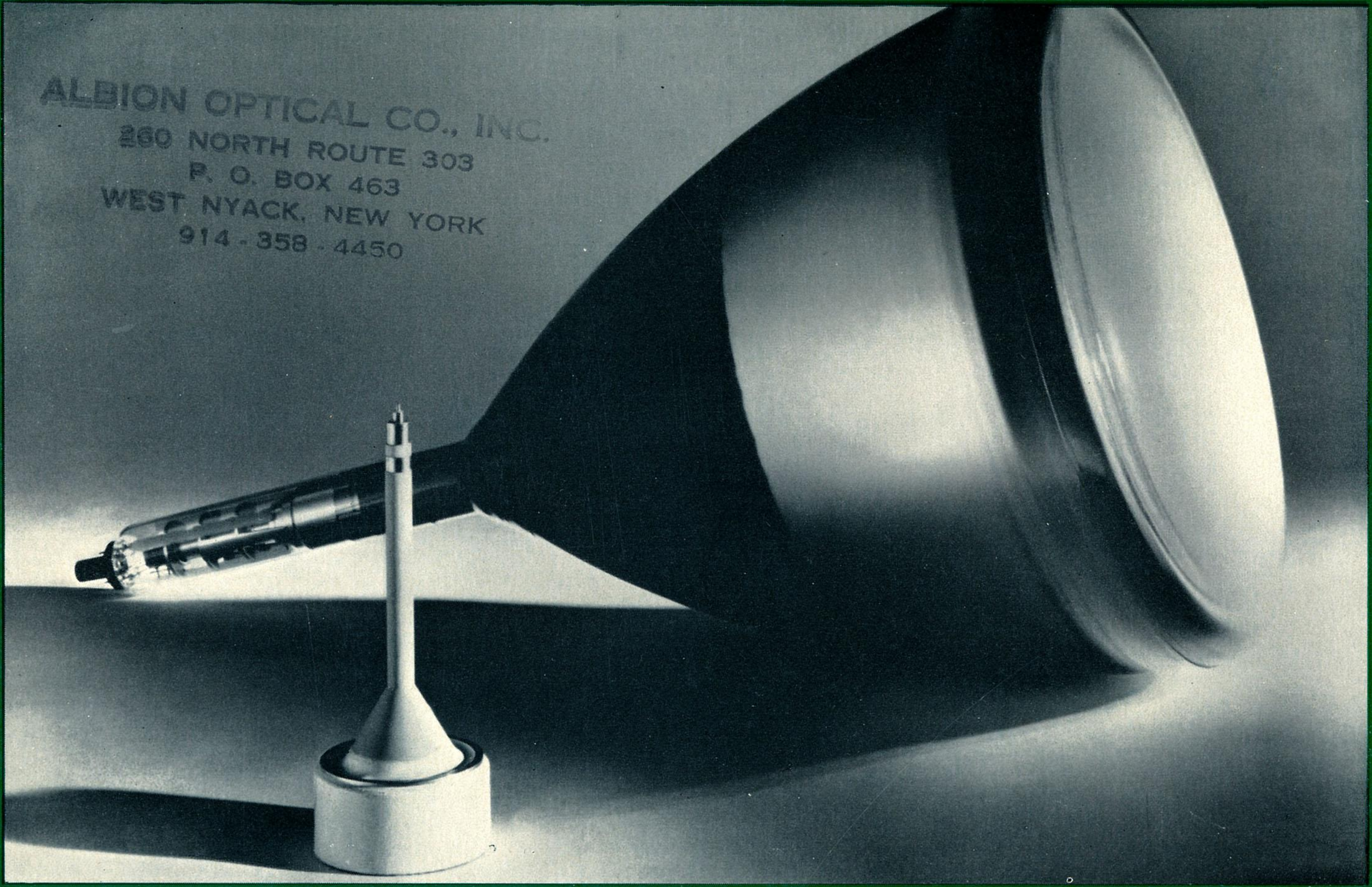
RANK ELECTRONIC TUBES

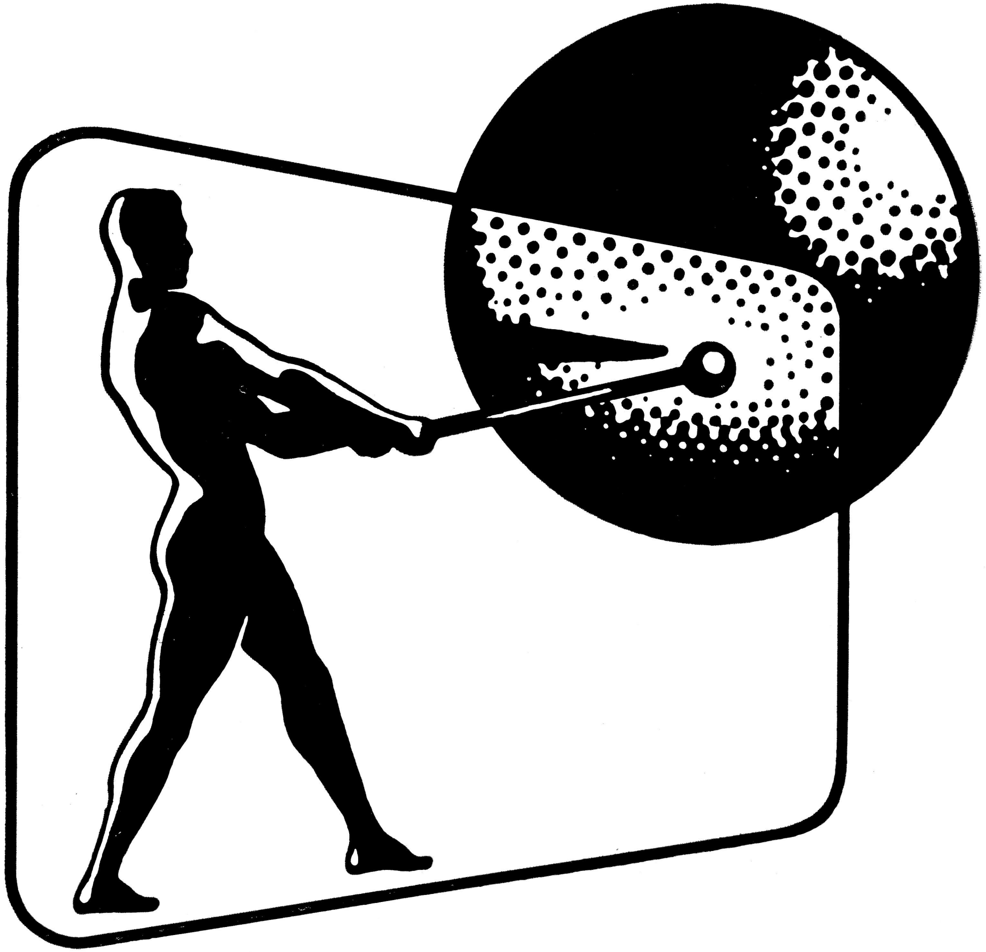


CATHODE RAY TUBES CATALOGUE

THE RANK ORGANISATION, SIDCUP BY-PASS, SIDCUP, KENT

TELEGRAMS: CINTEL, SIDCUP

TELEPHONE: LONDON, FOOTSCRAY 5541



CONTENTS

INTRODUCTION

This booklet contains a strange contrast of the latest, most exciting developments in display devices against the old-established, well-known tubes of the post-war era. Alongside ceramic envelope and fibre optic tubes, there are being produced Skiatron, or dark trace storage tubes, first developed for war-time radar sets. This underlines our double responsibility for advancing the state of the art at the fastest rate that technological expansion will permit, yet honouring the commitment to continue the supply of outmoded tubes, as long as there are sockets that require them.

R & D at Rank is presently directed towards higher resolution at low EHT for radar tubes; higher sensitivity with minimal length for instrument tubes; fibre optics for a host of display devices; rugged, ceramic envelopes for airborne tubes.

