a″	M	—	h	—	—	MO		UU7
UU8	Full-wave rectifier	4·0	2·8	h, k	—	a′	—	a″	M	—	h	—	—	MO		UU8
UU9	Full-wave rectifier	6·3	0·6	h	a′	i.c.	i.c.	i.c.	a″	k	h	—	—	B8A	EZ40, 66KU, U150, 6BT4	UU9
UU12	Full-wave rectifier	6·3	0·95	a″	i.c.	k	h	h	i.c.	a′	i.c.	i.c.	—	B9A	U709, EZ81	UU12
UY21	Half-wave rectifier	50·0	0·1	h	a	—	a	—	a	k	h	—	—	B8G	7H7	UY21
UY41	Half-wave rectifier	31·0	0·1	h	a	—	i.c.	i.c.	i.c.	k	h	—	—	B8A	U142, 311SU, 31A3	UY41
UY85	Half-wave rectifier	38·0	0·1	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	U381, U119, 38A3	UY85
VP23	Vari-mu R.F. pentode	2·0	0·05	h	—	a	g2	g3	M	—	h	—	g1	MO		VP23
VP41	Vari-mu R.F. pentode	4·0	0·65	h	k	a	g2	g3	M	—	h	—	g1	MO	VP4B, AC/VP2	VP41
W17	Vari-mu R.F. pentode	1·4	0·05	s, f, g3	a	g2	—	g3	g1	—	—	—	—	B7G	1F3, 1T4, DF91	W17
W21	Vari-mu R.F. pentode	2·0	0·1	M	g1	g3	f	f	—	g2	—	—	a	M	210VPA, VP210, K50M	W21
W25	Vari-mu R.F. pentode	1·7	0·025	f−, g3, s	a	g2	i.c.	f−, g3, s	g1	f+	—	—	—	B7G	1AJ4, DF96, 1F1	W25
W61	Vari-mu R.F. pentode	6·3	0·3	M	h	a	g2	g3	—	h	k	—	g1	K		W61
W76	Vari-mu R.F. pentode	13·0	0·16	s	h	a	g2	g3	—	h	k	—	g1	K	12K7GT	W76
W77	Vari-mu R.F. pentode	6·3	0·2	g1	k	h	h	a	s, g3	g2	—	—	—	B7G	6CQ6, 9D6, EF92, VP6, 6F21	W77
W81	Vari-mu R.F. pentode	6·3	0·3	h	a	g2	g3	s	g1	k	h	—	—	B8G	7H7	W81
W101	Vari-mu R.F. pentode	19	0·1	h	a	g2	g3	s	g1	k	h	—	—	B8G		W101
W107	Vari-mu R.F. pentode	12·6	0·1	g1	k	h	h	a	s, g3	g2	—	—	—	B7G		W107
W118	Vari-mu R.F. pentode	13	0·1	h	a	s	g3	g2	g1	k	h	—	—	B8A	W145, 10F9	W118
W119	Vari-mu R.F. pentode	13	0·1	k	g1	k	h	h	s	a	g2	g3	—	B9A	10F18, 13EC7	W119
W142	R.F. pentode	12·6	0·1	h	a	g3, k	i.c.	g2	g1	k	h	—	—	B8A	UF41, 121VP, 12AC5	W142
W143	Vari-mu R.F. pentode	6·3	0·2	h	a	g2	s, g3	—	g1	k	h	—	—	B8G	7H7, W81	W143
W145	Vari-mu R.F. pentode	13·0	0·1	h	a	s	g3	g2	g1	k	h	—	—	B8A	10F9, W118	W145
W147	Vari-mu R.F. pentode	6·3	0·2	s	h	a	g2	g3	—	h	k	—	g1	K	EF39, OM6	W147
W148	Vari-mu R.F. pentode	6·3	0·3	h	a	g2	g3	s	g1	k	h	—	—	B8G	7H7, W81	W148
W149	Vari-mu R.F. pentode	6·3	0·15	h	a	g2	g3	s	g1	k	h	—	—	B8G	7B7	W149
W150	Vari-mu R.F. pentode	6·3	0·2	h	a	g3, k	g3, k	g2	g1	k, g3	h	—	—	B8A	EF41, 62VP, 6F16, 6CJ5	W150
W719	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	6BY7, EF85, 6F26	W719
W727	Vari-mu R.F. pentode	6·3	0·3	g1	g3, s	h	h	a	g2	k	—	—	—	B7G	6BA6, EF93	W727

