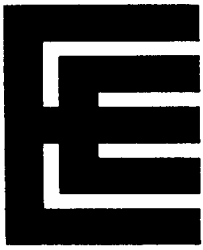
PRODUCT DATA

CATHODE RAY TUBES

ENGLISH ELECTRIC VALVES



The types specified in this publication form part of the wide range of EEV products.
Data sheets for the complete range are available in the EEV Valve Data Book. This comprises three volumes and is serviced at regular intervals with supplementary sheets. Further details of the Valve Data Book are available on request.

Quick reference information for the range, together with a comprehensive equivalents index, is given in the EEV Abridged Valve Data Booklet. Please write to the address below for your copy.

CATHODE RAY TUBES

English Electric Valve Co Ltd

Chelmsford Essex England
Telephone: Chelmsford (0245) 61777
Telex: 99103
Telegrams: Enelectico, Chelmsford

Printed in England

RADAR

Type (See page 2)	Screen	Nominal Diameter	Focus	Deflection	Deflection Angle	Beam Voltage Max (kV)	
T921	Z	9 inches	Electrostatic	Magnetic	58°	13	
T922	Z	12 inches	Electrostatic	Magnetic	50°	13	
T953	S, Y or Z	12 inches	Magnetic	Magnetic	50°	15·5	
T957	Y or Z	12 inches	Electrostatic	Magnetic	50°	18	
T958	Z	16 inches	Electrostatic	Magnetic	50°	18	←
T963	D, Y or Z	12 inches	Magnetic	Magnetic	50°	15·5	
T964	Y or Z	8½ inches	Electrostatic	Magnetic	41°	18	
T970	D, Y or Z	16 inches	Magnetic	Magnetic	50°	15·5	
T974	D, Y or Z	12 inches	Electrostatic	Magnetic	40°	18	
T977	D, Y or Z	12 inches	Magnetic	Magnetic	50°	15·5	←
T982	D, Y or Z	12 inches	Electrostatic	Magnetic	50°	18	←
T983	Z	16 inches	Electrostatic	Magnetic	50°	18	←
T986	D, Y or Z	12 inches	Electrostatic	Magnetic	40°	18	←

OSCILLOSCOPE

Type (See page 2)	Screen	Nominal Diameter	Focus	Deflection	P.D.A. System	Beam Voltage Max (kV)
T979	H, N or X	5 inches	Electrostatic	Electro-static	Mesh	18
T980	H, N or X	5 inches	Electrostatic	Electro-static	Mesh	18

← Indicates a change

MONITOR

Type (See footnote)	Screen	Nominal Screen Size	Focus	Deflection	Deflection Angle	Beam Voltage Max (kV)
*T954	S, T or Y	8½ inch diagonal	Magnetic	Magnetic	40°	15
T960	W	7 inch diagonal	Electrostatic	Magnetic	65°	16
→ T975	D, S or Y	21 inch diagonal	Electrostatic	Magnetic	90°	18

*This tube can be supplied without external conducting coating and is then known as T969S, T or Y.

FLYING SPOT SCANNER

Type (See footnote)	Screen	Nominal Diameter	Focus	Deflection	Deflection Angle	Beam Voltage Max (kV)
T966	A or C	7 inches	Magnetic	Magnetic	42°	35

PROJECTION

Type (See footnote)	Screen	Nominal Diameter	Focus	Deflection	Deflection Angle	Beam Voltage Max (kV)
T940	B, G, R or W	5 inches	Magnetic	Magnetic	47°	55

Screens The letter in column 2 is a suffix to the type number and indicates the screen characteristics. The screens listed for each basic type are those available as standard; most tubes can be manufactured with alternative screens and customers' enquiries are invited. See 'Cathode Ray Tube Phosphors' for a complete list of the screens available.

→Indicates a change

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CATHODE RAY TUBE PHOSPHORS

The table below gives brief details of the phosphors at present available for use in EEV Cathode Ray Tubes. More complete data appear on following pages.

EEV Phosphor	Nearest EIA Equivalent	Colour	Decay Characteristics	Typical Application
A	P24	Green	1μsec to 10%	Flying Spot Scanners – Colour
B	—	Blue	40μsec to 10% approx	Projection
C	P16	Bluish-purple	0·18μsec to 10%	Flying Spot Scanners – Monochrome
D	(E.V.S. 007)	Yellow-orange	20sec to 1%	Short-range Radar and Alphanumeric
G	P1	Yellowish-green	25msec to 10%	Projection and Oscilloscope
H	P31	Green	50μsec to 10%	Oscilloscope
M	P20	Yellow-green	60μsec to 10%	Storage Tubes
N	P2	Yellowish-green	5msec to 1% approx	Oscilloscope
P	P11	Blue	34μsec to 10%	Oscilloscope Photography
R	P3	Yellowish-orange*	20msec to 10%	Projection
S	—	Yellow-orange	30sec to 1%	Short-range Radar
T	—	Yellow-orange	30msec to 10%	Anti-flicker Displays
U	P12	Orange	210msec to 10%	Short-range Radar

*Used with Wratten 25 filter to give primary red.