Wherever there is a new technique to be applied to C.R.T.'s, there is R.E.T.

 RANK ELECTRONIC TUBES RANK ELECTRONIC TUBES

Radar Tubes (ELECTROMAGNETIC DEFLECTION)

TYPE	DIMENSIONS (NOMINAL) Diameter (mm.)	Diameter (in.)	Length (mm.)	FOCUS	BEAM ANGLE	TYPICAL OPERATING CONDITIONS Heaters Vh (V)	Ih (A)	Va_1 (kV)	Va_2 (kV)	Va_3 (kV)	Va_4 (kV)	Cut Off (V)	BASE	NOTES
5LO3A	125	5	315	E	53°	4·0	1·0	1·25	1·0	7·0		−45 to −80	B8–O	A_1 must be at least +50V with respect to A_2
5TO3A D W	125	5	280	M	53°	6.3	0·6	0·25	8·0			−25 to −70	B8–O	
6LO1A Y	160	6	390	E	37°	4·0	1·0	1·25	1·075	7·0		−45 to −100	B8–O	A_1 must be at least +50V with respect to A_2
6TO3A	160	6	369	M	37°	6·3	0·6	0·45	7·0			−45 to −110	B8–O	
7TO3A D	180	7	337	M	55°	6·3	0·6	0·25	7·0			−25 to −70	B8–O	
8FO1A	214	8½	450	E	41°	6·3	0·3	0·6	14·0	0 to 0·4	14.0	−27 to −44	B8H	Suitable for transistorised deflection systems
8FO2A	210	8½	270	E	90°	6·3	0·3	0·3	8·0	−0·3 to +0·3	8·0	−15 to −40	B8–O	Rectangular tube. Also suitable for T.V. monitor applications
9FO1A D Y	228	9	400	E	58°	6·3	0·3	0·3	12·0	−0·2 to +0·2	12·0	−30 to −70	B12A	
9LO1A D	228	9	445	E	58°	4·0	1·0	1·35	1·24	8·0		−50 to −100	B8–O	A_1 must be at least +50V with respect to A_2. 9LD1 similar but not aluminised
9MO6A D	228	9	445	M	58°	4·0	1·0	10·0				−60 to −120	B8–O	9MD6 similar but not aluminised
12FO1A	305	12	486	E	50°	6·3	0·3	0·3	12·0	−0·2 to +0·2	12·0	−30 to −70	B12A	Approved version CV5819
12FO2A	305	12	570	E	40°	6·3	0·3	0·6	16·0	−0·2 to +0·2	16·0	−32 to −40	B8H	Suitable for transistorised deflection systems
12LO3A	305	12	535	E	50°	4·0	1·0	2·0	1·85	12·0		−70 to −120	B8–O	A_1 must be at least +50V with respect to A_2

TYPE	*DIMENSIONS (NOMINAL)*			*FOCUS*	*BEAM ANGLE*	*TYPICAL OPERATING CONDITIONS*							*BASE*	*NOTES*
	Diameter		*Length*			*Heaters*								
	(mm.)	(in.)	(mm.)			*Vh* (V)	*Ih* (A)	Va_1 (kV)	Va_2 (kV)	Va_3 (kV)	Va_4 (kV)	*Cut Off* (V)		
12MO6A D	305	12	510	M	50°	4·0	1·0	10·0				−75 to −115	B8–O	12MD6 similar but not aluminised
12MO8A	305	12	512	M	50°	6·3	0·6	15·0				−50 to −90	B12A	
12TO3A	305	12	488	M	50°	6·3	0·6	0·7	10·0			−50 to −115	B8–O	
12TO4A D	305	12	515	M	50°	6·3	0·6	0·3	15·0			−30 to −90	B12A	
12TO6A	305	12	635	M	50°	6·3	0·3	0·3	15·0			−60 to −150	B12A	Approved version CV6113
12TO7A	305	12	515	M	50°	6·3	0·3	0·3	15·0			−30 to −90	B12A	
15LO3A	382	15	575	E	50°	4·0	1·0	2·0	1·6	10·0		−80 to −130	B8–O	A_1 must be at least +50V with respect to A_2
15MO8A	382	15	582	M	50°	4·0	1·0	10·0				−75 to −115	B8–O	
15TO3A	382	15	590	M	50°	6·3	0·6	0·8	15·0			−50 to −115	B8–O	
15TO4A	382	15	580	M	50°	6·3	0·6	0·3	15·0			−30 to −90	B12A	
16FO1A	410	16	600	E	50°	6·3	0·3	0·3	15·0	−0·2 to +0·2	15·0	−30 to −70	B12A	
16TO4A	406	16	512	M	70°	6·3	0·3	0·3	15·0			−30 to −90	B12A	
16TO6A	406	16	750	M	50°	6·3	0·3	0·3	15·0			−30 to −70	B12A	

 RANK ELECTRONIC TUBES RANK ELECTRONIC TUBES

Instrument Tubes (ELECTROSTATIC FOCUS AND DEFLECTION)

TYPE	*DIMENSIONS (NOMINAL)*			*TYPICAL OPERATING CONDITIONS*									*BASE*	*NOTES*
	Diameter		*Length*	*Heaters*										
	(mm.)	(in.)	(mm.)	*Vh* (V)	*Ih* (A)	*Va_1* (kV)	*Va_2* (V)	*Va_3* (kV)	*Va_4* (kV)	*Cut Off* (V)	*Sx* (V/cm.)	*Sy* (V/cm.)		
2EG1	50	2	194	6·3	0·6	2·0	300 to 560	2·0		−22 to −130	105	67	B12A	
D 3EG1 Y	70	$2\frac{3}{4}$	255	4·0	1·0	2·0	130	2·0	4·0	−65 to −145	80	69	B12B	P.D.A.
B 3ED2 G	75	3	292	6·3	0·6	2·0	400 to 560	2·0		−100 Max.	60	53	11 Pin Mag.	
B 3ED3P G O Y	75	3	254	6·3	0·6	1·5	350 to 500	1·5	3·0	−22 to −70	57	43	B14A	P.D.A. 3ED3F similar but flat face
B 5ED1PF G	133	5	425	6·3	0·6	1·5	450	1·5	3·0	−34 to −56	13	11	B14A	Flat face. P.D.A.
D 5EG2P	135	5	425	6·3	0·6	2·0	450 to 570	2·0	4·0	−105 Max.	36	36	11 Pin Mag.	P.D.A.
B 6EG4 W	160	6	421	4·0	1·0	2·0	700	4·0		−40 to −80	63	34	B12D	6EG4F similar but flat face
6EG5	160	6	421	4·0	1·0	2·0	700	4·0		−40 to −80	63	34	B12D	Low capacitance Y plates (13pF)
D 6EG7 O Y	160	6	421	4·0	1·0	2·0	800	5·0		−45 to −80	77	40	B12D	Suitable for asymmetrical deflection
12EG6 O	310	12	635	4·0	1·0	1·0	900	5·0		−60 to −110	42	42	B12D	