Type	Description	Heater		Pin Connections										Base	Equivalents	Type
		Volts	Amp.	1	2	3	4	5	6	7	8	9	Cap			
W729	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF85, 6BY7, 6F19	W729
W739	Vari-mu R.F. pentode	6·3	0·2	k	g1	k	h	h	s	a	g2	g3	—	B9A	6F18, 6EC7	W739
WD119	Double diode, vari-mu R.F. pentode	19·0	0·1	g2	g3	k	h	h	ap	a′	a″	g1	—	B9A	UBF89, 10FD12, 19FL8	WD119
WD142	Diode vari-mu R.F. pentode	12·6	0·1	h	ap	ad	g3	g2	g1	k, s	h	—	—	B8A	UAF42, 12S7	WD142
WD709	Double diode R.F. pentode	6·3	0·3	g2	g1	k	h	h	ap	a′d	a″d	g3	—	B9A	EBF80, ZD152	WD709
X17	Heptode frequency changer	1·4	0·05	f, g5	a	g2, 4	g1	f, g5	g3	f	—	—	—	B7G	1C1, 1R5, DK91	X17
X18	Heptode frequency changer	1·4	0·05	f, g5	a	g2	g1	g4	g3	f	—	—	—	B7G	1AC6, 1C2, DK92	X18
X24	Triode hexode frequency changer	2·0	0·2	at	gt, g3	g2, 4	f	f	M	ah	—	—	g1	M	220TH, TH2	X24
X25	Pentagrid freq. changer	1·4	0·025	f—	a	g2	g1	g4	g3	f+, g5	—	—	—	B7G	DK96, 1AB6, 1C3	X25
X61M	Triode hexode freq. changer	6·3	0·3	s	h	ah	g2, 4	gt, 3	at	h	k	—	g1	K	ECH35, 6K8G, OM10	X61M
X71M	Triode hexode frequency changer	13·0	0·16	s	h	ah	g2, 4	gt, 3	at	h	k	—	g1	K	12K8GT, X76M	X71M
X76M	Triode hexode freq. changer	13·0	0·16	s	h	ah	g2, 4	gt, 3	at	h	k	—	g1	K	12K8GT, X71M	X76M
X78	Triode hexode frequency changer	6·3	0·3	g2, 4	g1	k, h	h	ah	at	gt, 3	—	—	—	B7G		X78
X79	Triode hexode frequency changer	6·3	0·3	g2, 4	g1	k	h	h	ah	gt, 3	at	i.c.	—	B9A		X79
X81	Triode hexode frequency changer	6·3	0·3	h	ah	at	gt, 3	g2, 4	g1	k	h	—	—	B8G	7S7	X81
X81M	Triode hexode frequency changer	6·3	0·3	h	ah	at	gt, 3	g2, 4	g1	k	h	—	—	B8G	7S7	X81M
X101	Triode hexode freq. changer	19	0·1	h	a	at	g3, gt	g2, g4	g1	k	h	—	—	B8G		X101
X109	Triode hexode frequency changer	19·0	0·1	g2, 4	g1	k	h	h	ah	gt, 3	at	i.c.	—	B9A		X109
X118	Triode heptode freq. changer	28	0·1	h	a	at	gt, g3	g2, 4	g1	k, s	h	—	—	B8A	10C1, X145	X118
X119	Triode heptode freq. changer	19	0·1	g2, g4	g1	k, g5, s	h	h	ah	g3	at	gt	—	B9A	UCH81, 10C14, 19D8	X119
X142	Triode hexode frequency changer	14·0	0·1	h	ah	at	gt, 3	g2	g1	k	h	—	—	B8A	141TH, UCH42, 14K7	X142
X143	Triode hexode frequency changer	6·3	0·33	h	ah	at	gt	g2, 4	g1	g3	h	—	k, g5††	B8G	ECH21	X143
X145	Triode hexode frequency changer	28·0	0·1	h	ah	at	gt, 3	g2, 4	g1	k	h	—	—	B8A	10C1, X118	X145
X147	Triode hexode frequency changer	6·3	0·3	s	h	ah	g2, 4	gt, 3	at	h	k	—	g1	K	ECH35, 6X8G, X61M	X147
X148	Triode hexode frequency changer	6·3	0·3	h	ah	at	gt, 3	g2, 4	g1	s, k, g5	h	—	—	B8G	7S7, X81	X148
X150	Triode hexode frequency changer	6·3	0·225	h	ah	at	gt, 3	g2, 4	g1	k	h	—	—	B8A	ECH42, 6C10, 62TH, 6CU7	X150
X719	Triode heptode frequency changer	6·3	0·3	g2, g4	g1	k, g5,	h	h	ah	g3	at	gt	—	B9A	6AJ8, ECH81, 6C12	X719
X727	Heptode freq. changer	6·3	0·3	g1	k, g5	h	h	a	g2, 4	g3	—	—	—	B7G	6BE6, EK90, X77	X727
Y25	Tuning indicator	1·4	0·025	g	i.c.	—	f	f	—	—	a	—	—	B8D	DM71, 1M1, 1N3	Y25
Y61	Tuning indicator	6·3	0·3	—	h	a	t	g	—	h	k	—	—	K	6U5G, 6M1, 63ME, VFT6	Y61
Y63	Tuning indicator	6·3	0·3	—	h	a	t	g	—	h	k	—	—	K	6U5G, 63ME, 6M1, VFT6	Y63
Y119	Tuning indicator	19·0	0·1	g	k, g′	i.c.	h	h	i.c.	a	i.c.	t	—	B9A	UM80	Y119
Z63	R.F. pentode	6·3	0·3	s	h	a	g2	g3	—	h	k	—	g1	K	6J7G, KTZ63	Z63

Z66	R.F. pentode	6·3	0·63	—	h	a	g2	g3, s	—	h	k	—	g1	K		Z66
Z77	R.F. pentode	6·3	0·3	g1	k	h	h	a	g3, s	g2	—	—	—	B7G	6AM6, EF91, SP6, 6F12, 8D3	Z77
Z142	R.F. pentode	21·0	0·1	h	a	s	g3	g2	g1	k	h	—	—	B8A	UF42	Z142
Z150	R.F. pentode	6·3	0·33	h	a	s	g3	g2	g1	k	h	—	—	B8A	EF42	Z150
Z152	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF80, Z719, 6BX6, 64SPT	Z152
Z309	R.F. pentode	12·6 c.t.	0·3	k	g1	k	h	h	h c.t.	a	g2	g3, s	—	B9A		Z309
Z329	R.F. pentode	7·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	30F5, 7ED7	Z329
Z359	Video pentode	12·6	0·3	k	g1	k	h	h	—	a	g2	g3, s	—	B9A		Z359
Z719	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF80, 6BX6, Z152, 64SPT	Z719
Z729	A.F. pentode	6·3	0·2	g2	s	k	h	h	a	s	g3	g1	—	B9A	EF86, 6F22, 6267	Z729
Z749	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	6F23, EF812, 6EL7	Z749
Z759	Video pentode	6·3	0·6	k	g1	k	—	h	h	a	g2	g3, s	—	B9A		Z759
ZD17	Diode pentode	1·4	0·05	f, g3	—	ad	g2	ap	g1	f	—	—	—	B7G	1S5, 1FD9, DAF91	ZD17
ZD25	Diode pentode	1·4	0·025	f−, g3	i.c.	ad	g2	a	g1	f+	—	—	—	B7G	DAF96, 1AH5, 1FD1	ZD25
ZD152	Double diode pentode	6·3	0·3	g2	g1	k	h	h	ap	a′d	a″d	g3	—	B9A	6N8, EBF80, WD709	ZD152
1A7	Heptode frequency changer	1·4	0·005	s	f	a	g3, 5	g1	g2	f	—	—	g4	K	X14, DK32	1A7
1C1	Heptode frequency changer	1·4	0·05	f, g5	a	g2, 4	g1	f, g5	g3	f	—	—	—	B7G	1R5, DK91, X17	1C1
1C2	Heptode frequency changer	1·4	0·05	f	a	g2	g1	g4	g3	f, g5	—	—	—	B7G	1AC6, DK92, X18	1C2
1C3	Pentagrid freq. changer	1·4	0·025	f—	a	g2	g1	g4	g3	f+, g5	—	—	—	B7G	DK96, 1AB6, X25	1C3
1C5	Output pentode	1·4	0·1	s	f	a	g2	g1	—	f, g3	—	—	—	K	DL35, N14	1C5
1D5	Vari-mu R.F. tetrode	2·0	0·06	—	f	a	g2	—	—	f	—	—	g1	K		1D5
1D5	Half-wave rectifier §	40·0	0·2	a	—	h	h	k	—	—	—	—	—	O	40SUA, U4020	1D5
1F1	Vari-mu R.F. pentode	1·4	0·025	f−, g3, s	a	g2	i.c.	f−, g3, s	g1	f+	—	—	—	B7G	DF96, 1AJ4, W25	1F1
1F2	R.F. pentode	1·4	0·05	f−, g3	a	g2	—	f−, g3	g1	f+	—	—	—	B7G	DF92, 1L4	1F2
1F3	Vari-mu R.F. pentode	1·4	0·05	s, f, g3	a	g2	—	g3	g1	f	—	—	—	B7G	DF91, 1T4, W17	1F3
1FD1	Diode A.F. pentode	1·4	0·025	f−, g3	i.c.	ad	g2	a	g1	f+	—	—	—	B7G	DAF96, 1AH5, ZD25	1FD1
1FD9	Diode pentode	1·4	0·05	f, g3	—	ad	g2	ap	g1	f	—	—	—	B7G	DAF91, 1S5, ZD17	1FD9
1H5	Diode triode	1·4	0·05	s	f	at	—	ad	—	f	—	—	g	K	DAC32, HD14	1H5
1L4	R.F. pentode	1·4	0·05	f−, g3	a	g2	—	f−, g3	g1	f+	—	—	—	B7G	DF92, 1F2	1L4
1M1	Tuning indicator	1·4	0·025	g	i.c.	—	f	f	—	—	a	—	—	B8D	DM71, Y25, DM70	1M1
1M3	Tuning indicator	1·4	0·025	g	i.c.	—	f	f	—	—	a	—	—	B8D	DM70	1M3
1N5	R.F. pentode	1·4	0·05	s	f	a	g2	—	—	f, g3	—	—	g1	K	DF33, Z14	1N5
1P1	Output pentode	1·4 2·8	0·05 0·025	f—	a	g2	—	f tap, g3	g1	f+	—	—	—	B7G	DL96, 3C4, N25	1P1
1P10	Output pentode	2·8 1·4	0·05 0·1	f—	a	g1	g2	f tap, g3	a	f+	—	—	—	B7G	N17, 3S4, DL92	1P10
1P11	Output pentode	2·8 1·4	0·05 0·1	f	a	g2	—	f c.t., g3	g1	f	—	—	—	B7G	DL94, 3V4, N19	1P11
1R5	Heptode frequency changer	1·4	0·05	f, g5	a	g2, 4	g1	f, g5	g3	f	—	—	—	B7G	DK91, X17, 1C1	1R5
1S5	Diode pentode	1·4	0·05	f, g3	—	ad	g2	ap	g1	f	—	—	—	B7G	DAF91, 1FD9, ZD17	1S5
1T4	Vari-mu R.F. pentode	1·4	0·05	s, f, g3	a	g2	—	f, g3	g1	f	—	—	—	B7G	DF91, 1F3, W17	1T4
1U5	Diode pentode	1·4	0·05	f, g3	ap	g2	ad	—	g1	f	—	—	—	B7G		1U5
3Q4	Output tetrode	1·4 2·8	0·1 0·05	f	a	g1	g2	f c.t.	a	f	—	—	—	B7G	N18, DL95	3Q4
3S4	Output tetrode	2·8 1·4	0·05 0·1	f	a	g1	g2	f c.t.	a	f	—	—	—	B7G	DL92, 1P10, N17	3S4
3V4	Output tetrode	1·4 2·8	0·1 0·05	f	a	g2	—	f c.t.	g1	f	—	—	—	B7G	DL94, 1P11, N19	3V4
5U4	Full-wave rectifier	5·0	3·0	—	h	—	a′	—	a″	—	h	—	—	K	U52, GZ31	5U4
5V4	Full-wave rectifier	5·0	2·0	—	h	—	a′	—	a″	—	k, h	—	—	K	GZ32, 52KU, 5AQ4	5V4
5Y3	Full-wave rectifier	5·0	2·0	—	h	—	a′	—	a″	—	h	—	—	K	U50	5Y3