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CATHODE RAY TUBE PHOSPHORS

ENGLISH ELECTRIC

EEV Phosphor	Nearest EIA Equivalent	Colour	Decay Characteristics	Typical Application
V	P28	Yellow-green	8sec to 1%	Radar and Oscilloscope
W	P4	White	60μsec to 10% approx	Monitor
			12·5msec to 10% approx	Projection
X	P7	White Flash Yellow-green Afterglow	5μsec Blue 20sec Yellow	Radar and Oscilloscope
Y	P33 (E.V.S. 008)	Orange	60sec to 1%	Radar
Z	P26 (E.V.S. 009)	Orange	200sec to 1%	Radar

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CHELMSFORD
ENGLAND

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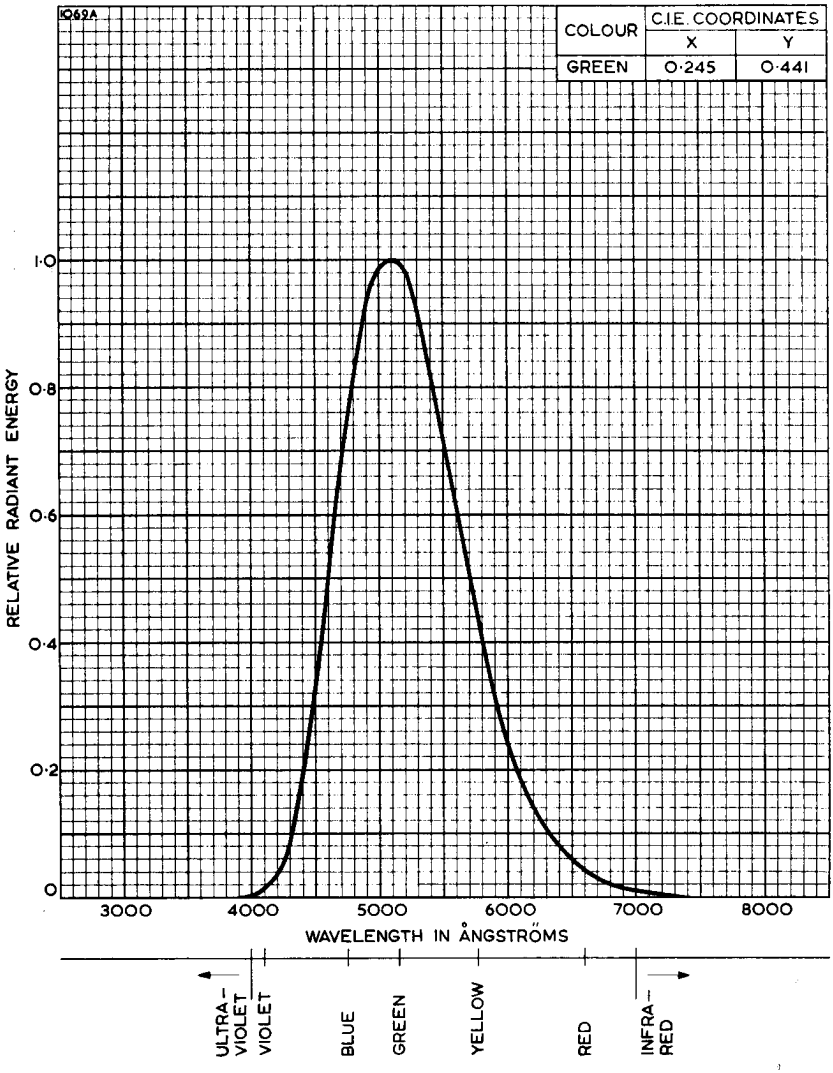
SPECTRAL OUTPUT CHARACTERISTIC