INSTRUMENT TUBES (ELECTROSTATIC FOCUS AND DEFLECTION) CONTINUED

TYPE	*DIMENSIONS (NOMINAL)* Diameter (mm.)	Diameter (in.)	Length (mm.)	*TYPICAL OPERATING CONDITIONS* Heaters *Vh* (V)	Heaters *Ih* (A)	Va_1 (kV)	Va_2 (V)	Va_3 (kV)	Va_4 (kV)	*Cut Off* (V)	*Sx* (V/cm.)	*Sy* (V/cm.)	*BASE*	*NOTES*
B D 90EG4 O Y	90	3½	332	4·0	1·0	2·0	700	4·0		−40 to −80	118	53	B12D	90EG4F similar but flat face
90EG4P	90	3½	332	4·0	1·0	2·0	380	2·0	4·0	−40 to −80	71	31	B12D	P.D.A.
B 90ED12 G	90	3½	300	6·3	1·2	1·5	300 to 450	1·5		−40 to −100	20	16	B12F	Two independent guns
R10–10DP31	100	4	380	6·3	0·6	0·9	200	0·9	4·0	−45 to −110	24	8	B12F	Double gun. Spiral P.D.A. Common X plates. Beam blanking electrodes. Useful window 8 × 6 cm. Overlap 4 cm. Side pin connection to def. plates. Flat face.
R10–11DP31	106	4	365	6·3	1·2	1·2	360	1·2	4·5	−24 to −120	19·5	7·2	B12F	—— do. ——
R13–10P31	133	5	330	6·3	0·3	1·5	150	1·5	3·0	−30 to −125	31·5	13	B12F	Spiral P.D.A. Beam blanking electrodes. Useful window 10 × 8 cm. Flat face.
R13–11P31	122 × 86	4·8 × 3·4	390	6·3	0·3	1·0	150	1·0	4·0	−30 to −105	9·3	12	B12F	Rectangular bulb. Spiral P.D.A. Beam blanking electrodes. Useful window 10 × 6 cm. Side pin connection to def. plates. Flat face.
R13–12DP31	133	5	380	6·3	0·6	1·0	200	1·0	4·0	−35 to −105	25	8	B12F	Double gun. Spiral P.D.A. Common X plates. Beam blanking electrodes. Useful window 10 × 8 cm. Overlap 4 cm. Side pin connection to def. plates. Flat face.

Scanning Tubes

The parameters that distinguish a Flying Spot Scanning tube from other C.R.T.'s are

(a) Small spot size.
(b) Short persistence phosphor.
(c) High brightness.
(d) Blemish-free faceplate and phosphor screen.

In Telecine conditions, the following comments apply.

SPOT SIZE

The traditional method of achieving a fine spot is "trimming" the beam by directing it through a small aperture. Such is the loss of beam current (and hence brightness) by this technique that other means have had to be found for scanning tubes. 30 years' experience in tube design has enabled R.E.T. to offer a range of professional, fine spot tubes unrivalled anywhere.

PERSISTENCE

Fast decay time is not all that is demanded of the phosphor screen. It must be efficient (bright) and rugged (resistant to burning). Every aspect of the preparation and deposition of scanning tube phosphors is regularly explored by our chemists who are committed to wringing the last ounce of performance out of the screen.

BRIGHTNESS

Any increase in light output of the tube, provided it maintains persistence and spot size, will improve the Signal/Noise ratio of a Flying Spot Scanning equipment. Such strides have been made in our laboratories that we are currently offering a tube (C225) that has double the brightness of the standard broadcast quality scanning tube, C212-PIF. The light output from all scanning tubes falls quite rapidly in the first few hours of running and can cause great nuisance to a busy operating engineer. R.E.T. therefore "age" all scanning tubes for 5 hours before despatch so that the screen is thoroughly stabilised by the time it is put into service.

BLEMISHES

R.E.T. define a blemish as being any defect on a TV raster, which exceeds one line width of that raster. Every tube is tested in a Scanner and the output is displayed on a 22" monitor which magnifies any flaw 5 times. When ordering a scanning tube, it is necessary only to specify the size of the display area and the TV line standard to be used. We will select tubes that are best suited to your conditions and ensure that no blemish is visible.

Scanning Tubes (ELECTROMAGNETIC FOCUS AND DEFLECTION)

TYPE	*DIMENSIONS (NOMINAL)* Diameter (mm.)	Diameter (in.)	Length (mm.)	*TYPICAL OPERATING CONDITIONS* Heaters Vh (V)	Heaters Ih (A)	Va (kV)	Cut-Off (V)	Drive* (V)	Line Width* (mm.)	Base	*DESCRIPTION*
C104	230	9	620	4·0	1·0	20	−60 to −100	32	0·15	B8-O	Telerecording tube. Optically worked flat face.
C106 (C109)	230	9	620	4·0	1·0	20	−72 to −138	33	0·2	B8-O	Standards conversion display tube. Optically worked flat face. C109 similar but 6·3 0·6 heater.
C211 (C214)	185	7	486	4·0	1·0	15	−55 to −105	32	0·2	B8-O	Flying spot tube for TV. or Radar. Optically worked flat face. C214 similar but 6·3 0·6 heater.
C212 (C225)	185	7	532	4·0	1·0	30	−75 to −125	33	0·15	B8-O	Flying spot tube for TV. Optically worked flat face. C225 similar but improved signal/noise.
C304	127	5	470	6·3	0·6	25	−75 to −125	37	0·2	B8-0	Flying spot tube for T.V. or Radar. Optically worked flat face.
C306	127	5	338	6·3	0·3	25	−50 to −100	30	0·15	B12-A	Flying spot tube for TV. Optically worked flat face.
C307	162	6	440	4·0	1·0	25	−40 to −90	32	0·15	B7-B	Flying spot tube for TV. Optically worked flat face.
C508 (C509)	87	3½	437	4·0	1·0	20	−55 to −105	33	0·1	B8-O	Flying spot tube. Optically worked flat face. C509 similar but 6·3 0·6 heater.
C510	87	3½	341	4·0	1·0	15	−129 to −185	32	0·2	B8-O	Flying spot tube for photographic applications. Optically worked flat face.
F101	185	7	503	6·3	0·6	20	−60 to −100	12†	0·08†	B8-O	Flying spot tube for photographic applications. Optically worked flat face.
F202	160	6	660	6·3	0·6	22	−30 to −90	30	0·3	B12-A	Optically worked flat face.
F301	87	3½	288	4·0	1·0	10	−75 to −125	30	0·5	B8-O	Flying spot tube. Optically worked flat face.
F402	230	9	620	4·0	1·0	25	−25 to −55	20‡	0·075†	B8-O	Flying spot tube for photographic applications. Optically worked flat face.
F501	125	5	300	4·0	1·0	15	−124 to −180	25‡	0·5‡	B8-O	Flying spot tube for photographic applications. Optically worked curved face. Neutral density filter.
PT401	117	4	550	6·3	0·32	25	−75 to −125	50	0·09	B9-A	Flying spot tube. Front surface scanned. Flat screen and viewing window.

* 100 μA Cathode current
† 5 μA " "
‡ 35 μA " "

Airborne Bright Display Tubes (ELECTROMAGNETIC DEFLECTION AND FOCUS)

TYPE	DIMENSIONS (NOMINAL) Diameter (mm.)	Diameter (in.)	Length (mm.)	Neck dia. (mm.)	Minimum Usable dia. (mm.)	TYPICAL OPERATING CONDITIONS Heaters Vh (V)	Heaters Ih (A)	Va (kV)	Cut-Off (V)	Line Width (mm.)	Approx. Peak Line luminance (ft. lamberts)	DESCRIPTION
G302	57	2	201	23	46	6·3	0·6	20	−20 to −40	0·18	10,000	Precision tube with accurately ground reference surfaces.
G306	80	3	238	23	60	6·3	0·6	20	−30 to −60	0·25	10,000	Precision tube with optically worked, spherical, concave face.
G307	64	2	202	21	47	6·3	0·3	15	−20 to −40	0·20	10,000	Precision tube with accurately ground reference surfaces. Rugged gun construction.
G308	61	2	202	23	45	6·3	0·3	14	−20 to −40	0·20	8,000	Accurate tube. Rugged gun construction.
G309	65	2	160	12	51	6·3	0·3	15	−20 to −40	0·20	12,000	High precision tube with very accurate reference surfaces. CERAMIC envelope. Suitable for use under severe vibration conditions. Coaxial base.
G311	34	1	160	12	25	6·3	0·3	15	−20 to −40	0·10	10,000	High precision tube with very accurate reference surfaces. CERAMIC envelope. Suitable for use under severe vibration conditions. Coaxial base.
G312	64	2	202	21	47	6·3	0·3	15	−20 to −40	0·20	10,000	High precision tube with accurate reference surfaces. Rugged gun construction.
G313	93	4	193	12	76	6·3	0·3	15	−20 to −40	0·20	12,000	High precision tube with very accurate reference surfaces. CERAMIC envelope. Suitable for use under severe vibration conditions. Coaxial base.
G314	123	5	225	12	102	6·3	0·3	15	−20 to −40	0·25	12,000	High precision tube with accurate reference surfaces. CERAMIC envelope. Suitable for use under severe vibration conditions. Coaxial base.
G315	64	2	202	21	47	6·3	0·3	15	−20 to −40	0·20	10,000	CERAMIC plug-in replacement for type G312. Suitable for use under severe vibration conditions.