†† Locking pin.

§ Indirectly heated.

Type	Description	Heater		Pin Connections										Base	Equivalents	Type
		Volts	Amp.	1	2	3	4	5	6	7	8	9	Cap			
5Z4	Full-wave rectifier	5·0	2·0	—	h	—	a′	—	a″	—	k, h	—	—	K	GZ30, R52	5Z4
6A8	Heptode frequency changer	6·3	0·3	s	h	a	g3, 5	g1	g2	h	k	—	g4	K	X63	6A8
6AB8	Triode pentode	6·3	0·3	at	gt	k	h	h	ap	g3	g2	g1	—	B9A	ECL80, LN152	6AB8
6AJ8	Triode heptode frequency changer	6·3	0·3	g2, 4	g1	s, k, g5	h	h	ah	g3	at	gt	—	B9A	ECH81, X719	6AJ8
6AK6	Output pentode	6·3	0·15	g1	g3, s	h	h	a	g2	k	—	—	—	B7G		6AK6
6AK8	Triple diode triode †	6·3	0·45	a′	a″	k″, s	h	h	a‴	k	g	at	—	B9A	EABC80, DH719, 6T8, 6LD12	6AK8
6AL5	Double diode	6·3	0·3	k′	a″	h	h	k″	s	a′	—	—	—	B7G	EB91, 6D2, D77, D152, DD6	6AL5
6AM5	Output pentode	6·3	0·2	g1	k, g3	h	h	a	i.c.	g2	—	—	—	B7G	N77, N144, EL91, 7D9, 6P17	6AM5
6AM6	R.F. pentode	6·3	0·3	g1	k	h	h	a	s, g3	g2	—	—	—	B7G	EF91, Z77, 6F12, 8D3, SP6	6AM6
6AQ5	Output tetrode	6·3	0·45	g1	k	h	h	a	g2	g1	—	—	—	B7G	N727, EL90	6AQ5
6AQ8	Double triode	6·3	0·435	a′	g′	k′	h	h	a″	g″	k″	s	—	B9A	ECC85, B719, 6L12	6AQ8
6AT6	Double diode triode	6·3	0·3	g	k	h	h	a′d	a″d	at	—	—	—	B7G	DH77, EBC90	6AT6
6B8	Double diode vari-mu R.F. pentode	6·3	0·3	s	h	ap	a′	a″	g2	h	k, g3	—	g1	K		6B8
6BA6	Vari-mu R.F. pentode	6·3	0·3	g1	s, g3	h	h	a	g2	k	—	—	—	B7G	EF93, W727	6BA6
6BE6	Heptode frequency changer	6·3	0·3	g1	k, g5	h	h	a	g2, 4	g3	—	—	—	B7G	X727, EK90, X77	6BE6
6BG6G	Line output tetrode	6·3	0·9	n.c.	h	k	n.p.	g1	n.p.	h	g2	—	a	K		6BG6G
6BH6	R.F. pentode	6·3	0·15	g1	k	h	h	a	g2	s, g3	—	—	—	B7G		6BH6
6BJ6	Vari-mu R.F. pentode	6·3	0·15	g1	k	h	h	a	g2	s, g3	—	—	—	B7G		6BJ6
6BQ5	Output pentode	6·3	0·76	i.c.	g1	g3, k	h	h	i.c.	a	i.c.	g2	—	B9A	EL84, N709, 6P15	6BQ5
6BQ7A	Double triode	6·3	0·4	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A		6BQ7
6BR7/8D5	Low noise A.F. pentode	6·3	0·15	—	g1	k	h	h	s	a	g2	g3	—	B9A		6BR7/8D5
6BW6	Output tetrode	6·3	0·45	i.c.	g1	k	h	h	—	a	g2	bp	—	B9A		6BW6
6BW7	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	8D6	6BW7
6BX6	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF80, Z719, Z152, 64SPT	6BX6
6BY7	Vari-mu R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	W719, EF85, 6F19	6BY7
6C4	Output triode	6·3	0·15	a	i.c.	h	h	a	g	k	—	—	—	B7G	L77, EC90	6C4
6C9	Triode heptode frequency changer	6·3	0·45	h	ah	at	gt, 3	g2, 4	g1	k, s	h	—	—	B8A		6C9
6C10	Triode hexode freq. changer	6·3	0·23	h	ah	at	gt, g3	g2, 4	g1	k	h	—	—	B8A	ECH42, X150, 62TH	6C10
6C12	Triode heptode freq. changer	6·3	0·3	g2, 4	g1	k, s, g5	h	h	ah	g3	at	gt	—	B9A	ECH81, X719, 6AJ8	6C12
6C31	Triode heptode freq. changer	6·3	0·83	s	h	ah	g2, 4	gt, g3	at	h	k	—	g1	K		6C31
6CD6	Output tetrode	6·3	2·5	—	h	k	—	g1	—	h	g2	—	a	K		6CD6
6CH6	Video output pentode	6·3	0·75	i.c.	g1	k	h	h	i.c.	a	g2	g3	—	B9A	EL821, 7D10	6CH6
6D1	Diode	6·3	0·15	h	k	h	—	—	—	—	—	—	a	B3G	EA50, SD61	6D1
6D2	Double diode	6·3	0·3	k′	a″	h	h	k″	s	a′	—	—	—	B7G	EB91, 6AL5, D77, DD6	6D2
6D3	Diode	6·3	0·3	a	k	h	h	a	—	—	—	—	—	B7G		6D3
6D6	R.F. pentode	6·3	0·3	h	a	g2	g3	k	h	—	—	—	g1	U.X. 6 pin		6D6
6F1	R.F. pentode	6·3	0·35	h	a	s, g3	g2	k	g1	k	h	—	—	B8A		6F1
6F6	Output pentode	6·3	0·7	—	h	a	g2	g1	—	h	k, g3	—	—	K	KT63	6F6
6F11	R.F. pentode	6·3	0·2	h	a	s	g3	g2	g1	k	h	—	—	B8A		6F11
6F12	R.F. pentode	6·3	0·3	g1	k	h	h	a	s, g3	g2	—	—	—	B7G	6AM6, EF91, SP6, 8D3, Z77	6F12
6F13	R.F. pentode	6·3	0·35	h	a	s	g3	g2	g1	k	h	—	—	B8A		6F13