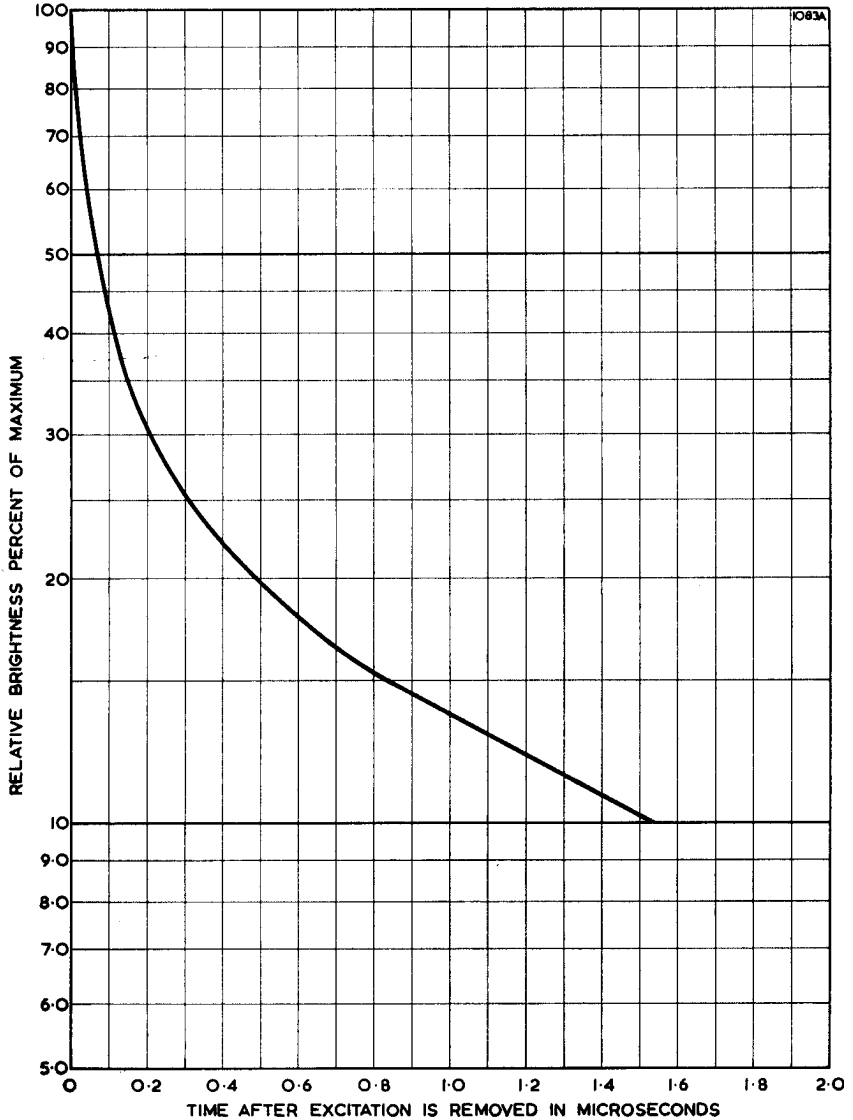


A PHOSPHOR

(Similar to P24)

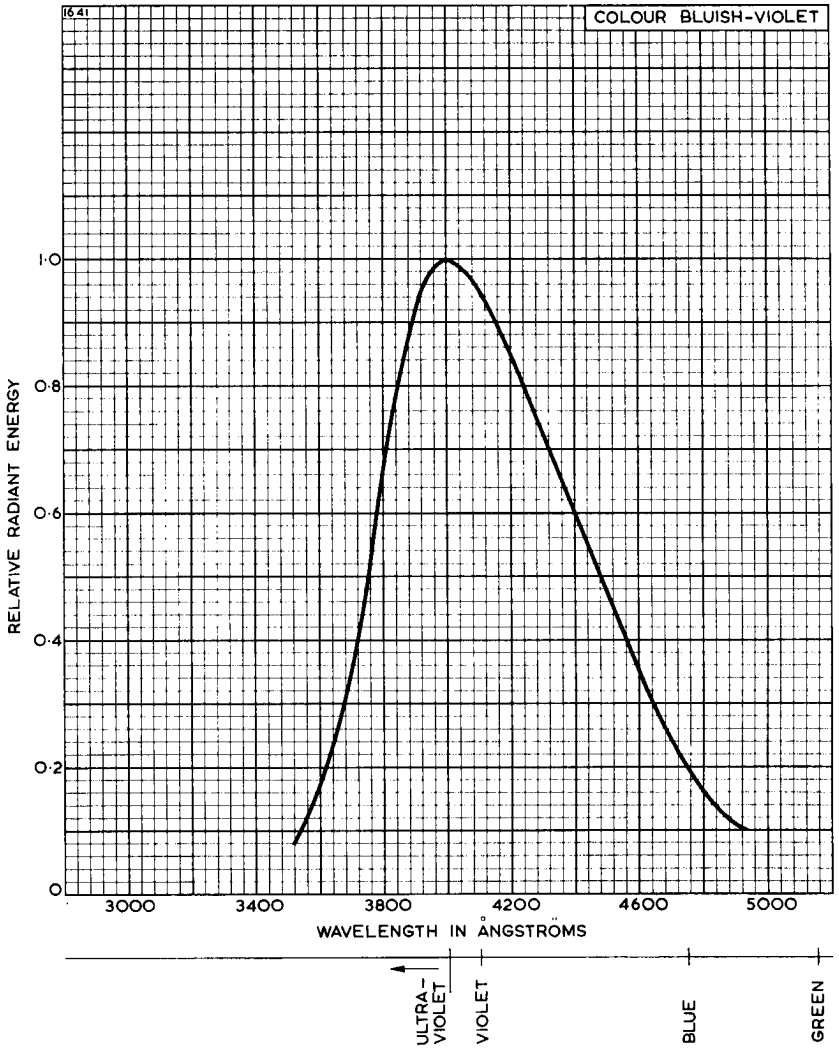
ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTIC



Printed in England

SPECTRAL OUTPUT CHARACTERISTIC



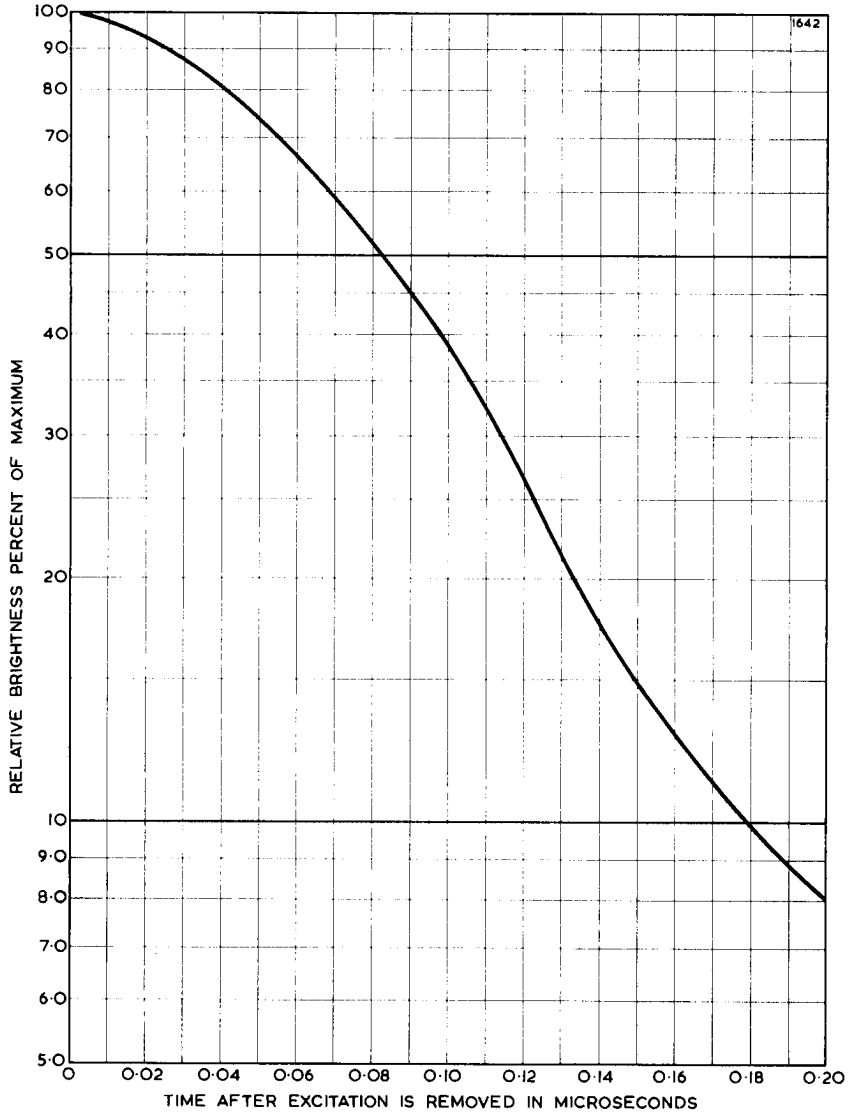
Printed in England

C PHOSPHOR

(Similar to P16)

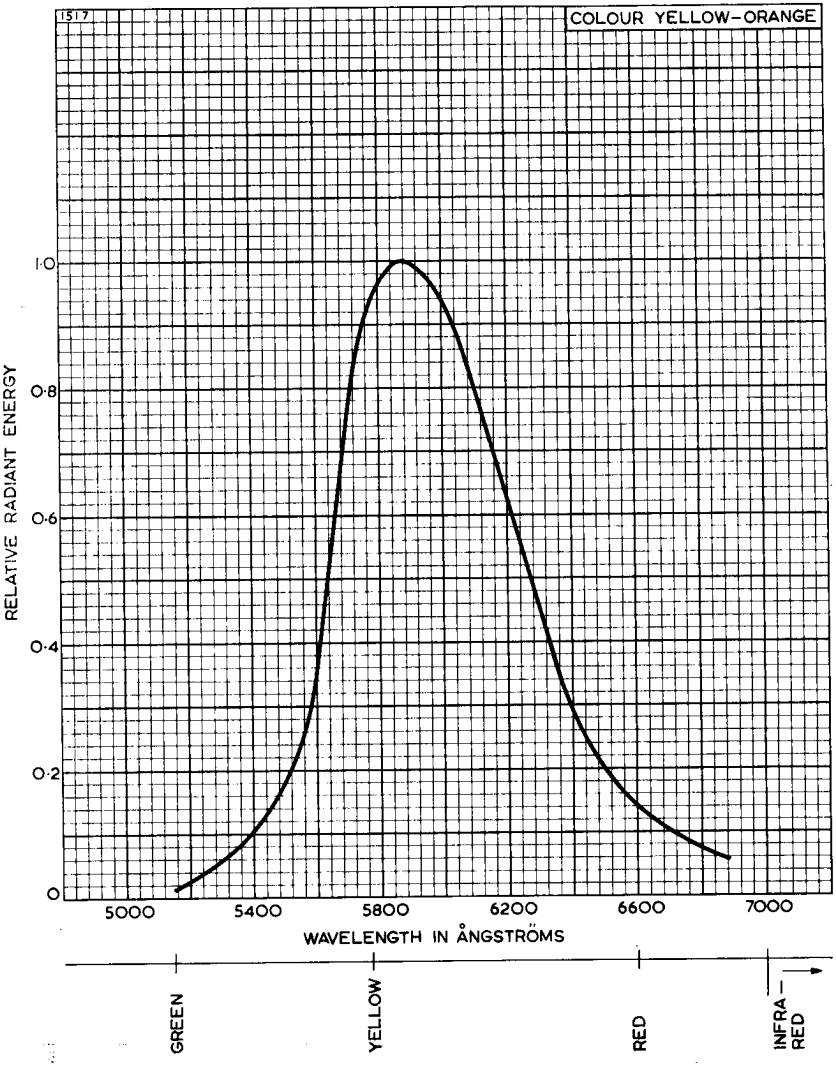
ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTIC



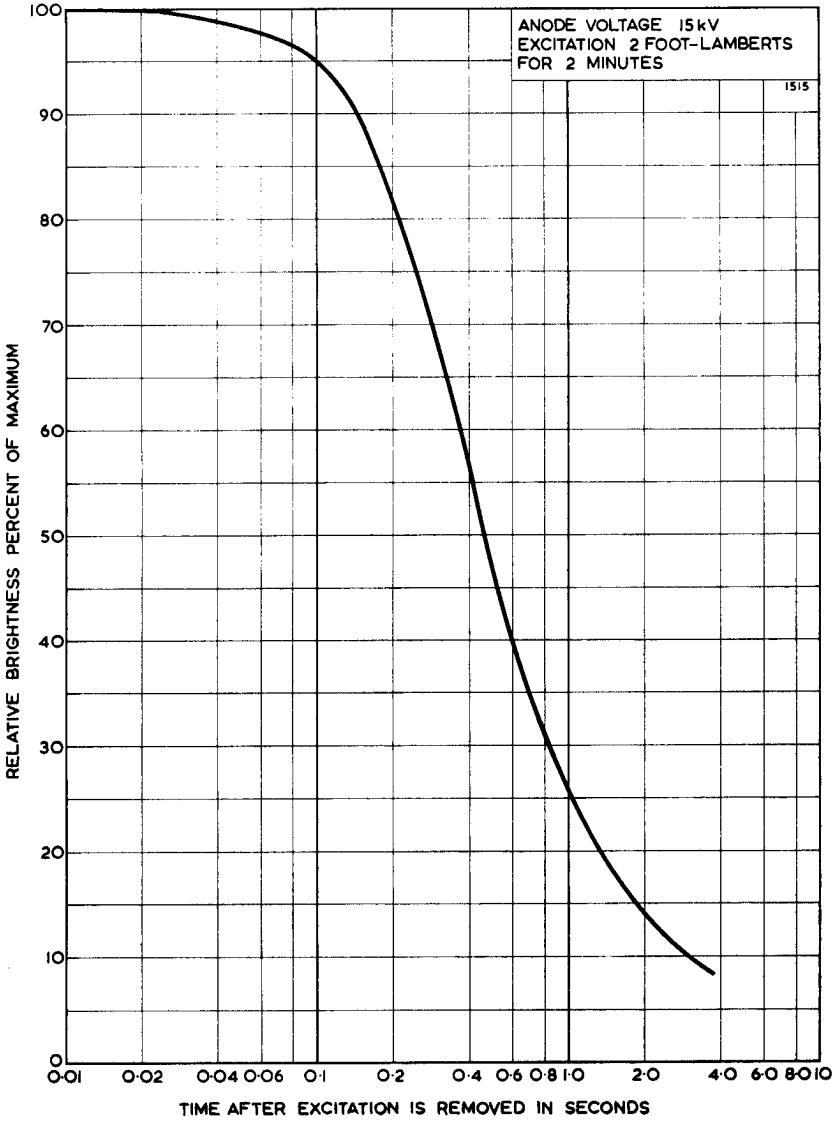
Printed in England

SPECTRAL OUTPUT CHARACTERISTIC



Printed in England

PERSISTENCE CHARACTERISTIC



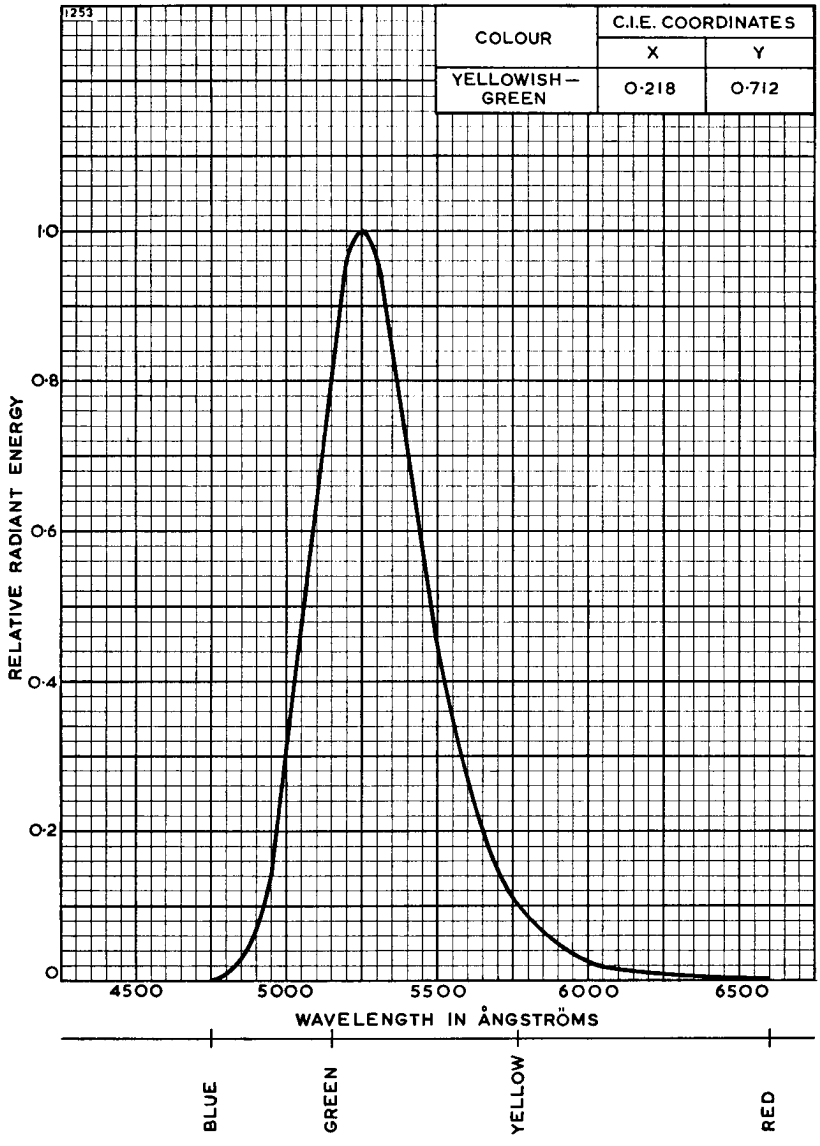
CATHODE RAY TUBES