Airborne Recording and Display Tubes

TYPE	DIMENSIONS (NOMINAL)				Deflection	Focus	TYPICAL OPERATING CONDITIONS				DESCRIPTION
	Diameter		Length	Neck dia.			Heaters			Cut-Off	
	(mm.)	(in.)	(mm.)	(mm.)			*Vh* (V)	*Ih* (A)	*Va* (kV)	(V)	
G303	58	2	305	23	M	M	6·3	0·6	5	—15 to —25	Precision, high resolution, photographic recording tube.
G304	51	2	158	23	M	E	6·3	0·6	1·5	—30 to —45	Precision tube with accurately ground reference surfaces. Extensively used in weapon system recorders.
G311	34	1	160	12	M	M	6·3	0·3	15	—20 to —40	Precision flight recording tube. Line width 0·075 mm. CERAMIC envelope. Suitable for use under severe vibration conditions.
G403	54	2	162	27·5	E	E	6·3	0·6	1·65	—31·5 to —48·5	Accurate flight instrument tube.

 RANK ELECTRONIC TUBES RANK ELECTRONIC TUBES

Matricons

The Matricon is a display tube having a unique design of electron gun which generates multiple electron beams. Each beam can be individually modulated.

PRINCIPLES OF OPERATION

A diffused low velocity electron stream is directed towards a positive baffle plate containing a matrix of holes and from each hole emerges a fine beam of electrons. The envelope of beams then passes through a second plate having an identical matrix arrangement. This is a ceramic insulating plate with metal inserts in every hole, each of which is insulated from the others and controllable by an outside connection. At this point selective blanking takes place to form the required character or symbol. The selected beams pass through an accelerating field and are focused electromagnetically. Final positioning of the character on the screen is achieved with conventional deflection coils. Because the character is formed instantaneously, the electron density is high compared with other systems of character writing, resulting in a high Brightness × Speed factor.

The standard matrix array is 7 × 5, plus an additional hole which can be used for cursive writing or circular scan. This format can be used for all upper case characters, a very wide variety of symbols and all numerals. Where very high character quality is required alternative matrix layouts have been produced. For example, to produce upper and lower case characters a 14-hole in-line array is used and this is stepped into 10 positions electrically thereby simulating a 14 × 10 matrix.

CIRCUIT REQUIREMENTS

The Matricon can be regarded as a conventional cathode ray tube except that its grid is positively driven. A standing current of several milliamps is drawn from the cathode to the baffle plate, the d.c. voltage of which is between zero and +5 volts. The current contained in each beam is in the order of 20 microamps. Each beam can be controlled by a low swing of grid voltage. Typically the beam is cut off by −5 volts and fully driven by +25 volts. Transistor drive is therefore recommended.

The circuit engineer will appreciate that the Matricon represents a tremendous saving in character generation circuitry.

Matricons (Multiple Beam C.R.T.'s—Electromagnetic Focus and Deflection)

	BULB					TYPICAL OPERATING CONDITIONS				
TYPE	Size (in.)	Shape	Beam angle (degrees)	Overall Length (in.)	Number of Beams	Character size (in.)	Va_1 (V)	Va_2 (V)	V Screen (kV)	DESCRIPTION
M0436	4	O	38	42	36	0·05	150 to 250	1000 to 1500	15	Projection tube. Optically worked convex face for use with Schmidt systems. 7 × 5 + 1 matrix.
M0515A	5	O	70	24	15	0·04	50 to 100	150 to 200	15	Image Reduction employed. Line Matricon.
M0515B	5	O	70	19	15	0·11	50 to 100	150 to 200	15	Image Reduction employed. Line Matricon.
M0536	5	O	70	19	36	0·08	50 to 100	150 to 200	15	Image Reduction employed. 7 × 5 + 1 matrix.
M0715F	7	O	60	28	15	0·10	150 to 250	1000 to 1500	15	Line Matricon. Flat face
M0831	8	□	70	23	31	0·14	150 to 250	1000 to 1500	15	Double-Line-Plus-One matrix.
M0936	9	O	55	28	36	0·15	150 to 250	1000 to 1500	15	7 × 5 + 1 matrix.
M0936F	9	O	70	26	36	0·10	150 to 250	1000 to 1500	15	Flat face. 7 × 5 + 1 matrix.
M1236A	12	O	55	32	36	0·18	150 to 250	1000 to 1500	15	7 × 5 + 1 matrix.
M1236B	12	O	55	25	36	0·30	50 to 100	150 to 200	15	Dimensionally similar to CV6113. Image Reduction employed. 7 × 5 + 1 matrix.
M1936	19	□	90	26	36	0·25	150 to 250	1000 to 1500	15	7 × 5 + 1 matrix.
M2336	23	□	90	28	36	0·25	150 to 250	1000 to 1500	15	7 × 5 + 1 matrix.

GENERAL: Heaters 6·3V, 0·7A.
Flying Lead Base on all tubes.
Grid drive for full brightness +25V. For cut-off −5V max.
Baffle voltage 0 to +5V (w.r.t. Cathode) at 25mA.
Helix resistance 300 M Ω.
Phosphor to customer's requirements.

Special Purpose Display Tubes (ELECTROMAGNETIC DEFLECTION)

TYPE	DIMENSIONS (NOMINAL) Diameter (mm.)	Diameter (in.)	Length (mm.)	Focus	TYPICAL OPERATING CONDITIONS Heaters Vh (V)	Ih (A)	Va_1 (kV)	Va_2 (V)	Va_3 (kV)	Cut-Off (V)	Drive (V)	Base	DESCRIPTION
C102	235	9	495	M	4·0	1·0	15	—	—	−55 to −105	32*	B8-O	Precision TV. monitor tube. Optically worked flat face. Line width 0·3 mm.*
C505	87	3½	379	M	6·3	0·6	15	—	—	−129 to −185	35*	B8-O	Precision TV. monitor tube. Optically worked flat face. Line width 0·125 mm.*
D101	245	9¼	746	M	1·78	10·65	50	—	—	−330 to −650	288†	Special	Projection tube. Optically worked convex face. Line width 0·15 mm.†
D103	245	9¼	746	M	1·4	9·6	45	—	—	−280 to −600	75‡	Special	Projection tube. Optically worked convex face. Line width 0·25 mm.‡
D303 (D305) (D306)	102	4	465	M	6·3	0·6	30	—	—	−105 to −205	50*	B8-O	Projection tube. Optically worked convex face. Line width 0·1 mm.* D305 similar but fitted with locating collar. D306 high definition version of D305.
D501	92	3½	333	M	6·3	0·5	25	—	—	−100 to −200	—	B7-B	Projection tube. Optically worked convex face. Locating collar to accurately reference phosphor image plane.
G704	185	7	500	M	6·3	0·6	5	—	—	−15 to −25	20*	B9A	Precision monitor tube. Low voltage. Optically worked flat face.
G901	127	5	252	E	6·3	0·6	1·5	350	1·5	−30 to −45	20*	B9D	Precision monitor tube. Optically worked flat face. Low voltage.
H105	87	3½	459	M	4·0	1·0	15	—	—	−55 to −105	30*	B8-O	Dark trace storage display tube. (Skiatron.)
PMT57	254	10	500	M	4·0	1·0	15	—	—	−50 to −85	40§	B8-O	TV. Monitor tube.
S102 (S103)	306	12	559	M	6·3	0·6	15	—	—	−55 to −80	37*	B8-O	Monitor tube. S103 similar but cut-off −80 to −105.