6F14	R.F. pentode	6·3	0·35	h	a	s	g3	g2	g1	k	h	—	—	B8A		6F14
6F15	Vari-mu R.F. pentode	6·3	0·2	h	a	s	g3	g2	g1	k	h	—	—	B8A		6F15
6F16	Vari-mu R.F. pentode	6·3	0·2	h	a	g3, k	i.c.	g2	g1	k	h	—	—	B8A	62VP, EF41, W150, 6CJ5	6F16
6F18	Vari-mu R.F. pentode	6·3	0·2	k	g1	k	h	h	s	a	g2	g3	—	B9A	W739, 6EC7	6F18
6F19	Vari-mu R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF85, W719, 6BY7	6F19
6F23	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF812, Z749, 6EL7	6F23
6F24	R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF814	6F24
6F25	Vari-mu R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF811	6F25
6F26	Vari-mu R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A		6F26
6F28	Video output tetrode	6·3	0·3	i.c.	g1	k	h	h	bp, s	a	g2	n.c.	—	B9A	EE80	6F28
6F29	Vari-mu frame grid R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF183, 6EH7	6F29
6F30	Frame-grid R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	EF184, 6EJ7	6F30
6F33	R.F. pentode	6·3	0·35	g1	k	h	h	a	s, g3	g2	—	—	—	B7G		6F33
6FD12	Double diode vari-mu pentode	6·3	0·3	g2	g1	k, s	h	h	a	a′d	a″d	g3	—	B9A	EBF89	6FD12
6H6	Double diode	6·3	0·3	s	h	a′	k′	a″	—	h	k″	—	—	K	D63	6H6
6J5	Triode	6·3	0·3	s	h	a	—	g	—	h	k	—	—	K	L63	6J5
6J7GT	R.F. pentode	6·3	0·3	s	h	a	g2	g3	—	h	k	—	g1	K	Z63	6J7GT
6K6GT	Output pentode	6·3	0·4	n.c.	h	a	g2	g1	n.p.	h	k, g3	—	—	K		6K6GT
6K7	Vari-mu R.F. pentode	6·3	0·3	s	h	a	g2	g3	—	h	k	—	g1	K	KTW63	6K7
6K8	Triode hexode frequency changer	6·3	0·3	s	h	ah	g2, 4	g1, gt	at	h	k	—	g3	K	X65	6K8
6K25	Gas triode	6·3	0·95	s	h	a	—	g	—	h	k	—	—	K		6K25
6L1	Double triode	6·3	0·4	h	a′	g′	k′	a″	g″	k″	h	—	—	B8A		6L1
6L6	Output tetrode	6·3	0·9	M	h	a	g2	g1	—	h	k	—	—	K	KT66	6L6
6L12	R.F. double triode	6·3	0·435	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A	B719, ECC85, 6AQ8	6L12
6L13	Double triode	12·6 c.t.	0·15	a″	g″	k″	h	h	a′	g′	k′	h c.t.	—	B9A	ECC83, 12AX7, B339	6L13
6L15	R.F. double triode	6·3	0·33	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A		6L15
6L16	V.H.F. double triode (cascode)	6·3	0·33	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A		6L16
6L18	Triode	6·3	0·3	h	a	i.c.	s	i.c.	g	k	h	—	—	B8A		6L18
6L19	Double triode	6·3	0·4	h	a′	g′	k′	a″	g″	k″	h	—	—	B8A		6L19
6L34	V.H.F. triode	6·3	0·3	g	k	h	h	k	g	a	—	—	—	B7G	EC91	6L34
6LD3	Double diode triode	6·3	0·23	h	a	g	s	a″d	a′d	k	h	—	—	B8A	EBC41, DH150, 62DDT	6LD3
6LD12	Triple diode triode	6·3	0·45	a‴d	a″d	k″d	h	h	a′d	k, s	g	at	—	B9A	EABC80, 6AK8, DH719	6LD12
6LD13	Double diode triode	6·3	0·2	a	g	k	h	h	a′d	s	a″d	i.c.	—	B9A	EBC81, 6BD7A	6LD13
9LD20	Double diode triode	6·3	0·25	h	a	g	s	a′d	a″d	k	h	—	—	B8A		6LD20
6M1	Tuning indicator	6·3	0·3	—	h	a	t	g	—	h	k	—	—	K	63ME, Y61, 6U5G	6M1
6M2	Tuning indicator (dual sensitivity)	6·3	0·2	i.c.	h	a″	g	t	a′	h	k	—	—	K	EM35, 64ME	6M2
6N7GT	Double triode	6·3	0·8	n.c.	h	a″	g″	g′	a′	h	k	—	—	K		6N7GT
6N8	Double diode vari-mu R.F. pentode	6·3	0·3	g2	g1	k, s	h	h	a	a′d	a″d	g3	—	B9A	EBF80, WD709, ZD152	6N8
6P1	Output tetrode	6·3	0·8	—	h	a	g2	g1	—	h	k	—	—	K		6P1
6P15	Output pentode	6·3	0·76	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	EL84, N709, 6BQ5	6P15
6P17	Output pentode	6·3	0·2	g1	k, g3	h	h	a	n.c.	g2	—	—	—	B7G	EL91, N144, 6AM5	6P17
6P25	Output tetrode	6·3	1·1	M	h	a	g2	g1	—	h	k	—	—	K	KT61	6P25
6P26	Output tetrode	6·3	0·6	s	h	a	g2	g1	—	h	k, bp	—	—	K		6P26
6P28	Output tetrode	6·3	1·1	—	h	—	g2	g1	—	h	k	—	a	K		6P28
6Q7	Double diode triode	6·3	0·3	s	h	at	a′	a″	—	h	k	—	g	K	DH63	6Q7
6SH7	R.F. pentode	6·3	0·3	s	h	k, g3	g1	k, g3	g2	h	a	—	—	K		6SH7
6SK7	Vari-mu R.F. pentode	6·3	0·3	M	h	g3	g1	k	g2	h	a	—	—	K		6SK7
6SL7	Double triode	6·3	0·3	g′	a′	k′	g″	a″	k″	h	h	—	—	K		6SL7
6SN7	Double triode	6·3	0·6	g′	a′	k′	g″	a″	k″	h	h	—	—	K	B65, ECC32	6SN7

† Separate cathode for one diode.