G PHOSPHOR

(Similar to P1)

ENGLISH ELECTRIC

SPECTRAL OUTPUT CHARACTERISTIC



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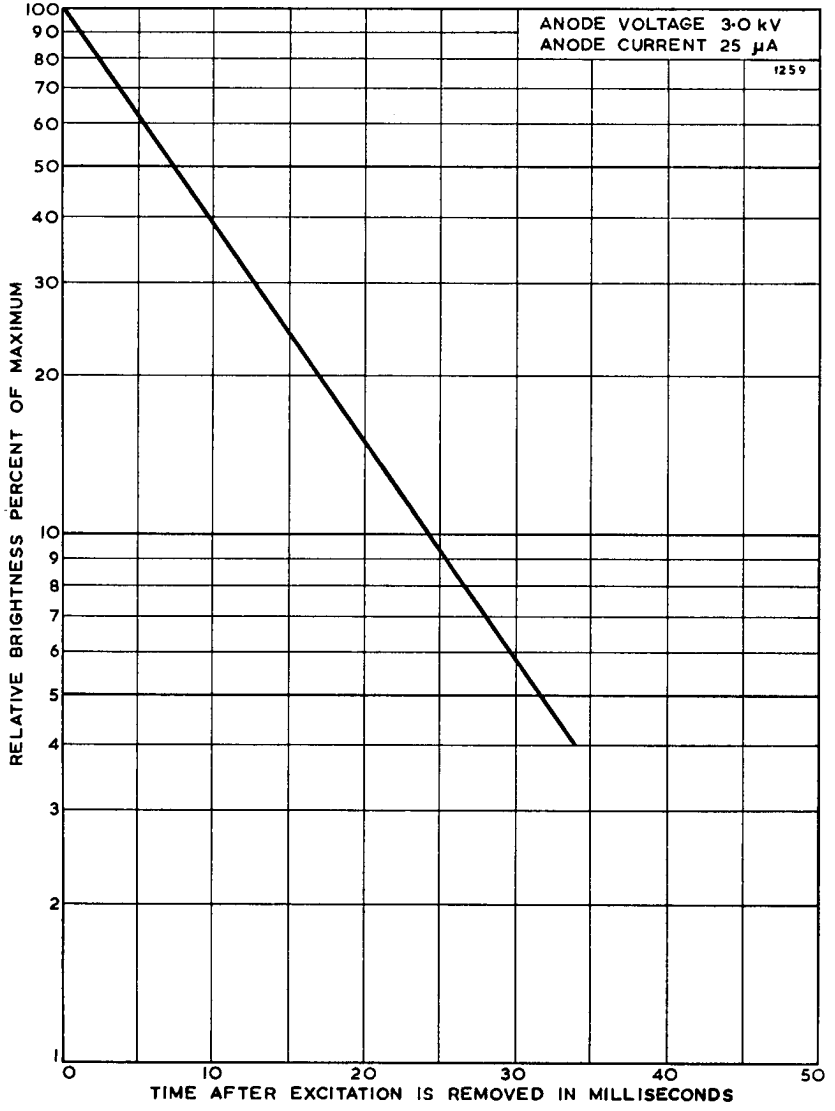
G PHOSPHOR