* 100 μA Cathode Current
† 500 μA " "
‡ 50 μA " "
§ 150 μA " "

Design Information

Resolution—Typical Methods of Measurement

(a) Spot Size

An undeflected focused spot is displayed in the centre of the screen, pulsed if necessary to avoid damage to the phosphor. The beam current (mean or peak pulse) is adjusted to a set value and the apparent diameter of the spot is measured with a microscope fitted with a calibrated eye-piece scale.

This method cannot yield very accurate results since the edge of a spot is not clearly defined.

(b) Line Width

Single Line—A line is scanned across the screen, either continuously or pulsed, and the apparent width of the line is measured with a microscope. For critical measurements, a microphotometer can be scanned across the line.

Expanded Raster—A television type of raster is presented on the screen, the frame scan is expanded until individual lines can be clearly seen, and their width is measured with a microscope. The results achieved will depend upon depth of modulation between adjacent lines.

Shrinking Raster—(Collapsing Raster)—As before, a television raster is displayed but in this case the frame scan is reduced until it is just possible to distinguish modulation between adjacent lines. The height of the raster is divided by the number of lines in the raster and this quantity is defined as the line width. Figures obtained by this method are about half that obtained when measuring a single line.

(c) Test Card

A typical test card contains a series of parallel or converging lines corresponding to different frequencies, the limiting frequency being defined as that at which separate lines can barely be resolved. Whilst this method is useful for comparative tests of similar tubes in a given equipment, it is less reliable than the other techniques.

(d) Spatial Frequency (Used for High Resolution Tubes)

A focused spot is slowly scanned in a repetitive manner so as to write a short line on the screen. It is assumed that the distribution of luminous intensity in the spot is Gaussian, and the speed of scan, which will be a function of the phosphor persistence, is adjusted so that there is no "tail" to the spot.

The scanned line is magnified and imaged by an optical system onto a graticule consisting of a series of parallel transparent and opaque bars positioned at right-angles to the direction of scan. The light passing through the graticule is collected by a photocell, the output of which is displayed on an oscilloscope.

The graticule consists typically of several groups of bars. In each group the width of the bars and intervening spaces are equal, the pitch of the bars decreasing successively from one group to the next. The spot diameter is appreciably less than the bar width in the first group so that the light is either passed to the photocell or cut off, but as the pitch decreases, a point is reached where the light is neither fully transmitted nor obstructed. If the modulation of signal on the oscilloscope, corresponding to the first group, is regarded as 100% then the modulation for succeeding groups will steadily fall.

Knowing the pitch of the bars and the magnification of the optical system, a relationship can be established between the depth of modulation and the energy distribution in the scanning spot.

If M is the magnification of the optical system and P is the pitch in centimetres of a given group of bars, then the apparent spatial frequency of modulation (F) of the spot on the tube screen produced by the bars is given by

$$F = \frac{M}{P} \text{ cycles/cm}$$

The spatial frequency response of the tube is commonly defined as that value of F corresponding to a modulation level of 60%. A spot diameter of 0·001", measured at the points where the intensity level is 50% of the peak, corresponds to a spatial frequency response in the order of 120 cycles/cm.

Unlike the previous methods, all of which involve subjective assessments of the edge of a spot or line, the spatial frequency response of a tube is an absolute measurement, and results do not depend on operator opinion.

With very long persistence phosphors, such as those now used in radar displays, it may take many minutes to scan the spot across the graticule, in which case the output of the photocell can be presented on a meter or displayed on a chart recorder.

DESIGN INFORMATION (CONTINUED)

Photometry

The **luminance** of an excited phosphor screen is a measure of the energy radiated per unit area which is accepted by an observer having a spectral response corresponding to that defined by the C.I.E. for the standard eye.

Units: foot-lamberts, equivalent foot candles, candela/ft.^{2}, candela/cm^2 (stilb), candela/m^2 (nit), etc.

Method of measurement: commonly an eye-corrected photocell.

The **brightness** of a screen, although quantitatively similar to the luminance, is a subjective measure of the physiological response of an actual observer, and is not commonly used.

The **intensity** of a screen is a measure of the total energy radiated, as accepted by an observer with the C.I.E. standard eye, and equals the luminance integrated over the whole excited area. Unit: candela.

For certain applications the luminance, either mean or peak, of the central region of a scanned line is of more importance than that of a raster, and for such measurements a microphotometer must be used.

For phosphors used in photographic applications photocells fitted with special blue filters are used to measure the actinic energy. Two units, the orthochromatic foot-lambert and the orthochromatic candela, have been specified for this purpose.

Focus and Deflection

Cathode ray tubes may be **focused** by means of electromagnets or permanent magnets external to the neck of the tube, or by electrostatic lenses within the neck. In certain cases, where focus must be independent of anode voltage and in some very high resolution tubes, a combination of electromagnetic and electrostatic focus is employed.

For the highest resolution, and in tubes where very large electron beam currents are involved, electromagnetic lenses are to be preferred. Permanent magnet lenses almost invariably degrade the resolution, but are frequently used where heat and power dissipation are critical. Electrostatic lenses, although less able to handle very large beam currents, weigh less than magnetic lenses and are capable of producing fairly high resolution.

To minimise spherical aberration the electron beam diameter should be less than one third of the lens internal diameter.

Deflection can be effected either by magnetic coils around the neck or deflector electrodes inside the tube. As in the case of focus, coils must be used if large beam currents are involved.

Magnetic deflection is commonly limited to about 100 kc/sec, and at higher frequencies electrostatic deflection must be used.

To a first order of approximation,

Electrostatic deflection $\tan\ \theta \propto \frac{l}{d} \cdot \frac{v}{V}$

Electromagnetic deflection $\tan\ \theta \propto \frac{l B}{V^{\frac{1}{2}}}$

where θ is the angle through which the electron beam is deflected
V is the voltage of the electrons in the deflection region
l is the effective length of the deflecting field
d is the separation of the deflector plates
v is the potential difference between the plates
B is the magnetic field intensity

Equivalents and Near Equivalents List

TYPE	R.E.T. Type	Availability	C.V. No.	Page
2BP11	2EB1	M	—	*
2BP1	2EG1	M	3678	4
2EB1	2EB1	M	—	*
2EG1	2EG1	M	3678	4
3AZP7	90ED12	M	8109	5
3AZP11	90EB12	M	5966	5
3AZP31	90EG12	M	8108	5
3EB2	3EB2	M	—	4
3EB3P	3EB3P	M	5034	4
3ED1	3ED1	M	2280	4
3ED2	3ED2	M	—	4
3ED3F	3ED3F	C	2419	4
3ED3P	3ED3P	M	2869	4
3EG1P	3EG1P	C	1526/8042	4
3EG2	3EG2	M	516	4
3EG3P	3EG3P	M	2935/8334	4
3EG4	3EG4	M	3941	*
3EO3P	3EO3P	M	2816	4
3EP31	3EG1–M1	C	—	4
3EY1	3EY1	M	2184	*
3EY3P	3EY3P	M	5004	4
3GP1	3EG2	M	516	4
3GP7	3ED2	M	—	4
3GP11	3EB2	M	—	4
3JP1	3EG3P	M	2935/8334	4
3JP2	3EY3P	M	5004	4
3JP7	3ED3P	M	2869	4
3JP11	3EB3P	M	5034	4
3JP26	3EO3P	M	2816	4