Type	Description	Heater		Pin Connections										Base	Equivalents	Type
		Volts	Amp.	1	2	3	4	5	6	7	8	9	Cap			
6T8	Triple diode triode	6·3	0·45	a'''d	a''d	k''d	h	h	a'd	k, s	g	at	—	B9A	6AK8, DH719, EABC80, 6LD12	6T8
6U4GT	Boost diode	6·3	1·2	—	—	k	—	a	—	h	h	—	—	K		6U4GT
6U5	Tuning indicator	6·3	0·3	—	h	a	t	g	—	h	k	—	—	K ¶	6M1, 63ME	6U5
6U7	Vari-mu R.F. pentode	6·3	0·3	s	h	a	g2	g3	—	h	k	—	g1	K	6K7G, KTW63	6U7
6U8	Triode pentode	6·3	0·45	at	g1	g2	h	h	ap	kp, g3, s	kp	gt	—	B9A	ECF82	6U8
6V4	Full-wave rectifier	6·3	0·6	a'	i.c.	k	h	h	i.c.	a''	i.c.	i.c.	—	B9A	EZ80	6V4
6V6	Output tetrode	6·3	0·45	M	h	a	g2	g1	—	h	k	—	—	K		6V6
6W2	E.H.T. Half-wave rectifier	6·3	0·08					Special Base						Spec. 1	R12A	6W2
6X4	Full-wave rectifier	6·3	0·6	a'	—	h	h	—	a''	k	—	—	—	B7G	EZ90, U78	6X4
6X5	Full-wave rectifier	6·3	0·65	—	h	a'	—	a''	—	h	k	—	—	K	EZ35, U147, U70	6X5
6X6	Tuning indicator	6·3	0·3	—	h	a	t	g	—	h	k	—	—	K		6X6
6Y6	Output tetrode	6·3	1·25	M	h	a	g2	g1	—	h	k	—	—	K		6Y6
6-30L2	Double triode	6·3	0·3	a''	g''	k''	h	h	a'	g'	k'	s	—	B9A	B729, ECC804, 6GA8	6-30L2
7AN7	Double triode	7·0	0·3	k''	g'', s	a''	h	h	g'	k' in	k' out	a'	—	B9A	B319, PCC84, 30L1	7AN7
7B6	Double diode triode	6·3	0·3	h	at	g	k	a'	a''	k	h	—	—	B8G	DH81	7B6
7B7	Vari-mu R.F. pentode	6·3	0·15	h	a	g2	g3	s	g1	k	h	—	—	B8G	W149	7B7
7C5	Output tetrode	6·3	0·45	h	a	g2	—	—	g1	k	h	—	—	B8G	N148	7C5
7C6	Double diode triode	6·3	0·15	h	at	g	k	a'	a''	k	h	—	—	B8G	DH149	7C6
7D9	Output pentode	6·3	0·2	g1	k, g3	h	h	a	—	g2	—	—	—	B7G	6AM5, EL91, N77, N144	7D9
7H7	Vari-mu R.F. pentode	6·3	0·3	h	a	g2	g3	s	g1	k	h	—	—	B8G	W148, W81, W143	7H7
7K7	Double diode triode	6·3	0·3	h	kt	at	gt	a'd	a''d	s, kd	h	—	—	B8G		7K7
7R7	Double diode vari-mu R.F. pentode	6·3	0·3	h	ap	a'	a''	g2	g1	s, k, g3	h	—	—	B8G		7R7
7S7	Triode hexode frequency changer	6·3	0·3	h	ah	at	gt, g3	g2, 4	g1	s, k g5	h	—	—	B8G	X148, X81	7S7
7Y4	Full-wave rectifier	6·3	0·5	h	—	a'	—	—	a''	k	h	—	—	B8G	U82, U149	7Y4
8A8	Triode pentode	9·0	0·3	at	g1	g2	h	h	ap	kp, g3, s	kt	gt	—	B9A	PCF80, 30C1, LZ319, 9A8, LZ329	8A8
8D3	R.F. pentode	6·3	0·3	g1	k	h	h	a	s, g3	g2	—	—	—	B7G	6AM6, EF91, Z77, 6F12, SP6	8D3
8D5	see 6BR7															8D5
9A8	Triode pentode	9·0	0·3	at	g1	g2	h	h	ap	k, g3	kt	gt	—	B9A	8A8, PCF80, 30C1, LZ319	9A8
9BW6	Output tetrode	9·0	0·3	i.c.	g1	k	h	h	—	a	g2	g3	—	B9A		9BW6
9D6	Vari-mu R.F. pentode	6·3	0·2	g1	k	h	h	a	s, g3	g2	—	—	—	B7G	6CQ6, EF92, W77, VP6	9D6
9D7	Vari-mu R.F. pentode	6·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A		9D7
9U8	Triode pentode	9·5	0·3	at	g1	g2	h	h	ap	kp, g3, s	kt	gt	—	B9A	PCF82	9U8
10C1	Triode heptode frequency changer	28·0	0·1	h	ah	at	gt, 3	g2, 4	g1	k, s	h	—	—	B8A	X145, X118	10C1
10C2	Frequency changer	28·0	0·1	h	ah	at	gt	g2	g1	k, s, g3	h	—	—	B8A		10C2
10C14	Triode heptode freq. changer	19	0·1	g2, 4	g1	k, g5, s	h	h	ah	g3	at	gt	—	B9A	UCH81, X119	10C14
10D2	Double diode (separate cathodes)	19·0	0·1	k'	a''	h	h	k''	s	a'	—	—	—	B7G		10D2
10F1	R.F. pentode	22·0	0·1	h	a	g3, s	g2	k	g1	k	h	—	—	B8A	Z145	10F1
10F3	R.F. pentode	22·0	0·1	h	a	s	g3	g2	g1	k	h	—	—	B8A		10F3
10F9	Vari-mu R.F. pentode	13·0	0·1	h	a	s	g3	g2	g1	k	h	—	—	B8A	W145, W118	10F9
10F18	Vari-mu R.F. pentode	13·0	0·1	k	g1	k	h	h	s	a	g2	g3	—	B9A	W119	10F18