(Similar to P1)

ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTIC



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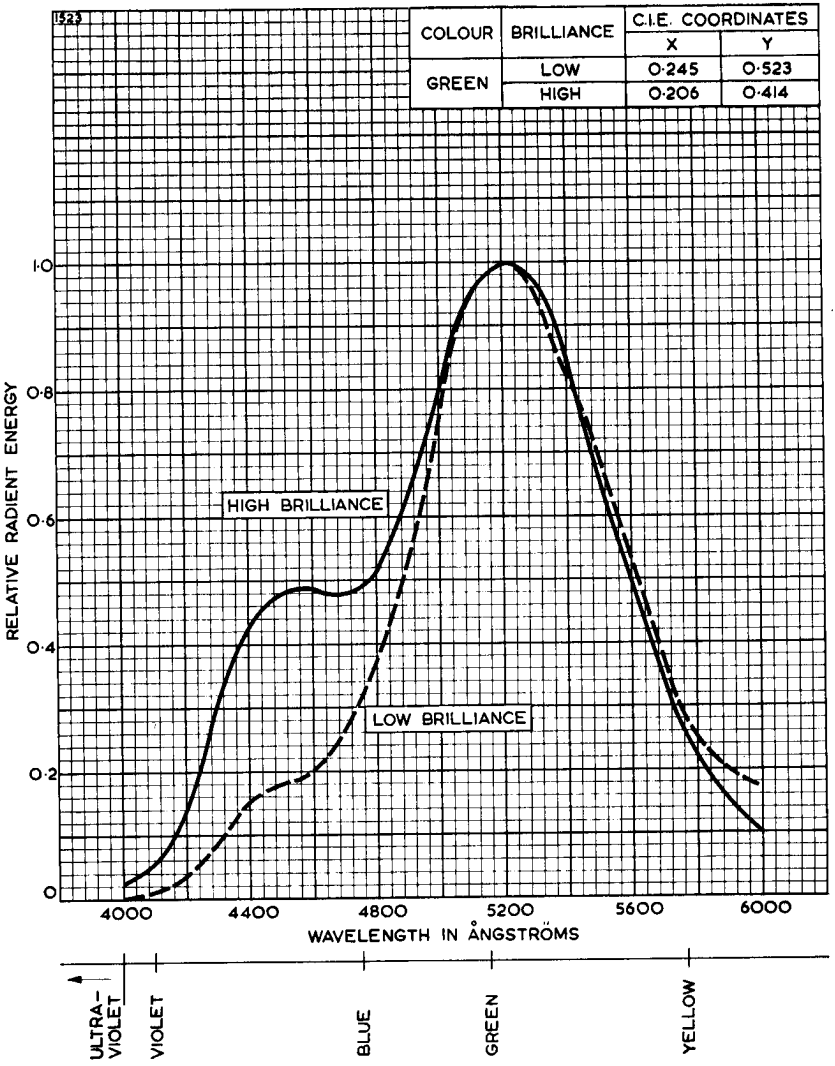
H PHOSPHOR

(Similar to P31)