TYPE	R.E.T. Type	Availability	C.V. No.	Page
3RP1	3EG4	M	3941	*
5ABP1	5EG3PF	M	—	*
5ADP1	5EG1PF	M	5035	4
5ADP2	5EG1PF	M	5793	4
5ADP7	5ED1PF	M	5125	4
5ADP11	5EB1PF	M	—	4
5EB1PF	5EB1PF	M	—	4
5ED1PF	5ED1PF	M	5125	4
5ED2P	5ED2P	M	5154	4
5EG1PF	5EG1PF	M	5035/5793	4
5EG2P	5EG2P	M	1791/3918	4
5EG3PF	5EG3PF	M	—	*
5EG11PF	5EG11PF	M	—	*
5FP4A	5TW3A	M	1789	*
5FP7	5TD3A	M	718	*
5FP26	5TO3A	M	1868/3959	2
5JP1	5EG2P	M	1791	4
5JP2A	5EG2P	M	3918	4
5JP7A	5ED2P	M	5154	4
5LO1A	5LO1A	C	—	*
5LO1AM	5LO1AM	C	—	*
5LO3A	5LO3A	M	—	2
5TD3A	5TD3A	M	718	2
5TO1A	5TO3A	M	—	2
5TO3A	5TO3A	M	1868/3959	2
5TW3A	5TW3A	M	1789	2
6EB4	6EB4	M	—	4
6ED6	6ED6	M	1397	*
6ED6B	6ED6B	M	2810	*

TYPE	R.E.T. Type	Availability	C.V. No.	Page
6ED7	6ED7	M	—	4
6ED8	6ED8	M	966/6109	*
6EG4	6EG4	M	1385/440	4
6EG4F	6EG4F	C	—	4
6EG5	6EG5	M	—	4
6EG7	6EG7	C	—	4
6EO7	6EO7	M	282	4
6EO7B	6EO7B	M	960	*
6EW4F	6EW4F	M	—	4
6EY6	6EY6	M	1591	*
6EY7	6EY7	M	252	*
6LO1A	6LO1A	C	—	2
6LY1A	6LY1A	M	1530/2415	2
6TO3A	6TO3A	C	—	2
7/26AB	C212–PIF	C	—	7
7/26Q4B	C212–QIF	C	—	7
7BP7A	7TD3A	M	884/3637	2
7BP26A	7TO3A	M	—	2
7MB1A	7MB1A	M	1880	*
7TD3A	7TD3A	M	884/3637	2
7TO3A	7TO3A	M	—	2
8FO1A	8FO1A	C	—	2
8FO1A–L2	8FO1A–L2	C	—	2
8FO2A	8FO2A	C	—	2
8MB4A	8MB4A	M	—	*
9/02HM	9LO1A	C	—	2
9/03HB	9FO1A	C	—	2
9/03LB	9FO1A–L2	C	5300	2
9FD1A	9FD1A	C	—	2

C=CURRENT TYPE

M=MAINTENANCE TYPE, NOT RECOMMENDED FOR NEW EQUIPMENT

TYPE	R.E.T. Type	Availability	C.V. No.	Page
9FO1A	9FO1A	C	8298	2
9FO1A–L2	9FO1A–L2	C	5300	2
9FY1A	9FY1A	M	—	2
9LD1	9LD1	M	254	2
9LO1A	9LO1A	C	464	2
9MD6	9MD6	C	262	2
9MO6A	9MO6A	C	—	2
9MO7A	9MO7A	C	2108	*
9MW5AX	C102–B3	M	2192	12
10LO3A	10LO3A	M	—	*
10MW4A	10MW4A	C	—	*
11/01	10MW4A	C	—	*
12/02HM	12TO3A	C	2328	3
12/03HB	12FO1A	C	—	2
12/03LB	12FO1A–L2	C	5819	2
12/04HM	12TO4A	C	429	3
12/08HM	12TO7A	C	8861	3
12/08L3M	12TO7A–L6	C	6130	3
12/10HB	12FO1A	C	—	2
12/10LB	12FO1A–L2	C	5819	2
12/48H2M	12TO6A	C	6167	3
12/48LM	12TO6A–L2	C	—	3
12/48L3M	12TO6A–L6	C	6113	3
12/54L2M	12TO4A–L3	C	—	3
12EG6	12EG6	M	—	4
12EO6	12EO6	M	—	4
12FO1A	12FO1A	C	—	2
12FO1A–L2	12FO1A–L2	C	5819	2
12FO2A	12FO2A	C	—	2

TYPE	R.E.T. Type	Availability	C.V. No.	Page
12LD4A	12LD4A	M	—	*
12LO1A	12LO3A	C	2162	2
12LO3A	12LO3A	C	2162	2
12LO3AM	12LO3A	C	2162	2
12MD4	12MD4	M	1140	*
12MD6	12MD6	M	1546	2
12MO6A	12MO6A	M	—	3
12MO8A	12MO8A	C	—	3
12TD4A	12TD4A	M	2314/2447	3
12TO1A	12TO3A	C	2328	3
12TO3A	12TO3A	C	2328	3
12TO4A	12TO4A	C	429	3
12TO4A–L3	12TO4A–L3	C	—	3
12TO5A	12TO5A	M	—	*
12TO6A	12TO6A	C	6167	3
12TO6A–L6	12TO6A–L6	C	6113	3
12TO7A	12TO7A	C	6172	3
12TO7A–L6	12TO7A–L6	C	6130	3
15LO1A	15LO3A	C	1744	3
15LO3A	15LO3A	C	1744	3
15MO4A	15MO4A	M	—	*
15MO6A	15MO8A	M	—	3
15MO8A	15MO8A	C	—	3
15TO3A	15TO3A	M	—	3
15TO4A	15TO4A	C	—	3
16/04HM	16TO4A	C	—	3
16FO1A	16FO1A	C	—	3
16MO8A	16MO8A	C	—	*
16TO4A	16TO4A	C	—	3

TYPE	R.E.T. Type	Availability	C.V. No.	Page
16TO6A	16TO6A	C	—	3
17TO4A	17TO4A	M	—	*
30D5	9LD1	M	254	2
31E13	12TO4A	C	429	3
31F14	16FO1A	C	—	3
36EO	36EO	C	—	*
90EB4	90EB4	M	1529	5
90EB9P	90EB9P	M	407	*
90EB12	90EB12	M	5966	5
90ED4	90ED4	M	1521	5
90ED9P	90ED9P	M	1524	*
90ED12	90ED12	M	8109	5
90EG4	90EG4	M	1587/5084/8197	5
90EG4F	90EG4F	M	—	5
90EG4P	90EG4P	C	—	5
90EG12	90EG12	M	8108	5
90EO4	90EO4	M	2228	5
90EO9P	90EO9P	M	1547	*
90EY4	90EY4	M	2301/3600	5
90EY6P	90EY6P	M	2286	*
163PP19	16TO4A	C	—	3
701D	3EG1	C	1526	4
702D	3EY1	M	2184	4
746D	3ED1	M	2280	4
901A	90EG4	M	1587	5
902A	90EY4	M	2301/3600	5
908A	90EB4	M	1529	5
946A	90ED4	M	1521	5
1074H	R10–11DP31	C	—	5

C=CURRENT TYPE M=MAINTENANCE TYPE, NOT RECOMMENDED FOR NEW EQUIPMENT

TYPE	R.E.T. Type	Availability	C.V. No.	Page
1601A	6EG4	M	1385/440	4
1646A	6ED8	M	966/6109	*
3069M	12TO4A	C	429	3
3073Q	12FO1A-L2	C	8293	2
4100V	16MO8A	C	—	*
AF21-12	8FO1A	C	—	2
AF22-10	9FO1A	C	8298	2
AF31-10	12FO1A	C	—	2
AL22-10	9FO1A-L2	C	5300	2
AL31-10	12FO1A-L2	C	5819	2
B704-C1	B704-C1	M	—	*
B705-C1	B705-C1	M	—	*
B801	B801	M	—	*
C102-B3	C102-B3	M	2192	12
C104-J2F	C104-J2F	C	—	7
C106	C106	C	—	7
C109	C109	M	—	7
C211-Q1F	C211-Q1F	C	2897	7
C211-Q2F	C211-Q2F	C	8167	7
C212-J2F	C212-J2F	C	—	7
C212-P1F	C212-P1F	C	—	7
C212-Q1F	C212-Q1F	C	—	7
C214-L1	C214-L1	C	2904	7
C219-Q1F	C219-Q1F	C	—	*
C225-P1F	C225-P1F	C	—	7
C304	C304	C	—	7
C305	C305	C	—	*
C306	C306	C	—	7
C307-P1F	C307-P1F	C	—	7