10FD12	Double diode vari-mu pentode	19	0·1	g2	g1	k, s	h	h	a	a′d	a″d	g3	—	B9A	UBF89, WD119	10FD12
10L1	V.H.F. triode	19·0	0·1	g1	k	h	h	k	g1	a	—	—	—	B7G		10L1
10L14	R.F. double triode	26·0	0·1	a″	g″	k″	h	h	a′	g′	k′	s	—	B9A	B109, UCC85	10L14
10LD3	Double diode triode	14·0	0·1	h	at	g	s	a′d	a″d	k	h	—	—	B8A	DH142, DH118, UBC41, 141DDT	10LD3
10LD11	Double diode triode	15·0	0·1	h	at	g	s	a′d	a″d	k	h	—	—	B8A	DL145	10LD11
10LD12	Triple diode triode	28·0	0·1	a‴d	a″d	k″d	h	h	a′d	k, s	g	at	—	B9A	DH109, UABC80	10LD12
10LD13	Double diode triode	13·0	0·1	a	g	k	h	h	a′d	s	a″d	i.c.	—	B9A	UBC81, DH119	10LD13
10M1	Tuning indicator	19·0	0·1	—	h	a	t	g	—	h	k	—	—	K		10M1
10M2	Tuning indicator (dual sensitivity)	12·6	0·1	h	i.c.	a″	t	g	a′	a	h	—	—	K		10M2
10P13	Output tetrode	40·0	0·1	h	a	i.c.	i.c.	g2	g1	k, g3	h	—	—	B8A	N145, N118	10P13
10P14	Output tetrode	40·0	0·1	—	h	a	g2	g1	—	h	k	—	—	K		10P14
10P18	Output pentode	45·0	0·1	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	N119, UL84	10P18
10PL12	Triode pentode (sep. cath.)	50	0·1	gt	kp, g3, s	g1	h	h	ap	g2	kt	at	—	B9A	UCL82 (near), LN119	10PL12
12A6	Output tetrode	12·6	0·15	—	h	a	g2	g1	—	h	k, g3	—	—	K		12A6
12AC6	Car radio vari-mu pentode	12·6	0·15	g1	g3, s	h	h	a	g2	k	—	—	—	B7G		12AC6
12AD6	Car radio freq. changer	12·6	0·15	g1	k, g5	h	h	a	g2, 4	g3	—	—	—	B7G		12AD6
12AE6	Car radio double diode triode	12·6	0·15	g	k	h	h	a″d	a′d	a	—	—	—	B7G		12AE6
12AH8	Triode heptode frequency changer	6·3 12·6	0·3 0·15	g2, 4	g1	k	h	h	ah	gt, g3	at	h c.t.	—	B9A		12AH8
12AT6	Double diode triode	12·6	0·15	g	k	h	h	a′	a″	at	—	—	—	B7G	HBC90	12AT6
12AT7	Double triode	12·6 c.t.	0·15	a′	g′	k′	h	h	a″	g″	k″	h tap	—	B9A	ECC81, B309, B152	12AT7
12AU7	Double triode	12·6 c.t.	0·15	a′	g′	k′	h	h	a″	g″	k″	h tap	—	B9A	ECC82, B329	12AU7
12AX7	Double triode	12·6 c.t.	0·15	a″	g″	k″	h	h	a′	g′	k′	h tap	—	B9A	ECC83, B339, 6L13	12AX7
12BA6	Vari-mu R.F. pentode	12·6	0·15	g1	s, g3	h	h	a	g2	k	—	—	—	B7G	HF93	12BA6
12BE6	Heptode frequency changer	12·6	0·15	g1	k, g5	h	h	a	g2, 4	g3	—	—	—	B7G	HK90	12BE6
12BH7	Double triode	12·6 c.t.	0·3	a′	g′	k′	h	h	a″	g″	k″	h tap	—	B9A		12BH7
12C8	Double diode pentode	12·6	0·15	s	h	ap	a′	a″	g2	h	k, g3	—	g1	K		12C8
12J7	R.F. pentode	12·6	0·15	s	h	a	g2	g3	—	h	k	—	g1	K		12J7
12K5	Car radio driver tetrode	12·6	0·45	k	g2 • (• control grid)	h	h	g1	g1	a	—	—	—	B7G		12K5
12K7	Vari-mu R.F. pentode	12·6	0·15	s	h	a	g2	g3	—	h	k	—	g1	K	W76	12K7
12K8	Triode hexode frequency changer	12·6	0·15	s	h	ah	g2, 4	g1, gt	at	h	k	—	g3	K	X76	12K8
12Q7	Double diode triode	12·6	0·15	s	h	at	a′	a″	—	h	k	—	g	K	DH76	12Q7
12SL7	Double triode	12·6	0·15	g′	a′	k′	g″	a″	k″	h	h	—	—	K		12SL7
12SN7	Double triode	12·6	0·3	g′	a″	k′	g′	a′	k′	h	h	—	—	K	B36	12SN7
12U5	Tuning indicator	12·6	0·15	—	h	a	t	g	—	h	k	—	—	K		12U5
14B6	Double diode triode	12·6	0·15	h	at	g	k	a′	a″	k	h	—	—	B8G		14B6
14H7	Vari-mu R.F. pentode	12·6	0·15	h	a	g2	g3	s	g1	k	h	—	—	B8G		14H7
14R7	Double diode vari-mu R.F. pentode	12·6	0·15	h	ap	a′	a″	g2	g1	s, k, g3	h	—	—	B8G		14R7
14S7	Triode hexode frequency changer	12·6	0·15	h	ah	at	gt, g3	g2, 4	g1	s, k	h	—	—	B8G		14S7
16A5	Output pentode	16·5	0·3	—	g1	k, g3	h	h	—	a	—	g2	—	B9A	N154, N329, PL82, 30P16	16A5
16A8	Triode pentode	16·0	0·3	gt	kp, g3, s	g1	h	h	ap	g2	kt	at	—	B9A	PCL82	16A8
17Z3	Boost diode	17·0	0·3	i.c.	i.c.	i.c.	h	h	i.c.	i.c.	i.c.	a	k	B9A	PY81, U153	17Z3
19AQ5	Output tetrode	19·0	0·15	g1	k	h	h	a	g2	g1	—	—	—	B7G		19AQ5

¶ Note: 6U5/6G5 has a U.X. base.

Type	Description	Heater		Pin Connections										Base	Equivalents	Type
		Volts	Amps.	1	2	3	4	5	6	7	8	9	Cap			
19BG6	Output tetrode	19·0	0·3	—	h	k, g3	—	g1	—	h	g2	—	a	K		19BG6
19D8	Triode heptode	19·0	0·1	g2, 4	g1	k, g5, s	h	h	ah	g3	at	gt	—	B9A	UCH81, 10C14, X119	19D8
19X3	Boost diode	19·0	0·3	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	PY80, U152, U309	19X3
19Y3	Half-wave rectifier	19·0	0·3	i.c.	i.c.	k	h	h	i.c.	i.c.	i.c.	a	—	B9A	PY82, U154, U319, 19SU	19Y3
20D1	Double diode	9·5	0·2	k′	a″	h	h	k″	s	a′	—	—	—	B7G		20D1
20D4	Triode heptode freq. changer	6·3	0·3	g2, 4, 5	g1	k	h	h	ah	g3	at	gt	—	B9A		20D4
20F2	R.F. pentode	11·0	0·2	h	a	s	g3	g2	g1	k	h	—	—	B8A		20F2
20L1	Double triode	12·6	0·2	h	a′	g′	k′	a″	g″	k″	h	—	—	B8A		20L1
20P1	Line output tetrode	38·0	0·2	—	h	—	g2	g1	—	h	k	—	a	K		20P1
20P3	Output tetrode	20·0	0·2	—	h	a	g2	g1	—	h	k	—	—	K		20P3
20P4	Line output tetrode	38·0	0·2	—	h	—	g2	g1	—	h	k	—	a	K		20P4
20P5	Output tetrode	20·0	0·2	h	a	i.c.	i.c.	g2	g1	k, g3	h	—	—	B8A		20P5
21A6	Output pentode	21·5	0·3	i.c.	g1	k	h	h	i.c.	i.c.	g2	g3	a	B9A	N152, PL81, N339, N359	21A6
21B6	Line output	21·5	0·3	i.c.	g1	k	h	h	i.c.	i.c.	g2	g3	a	B9A	PL81 (near)	21B6
25A6	Output pentode	25·0	0·3	—	h	a	g2	g1	—	h	k, g3	—	—	K		25A6
25L6	Output tetrode	25·0	0·3	M	h	a	g2	g1	—	h	k	—	—	K	KT32	25L6
25Z4	Half-wave rectifier	25·0	0·3	—	h	a	—	a	—	h	k	—	—	K	U31	25Z4
25Z6	Full-wave rectifier	25·0	0·3	s	h	a′	k′	a″	—	h	k″	—	—	K		25Z6
27SU	Half-wave rectifier	{ 13·25 26·5	0·9 0·45 }	h tap	h	—	—	a	—	h	k	—	—	K		27SU
30C1	Triode pentode	9·0	0·3	at	g1	g2	h	h	ap	k, g3, s	kt	gt	—	B9A	9A8, PCF80, LZ319, LZ329	30C1
30C13	Triode pentode F.C.	9·0	0·3	kp	g2	ap	h	h	at	gt	k	g1	—	B9A		30C13
30C15	Triode-pentode freq. changer	9·0	0·3	kp	g2	ap	h	h	at	gt	kp, g3, s, kt	g1	—	B9A		30C15
30C17	Triode-pentode freq. changer	7·4	0·3	k, g3, s	g2	ap	h	h	at	gt	k, g3, s	g1	—	B9A		30C17
30C18	Triode, frame-grid vari-mu pentode	7·4	0·3	at	g2	ap	h	h	kt, g3, s	g1	kp *	gt	—	B9A	PCF805	30C18
30F5	R.F. pentode	7·3	0·3	k	g1	k	h	h	s	a	g2	g3	—	B9A	Z329, 7ED7	30F5
30F27	V.H.F. tetrode	3·7	0·3	k	g1	k, in	h	h	s	a	g2	k	—	B9A		30F27
30FL1	Triode output tetrode	9·4	0·3	at	gt	kt	h	h	ap	g2	g1	kp, g3	—	B9A	LN339, PCF800	30FL1
30FL12	Triode-tetrode (video amp.)	9·8	0·3	at	gt	kt	h	h	aq	g2	g1	kq, bp, s	—	B9A	PCF82	30FL12
30FL13	Triode-tetrode	10·0	0·3	at	gt	kt	h	h	aq	g2	g1q	k, bp	—	B9A		30FL13
30L1	Double triode	7·0	0·3	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A	7AN7, PCC84, B319	30L1
30L15	Double triode	7·0	0·3	k″	g″, s	a″	h	h	g′	k′ in	k′ out	a′	—	B9A	PCC805, B349	30L15
30L17	Cascode double-triode	7·2	0·3	k″	g″, s1	a″	h	h, s2	g′	k′in	k′out	a′	—	B9A	PCC806	30L17
30P4	Output tetrode	25·0	0·3	i.c.	h	i.c.	g2	g1	—	h	k, g3	—	a	K	PL36, N308, 25GF6	30P4
30P4MR	Line-output beam tetrode †	25	0·3	n.c.	h	i.c.	g2	g1	n.p.	h	k	—	a	K		30P4MR
30P12	Output tetrode	12·6	0·3	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	N369, 12FB5	30P12
30P16	Output Pentode	16·5	0·3	i.c.	g1	k, g3	h	h	i.c.	a	i.c.	g2	—	B9A	N154, N329, PL82, 16A5	30P16
30P18	Output pentode	15·0	0·3	i.c.	g1	k, g3	h	h	—	a	i.c.	g2	—	B9A	PL84, N379	30P18
30P19	Line output tetrode	25·0	0·3	n.c.	h	i.c.	g2	g1	—	h	k	—	a	K	PL302, N389	30P19
30PL1	Triode output tetrode	13·0	0·3	at	gt	kt	h	h	ap	kp, g3	g2	g1	—	B9A	LN319, 13GC8	30PL1
30PL13	Triode tetrode (sep. cath.)	16	0·3	gt	kq,bp, s	g1	h	h	aq	g2	kt	at	—	B9A	PCL800, 16GK8	30PL13
30PL14	Triode-tetrode (frame output)	16·0	0·3	gt	kq, s	g1	h	h	aq	g2	kt	at	—	B9A	PCL88, LN329	30PL14
31A3	Half-wave rectifier	31·0	0·1	h	a	i.c.	i.c.	i.c.	i.c.	k	h	—	—	B8A	UY41	31A3
35A5	Output tetrode	35·0	0·15	h	a	g2	—	—	g1	k	h	—	—	B8G		35A5