TYPE	R.E.T. Type	Availability	C.V. No.	Page
C508-Q1F	C508-Q1F	C	—	7
C509-Q1F	C509-Q1F	C	—	7
C510-C6	C510-C6	C	—	7
CV.252	6EY7	M	252	4
CV.254	9LD1	M	254	2
CV.262	9MD6	C	262	2
CV.282	6EO7	M	282	4
CV.407	90EB9P	M	407	*
CV.429	12TO4A	C	429	3
CV.440	6EG4	M	440	4
CV.464	9LO1A	C	464	2
CV.516	3EG2	M	516	4
CV.718	5TD3A	M	718	2
CV.884	7TD3A	M	884	2
CV.960	6EO7B	M	960	4
CV.966	6ED8	M	966	*
CV.1097	6EG4	M	1097	4
CV.1140	12MD4	M	1140	*
CV.1385	6EG4	M	1385	4
CV.1397	6ED6	M	1397	*
CV.1521	90ED4	M	1521	5
CV.1524	90ED9P	M	1524	*
CV.1526	3EG1	C	1526	4
CV.1529	90EB4	M	1529	5
CV.1530	6LY1A	M	1530	2
CV.1546	12MD6	M	1546	2
CV.1547	90EO9P	M	1547	*
CV.1587	90EG4	M	1587	5
CV.1591	6EY6	M	1591	*

TYPE	R.E.T. Type	Availability	C.V. No.	Page
CV.1744	15LO3A	C	1744	3
CV.1789	5TW3A	M	1789	2
CV.1791	5EG2P	M	1791	4
CV.1868	5TO3A	M	1868	2
CV.1869	12TO1A	M	2328	*
CV.1880	7MB1A	M	1880	*
CV.1952	12TO4A	C	429	3
CV.1965	12TO4A	C	1965	3
CV.2108	9MO7A	C	2108	*
CV.2137	6ED6	M	2137	*
CV.2162	12LO3A	C	2162	2
CV.2184	3EY1	M	2184	4
CV.2192	C102-B3	M	2192	12
CV.2228	90EO4	M	2228	5
CV.2280	3ED1	M	2280	4
CV.2286	90EY6P	M	2286	*
CV.2301	90EY4	M	2301	5
CV.2314	12TD4A	M	2314	3
CV.2328	12TO3A	C	2328	3
CV.2342	G301-J2	M	2342	*
CV.2419	3ED3	C	2419	4
CV.2467	G103-C1	M	2467	*
CV.2468	G103-L3	M	2468	*
CV.2810	6ED6B	M	2810	*
CV.2816	3EO3P	M	2816	4
CV.2869	3ED3P	M	2869	4
CV.2897	C211-Q1	C	2897	7
CV.2904	C214-L1	C	2904	7
CV.2935	3EG3P	M	2935	4

C=CURRENT TYPE   M=MAINTENANCE TYPE, NOT RECOMMENDED FOR NEW EQUIPMENT

TYPE	R.E.T. Type	Availability	C.V. No.	Page
CV.3600	90EY4	M	3600	5
CV.3637	7TD3A	M	3637	2
CV.3678	2EG1	M	3678	4
CV.3918	5EG2P	M	3918	4
CV.3941	3EG4	M	3941	*
CV.3959	5TO3A	M	3959	2
CV.5004	3EY3P	M	5004	4
CV.5034	3EB3P	M	5034	4
CV.5035	5EG1PF	M	5035	4
CV.5084	90EG4	M	5084	5
CV.5125	5ED1PF	M	5125	4
CV.5139	5TO3A	M	5139	2
CV.5154	5ED2P	M	5154	4
CV.5300	9FO1A–L2	C	5300	2
CV.5389	5TW3A	M	5389	2
CV.5793	5EG1PF	M	5793	4
CV.5819	12FO1A–L2	C	5819	2
CV.5966	90EB12	M	5966	5
CV.6050	G302–J2	C	6050	8
CV.6074	G304–J2	C	6074	9
CV.6093	PT.401–Q2	C	6093	7
CV.6101	D501	C	6101	12
CV.6109	6ED8	M	6109	*
CV.6113	12TO6A–L6	C	6113	3
CV.6126	G306–J2F	C	6126	8
CV.6130	12TO7A–L6	C	6130	3
CV.6152	G303–C9	C	6152	9
CV.6167	12TO6A	C	6167	3
CV.6172	12TO7A	C	6172	3

TYPE	R.E.T. Type	Availability	C.V. No.	Page
CV.8042	3EG1	C	8042	4
CV.8052	12LO3A	C	8052	2
CV.8108	90EG12	M	8108	5
CV.8109	90ED12	M	8109	5
CV.8167	C211–Q2F	C	8167	7
CV.8197	90EG4	M	8197	5
CV.8293	12FO1A–L2	C	8293	2
CV.8298	9FO1A	C	8298	2
CV.8313	G901–J2	C	8313	12
CV.8334	3EG3P	M	8334	4
CV.8580	G701–J2	M	8580	*
CV.8861	12TO7A	C	8861	3
CV.9311	G312–J2	C	9311	8
D13–27GH	R13–10P31	C	—	5
D13–33GH	R13–11P31	C	—	5
D101–E3	D101–E3	M	—	12
D103	D103	M	—	12
D303	D303	C	—	12
D305	D305	C	—	12
D306–E3	D306–E3	C	—	12
D401–P1F	D401–P1F	M	—	*
D501	D501	C	6101	12
DB13–34	5EB1PF	M	—	4
DG4–2	2EG1	M	3678	4
DG13–34	5EG1PF	M	5035/5793	4
DP13–34	5ED1PF	M	5125	4
ECR35	90EG4	M	1587	5
FO701	FO701	C	—	*
F21–10LC	8FO1A	C	—	2

TYPE	R.E.T. Type	Availability	C.V. No.	Page
F21–10LD	8FO1A–L2	C	—	2
F22–10LD	9FO1A–L2	C	—	2
F31–11LC	12FO2A	C	—	2
F31–11LD	12FO2A–L2	C	—	2
F101–C3	F101–C3	M	VCRX365	7
F202–C8	F202–C8	C	—	7
F301	F301	M	—	7
F402	F402	C	—	7
F501–C1	F501–C1	M	—	7
G102	G102	M	—	*
G103–C1	G103–C1	M	2467	*
G103–L3	G103–L3	M	2468	*
G201	G201	M	—	*
G301–J2	G301–J2	M	2342	*
G302–J2F	G302–J2F	C	6050	8
G303–C9	G303–C9	C	6152	9
G304–J2	G304–J2	C	6074	9
G306–J2F	G306–J2F	C	6126	8
G307–J2	G307–J2	C	—	8
G308	G308	C	—	8
G309	G309	C	VX9265	8
G311	G311	C	—	8
G312	G312	C	9311	8
G313	G313	C	—	8
G314	G314	C	—	8
G315	G315	C	—	8
G401	G401	M	—	*
G403	G403	C	—	9
G601–C5	G601–C5	M	VCRX434	*

C=CURRENT TYPE M=MAINTENANCE TYPE, NOT RECOMMENDED FOR NEW EQUIPMENT

TYPE	R.E.T. Type	Availability	C.V. No.	Page
G701–J2	G701–J2	M	8580	*
G703–J2	G703–J2	M	—	*
G704–J2	G704–J2	C	—	12
G901–J2	G901–J2	C	8313	12
H105	H105	C	—	12
LD657	8FO1A	C	—	2
M0436	M0436	C	—	11
M0515A	M0515A	C	—	11
M0515B	M0515B	C	—	11
M0536	M0536	C	—	11
M0715F	M0715F	C	—	11
M0831	M0831	C	—	11
M0936	M0936	C	—	11
M0936F	M0936F	C	—	11
M1236A	M1236A	C	—	11
M1236B	M1236B	C	—	11
M1936	M1936	C	—	11
M2336	M2336	C	—	11
M7/313	C211–Q1F	C	2897	7
MC13–16	C306–Q1F	C	—	7
MF13–1	5TO3A	C	1868/3959	2
MF31–55	12TO4A	C	429	3
MF31–95	12TO3A	C	2328	3
MF41–10	16TO4A	C	—	3
MK13–16	C306–P1F	C	—	7
MP13–1	5TD3A	C	718	2
MP31–55	12TO4A	C	2314	3
MP31–95	12TO1A	C	1869	*
MW13–35	5TW3A	C	1789/5389	2
MX20	12TO4A	C	429	3

TYPE	R.E.T. Type	Availability	C.V. No.	Page
MX21	12TO4A	C	429	3
MX29	C307–P1F	C	—	7
MX29S	C307–P1F	C	—	7
MX32	D501	C	6101	12
MX37	6LO1A	C	2415	2
MX38	6LY1A	M	1530	2
MX57	C212–P1F	C	—	7
PMT57	PMT57	M	—	12
PT.401–Q2	PT.401–Q2	C	6093	7
R10–10DP31	R10–10DP31	C	—	5
R10–11DP31	R10–11DP31	C	—	5
R13–10P31	R13–10P31	C	—	5
R13–11P31	R13–11P31	C	—	5
R13–12DP31	R13–12DP31	C	—	5
S102	S102	C	—	12
S103	S103	C	—	12
SE4/2B	R10–10DP31	C	—	5
SE5/2A	R13–12DP31	C	—	5
SE5F	R13–10P31	C	—	5
T921Z	9LO1A	C	464	2
T922Z	12LO3A	C	2162	2
T938Y	9FO1A–L2	C	5300	2
T938Z	9FO1A	C	—	2
T939Y	12FO1A–L2	C	5819	2
T939Z	12FO1A	C	—	2
T956Y	9FO1A–L2	C	5300	2
T956Z	9FO1A	C	—	2
T957Y	12FO1A–L2	C	5819	2
T957Z	12FO1A	C	—	2
T958Z	16FO1A	C	—	3

TYPE	R.E.T. Type	Availability	C.V. No.	Page
T963D	12TO6A–L6	C	6113	3
T963Y	12TO6A–L2	C	—	3
T963Z	12TO6A	C	6167	3
T964Y	8FO1A–L2	C	—	2
T964Z	8FO1A	C	—	2
T966A	C212–P1F	C	—	7
T966C	C212–Q1F	C	—	7
T970D	16TO6A–L6	C	—	3
T970Y	16TO6A–L2	C	—	3
T970Z	16TO6A	C	—	3
T974D	12FO2A–L6	C	—	2
T974Y	12FO2A–L2	C	—	2
T974Z	12FO2A	C	—	2
T977D	12TO7A–L6	C	6130	3
T977Y	12TO7A–L2	C	—	3
T977Z	12TO7A	C	6172	3
T978D	12TO6A–L6	C	—	3
T978Y	12TO6A–L2	C	—	3
T978Z	12TO6A	C	—	3
V3167	R13–11P31	C	—	5
VCRX365	F101–C3	C	VCRX365	7
VCRX434	G601–C5	M	VCRX434	*
VX9229	G303–C9	C	6152	9
VX9241	G306–J2F	C	6126	8
VX9265	G309	C	—	8

This index lists directly equivalent and nearly equivalent tube types. Reference should be made to R.E.T. to establish the compatibility of apparently similar items.

* **Not included in catalogue. Details available on request.**

C=CURRENT TYPE M=MAINTENANCE TYPE, NOT RECOMMENDED FOR NEW EQUIPMENT

Phosphor Code

BRITISH CV. SYSTEM:

FIRST LETTER .. .. COLOUR OF FLASH
SECOND LETTER .. .. COLOUR OF AFTERGLOW
NUMBER .. .. DECAY FROM 1 EQUIVALENT FOOT CANDLE TO 1% OF THAT VALUE (SEE TABLE)

COLOURS:

R .. Red
O .. Orange
Y .. Yellow
G .. Green
B .. Blue
U .. Ultra Violet
W .. White

DECAY

NUMBER	*AFTERGLOW*			*DESCRIPTION*
1	0	to	10μS	Killed
2	10	,,	100μS	Ultra Short
3	100	,,	1000μS	Very Short
4	1	,,	10mS	Short
5	10	,,	100mS	Medium Short
6	100	,,	1000mS	Medium
7	1	,,	10 S	Medium Long
8	10	,,	100 S	Long
9	100 S	,,	—	Very Long

e.g. OO5 = Orange Flash, Orange Afterglow, Decaying to 1% in 10 to 100 Milliseconds

Phosphor Equivalents List

RANK ELECTRONIC TUBES	C.V. CODE	AMERICAN E.I.A.	MULLARD		FERRANTI	E.E.V.	BRIMAR	G.E.C.	20th CENTURY
			Old	New					
B	BB3	P11	B	BE	P	P	—	08	B
B3	WW4	P4	W	W	T	W	—	18	W
C1	BB2	P11	C	BA	—	—	—	—	—
C2	BB3	P11	—	—	—	—	—	—	—
C3	BB2	P22B	X	X	—	B	—	—	—
C4	BB2	P11	A	BD	—	—	—	—	—
C5	BB4	P11	—	—	—	—	T3	—	—
C6	BB3	P11	—	—	—	—	—	—	—
C7	BB3	P11	—	—	—	—	—	—	—
C8	BB3	P11	—	—	—	—	—	—	—
C9	BB3	P11	—	—	—	—	—	—	—
C10	BB5	P22B	U	BF	—	—	—	—	—
D	BY8	P7	P	GM	J	X	T6	46	D
E3	B06	P18	—	—	—	—	—	—	—
F1	BB3	P22	—	—	—	—	—	—	—
G	GG6	P1	G	GJ	D	G	T1	01	G
H1	006	P12	—	—	K4	—	—	—	—
J2	GG5	P22G	G	GK	—	G	—	—	—
L1	009	P26	F	LC	H	Z	T7	19	F
L2	008	P33	L	LD	L	Y	T15	23	F3
L3	008	P33	—	—	L2	S	—	—	—
L4	006	P12	D	LA	K3	U	—	—	F2
L5	008	P25	E	LB	M	—	T13	—	—
L6	007	—	—	—	L3	D	—	—	—
M1	GG2	P31	H	GH	S	H	—	24	K
O	009	P26	F	LC	H	Z	T7	19	F
P1	GG2	P24	K	GE	A	A	T5	15	E
Q1	BB1	P16	V	BC	Q	C	—	22	—
Q2	BB1	P16	—	—	Q4	—	—	—	—
R1	RR5	P27	—	—	—	—	—	—	—
R2	YY4	P22R	Y	YA	—	R	—	—	R
T1	BY8	P7	P	GM	J	X	T6	46	D
W	WW4	P4	W	W	T	W	T4	18	W
Y	YY8	P28	—	—	K	V	—	02	H
—	GG5	P2	N	GL	K2	N	—	25	—
—	YY4	P20	—	KA	V	M	—	—	K
—	GG9	P34	—	—	Y	—	—	—	—
—	BG8	P32	M	GB	—	—	—	—	—
—	005	—	—	—	Z	T	T11	—	—

This list of equivalent phosphors is approximate and reference should be made to the tube manufacturer concerning specific performance of any type.

RANK ELECTRONIC TUBES

Manufacturers

of

SPECIALIST CATHODE RAY TUBES

PHOTOCELLS

PHYSICS DEMONSTRATION TUBES

CATHODE RAY TUBES CATALOGUE

THE RANK ORGANISATION, SIDCUP BY-PASS, SIDCUP, KENT

TELEGRAMS: CINTEL, SIDCUP

TELEPHONE: LONDON, FOOTSCRAY 5541

Printed in England by F. R. Britton & Co. Ltd./5m/Sept. 1966