35L6	Output tetrode	35·0	0·15	M	h	a	g2	g1	—	h	k	·—	—	K		35L6
35W4	Half-wave rectifier	35·0	0·15	—	—	h	h	a	h c.t.	k	—	—	—	B7G	HY90	35W4
35Z3	Half-wave rectifier	35·0	0·15	h	a	—	—	—	—	k	h	—	s††	B8G		35Z3
35Z4	Half-wave rectifier	35·0	0·15	—	h	—	—	a	—	h	k	—	—	K	U76	35Z4
35Z6	Full-wave rectifier	35·0	0·3	s	h	a′	k′	a″	—	h	k″	—	—	K		35Z6
50C5	Output tetrode	50·0	0·15	k, g3	g1	h	h	g1	g2	a	—	—	—	B7G	HL92	50C5
50CD6	Output tetrode	50·0	0·3	—	h	k, g3	—	g1	—	h	g2	—	a	K		50CD6
50L6	Output tetrode	50·0	0·15	M	h	a	g2	g1	—	h	k	—	—	K	KT71	50L6
52KU	Full-wave rectifier	5·0	2·0	—	h	—	a′	—	a″	—	k, h	—	—	K	R52	52KU
53KU	Full-wave rectifier	5·0	2·8	—	h	—	a′	—	a″	—	k, h	—	—	K	U54, GZ37	53KU
54KU	Full-wave rectifier	5·0	2·3	—	h	—	a′	—	a″	—	k, h	—	—	K	GZ32	54KU
61BT	Output tetrode	6·3	0·7	—	h	—	g2	g1	—	h	k	—	—	K		61BT
61SPT	R.F. pentode	6·3	1·27	—	h	g3	g2	g1	—	h	k	—	a	K		61SPT
62BT	Output tetrode	6·3	1·27	—	h	—	g2	g1	—	h	k	—	a	K		62BT
62DDT	Double diode triode	6·3	0·23	h	at	g	s	a″	a′	k	h	—	—	B8A	EBC41, DH150, 6LD3	62DDT
62TH	Triode hexode F.C.	6·3	0·23	h	ah	at	gt, 3	g2, 4	g1	k	h	—	—	B8A	ECH42, X150, 6C10	62TH
63ME	Tuning indicator	6·3	0·3	—	h	a	t	g	—	h	k	—	—	K	VFT6, 6U5G, Y63, 6M1	63ME
63SPT	R.F. pentode	6·3	0·3	h	g2	a	g3	s	k	g1	s	h	—	B9G	EF50	63SPT
64ME	Tuning indicator (dual sensitivity)	6·3	0·2	n.c.	h	a′	g	t	a″	h	k	—	—	K	6M2, EM35	64ME
65ME	Tuning indicator	6·3	0·3	g	k	i.c.	h	h	i.c.	a	i.c.	t	—	B9A	EM80,6BR5	65ME
66KU	Full-wave rectifier	6·3	0·6	h	a″	—	i.c.	—	a′	k	h	—	—	B8A	EZ40, U150, UU9	66KU
67PT	Output pentode	6·3	0·7	h	a	i.c.	i.c.	g2	g1	k, g3	h	—	—	B8A	EL41, N150	67PT
141DDT	Double diode triode	14·0	0·1	h	at	g	s	a″	a′	k	h	—	—	B8A	UBC41, 10LD3, DH118, DH142	141DDT
141TH	Triode hexode frequency changer	14·0	0·1	h	ah	at	gt, 3	g2, 4	g1	k	h	—	—	B8A	UCH42, X142	141TH
142BT	Output beam tetrode	14	0·2	n.c.	h	a	g2	g1	n.c.	h	k, pb	—	—	K		142BT
171DDP	Double diode vari-mu R.F. pentode	17·0	0·1	g2	g3	k	h	h	ap	a′	a″	g1	—	B9A	UBF80	171DDP
185BT } 185BTA }	Output tetrode	18·0	0·45	—	h	—	g2	g1	—	h	k	—	a	K		{ 185BT { 185BTA
311SU	Half-wave rectifier	31·0	0·1	h	a	—	i.c.	i.c.	i.c.	k	h	—	—	B8A	U142, UY41, 31A3	311SU
332PEN	Output pentode	33·0	0·2	—	h	a	g2	g1	—	h	k, g3	—	—	K	CL33	332PEN
451PT	Output pentode	45·0	0·1	h	a	g3, k	i.c.	g2	g1	k	h	—	—	B8A	UL41, N142, 45A5	451PT
807	Output tetrode	6·3	0·9	h	g2	g1	k	h	—	—	—	—	a	U.X. 5 pin	QVO5-25	807
1629	Tuning indicator	12·6	0·15	—	h	a	t	g	—	h	k	—	—	K		1629

* Joined to pin 6 but should be used for purpose stated. † For certain Murphy receivers. Other 30P4 may be replaced by 30P19 without modification, †† Locking pin.

Civilian Equivalents of Selected Service Type Valves and Transistors

Service Type	*Equivalent*	*Service Type*	*Equivalent*	*Service Type*	*Equivalent*
CV21	VP41	CV882	7B6	CV1944/6	6K8 *
CV24	HL41	CV885, 6	7C5 *	CV1947/8	6L6 *
CV65	PEN 25	CV887	7C6	CV1977	UL41
CV131	9D6, EF92	CV895	7H7	CV1985	6SL7
CV133	6C4	CV900	7R7	CV1988	6SN7
CV140	6AL5, EB91	CV901	7Y4	CV2128	ECH81
CV171	W21	CV917	12J7	CV2500	35Z4
CV281	X61M	CV918	12K7	CV2862	AZ31
CV283	6AL5	CV1039	MU14, IW4-350	CV2926	EBL31
CV303	EF22	CV1053	EF39	CV2398	EL33
CV358	EF37A	CV1055	EBC33	CV2954	FC2A
CV378	GZ32	CV1067	6J5	CV2996	HL41DD
CV394	EM34	CV1071	5U4	CV3630	PEN 44
CV452	6AT6, EBC90	CV1075	KT66	CV3631	PEN 45DD
CV453	6BE6, EK90	CV1103	Y63, EM35	CV3753	U31
CV454	6BA6, EF93	CV1186	6F6	CV3759	R2
CV492	12AX7, ECC83	CV1268	5Y3	CV3761	UU7
CV493	6X4, EZ90	CV1281	KTW61	CV3793	VP23
CV504	6U5	CV1286	6L6	CV3804	W21
CV509/11	6V6 *	CV1296	MU14	CV3819/20	X24
CV515	6Y6G	CV1301	6H6	CV3882	EBC41
CV525	12A6	CV1331	VP23	CV3883	EAF42
CV526	12A6GT	CV1335	SP41	CV3884	ECC40
CV549/50	25A6 *	CV1342	QP25	CV3885	EF40
CV551/3	25L6 *	CV1345	TP25	CV3886	EF41
CV559	25Z6	CV1347	ECH35	CV3887	EF42
CV561/2	35L6 *	CV1359	ME41	CV3888	ECH42
CV565	35Z3	CV1401	CL33	CV3889	EL41
CV571	50L6	CV1402	CY31	CV3890	EL42
CV572/4	6X5 *	CV1407	PEN 45	CV3891	EZ40
CV575	5U4	CV1411	TH41	CV3892	AZ41
CV578/80	6A8 *	CV1413	UU6	CV3908	6BH6
CV586	EL37	CV1414	VP41	CV3909	6BJ6
CV587/9	6Q7 *	CV1438	KT61	CV3927	12K8GT
CV593	GZ32	CV1463	CBL31	CV5055	EM81
CV703	12K8	CV1574	SP41	CV5065	6U8/ECF82
CV706	6U7G	CV1581	ECH35	CV5072	EZ81
CV713	6F6G/GT	CV1800/2	1A7 *	CV5080	EF37A
CV726	35Z3	CV1803/5	1C5 *	CV5110	EF39
CV729	5V4G, GZ32	CV1806	1D5	CV7003	OC44
CV731	6F6	CV1818/20	1H5 *	CV7004	OC45
CV764	1D5	CV1821/3	1N5 *	CV7005	OC71
CV782	1R5, DK91	CV1854/6	5Y3 *	CV7006	OC72
CV784	1S5, DAF91	CV1863/4	5Z4	CV7008	GET6
CV785	1T4, DF91	CV1893/4	6B8 *	CV7009	GET10
CV818	3Q4	CV1911/2	6F6 *	CV7011/12	V30/30P
CV820	3S4, DL92	CV1929/31	6H6 *	CV7083	OC29
CV841	5U4GT	CV1932/4	6J5 *	CV7089	OC171
CV852	6C4	CV1941/3	6K7 *		

* In practically all cases, the first CV number is the equivalent of the type suffixed G, and the last CV number is the equivalent of the GT type valve, *i.e.*, in the case of CV509/11, CV509 = 6V6G, CV510 = 6V6, CV511 = 6V6GT.

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