SPECTRAL OUTPUT CHARACTERISTIC



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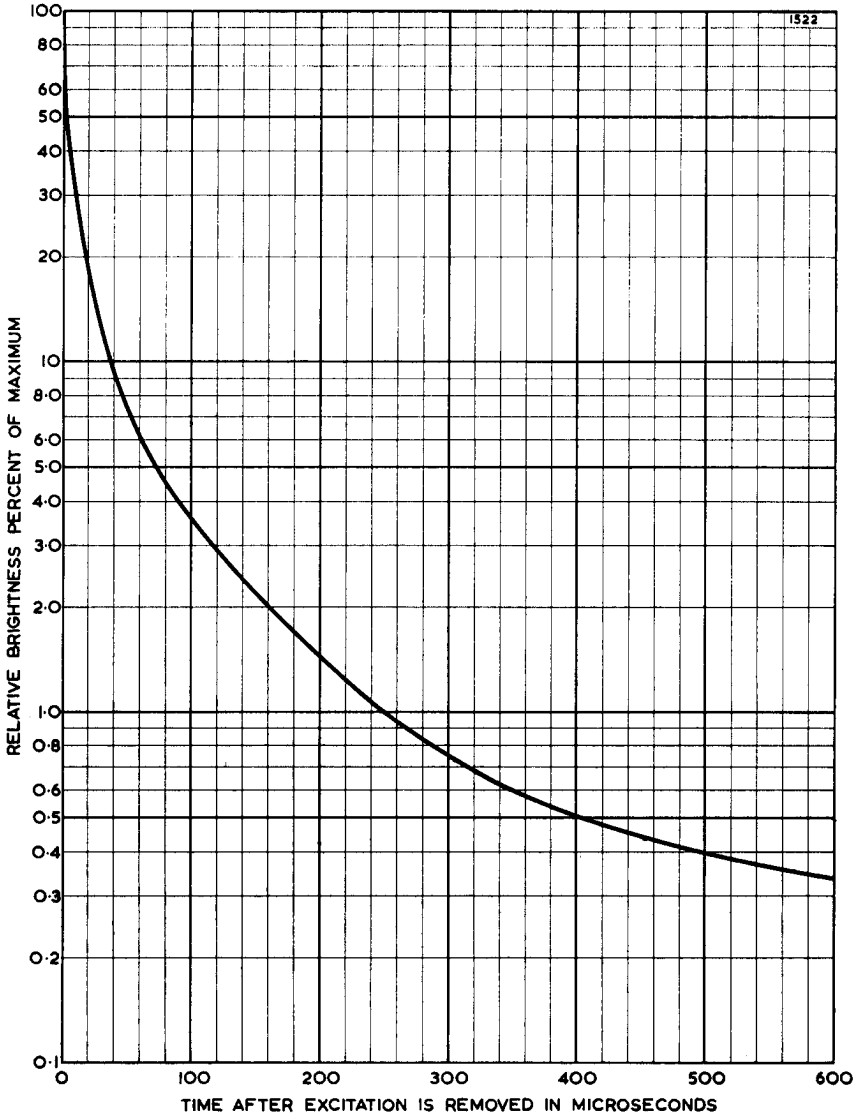
H PHOSPHOR

(Similar to P31)

ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTIC



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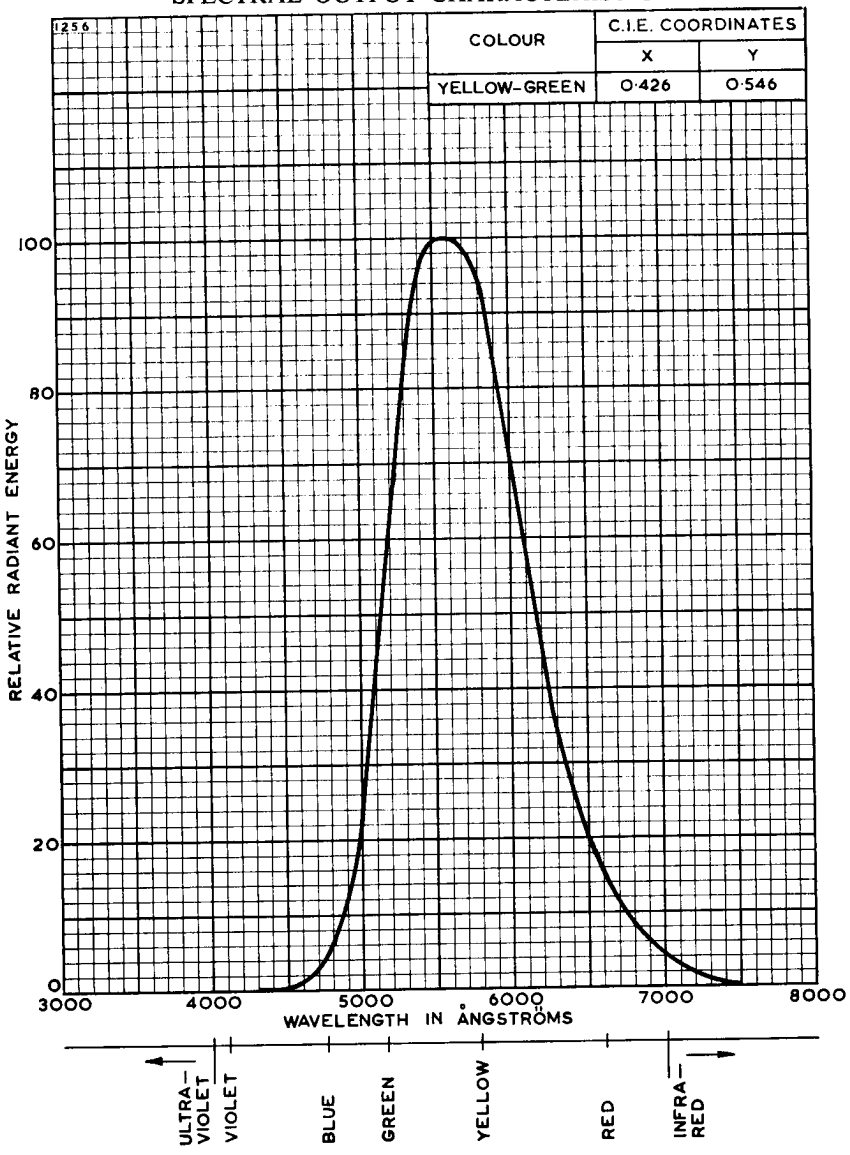
CATHODE RAY TUBES

M PHOSPHOR

(Similar to P20)

SPECTRAL OUTPUT CHARACTERISTIC



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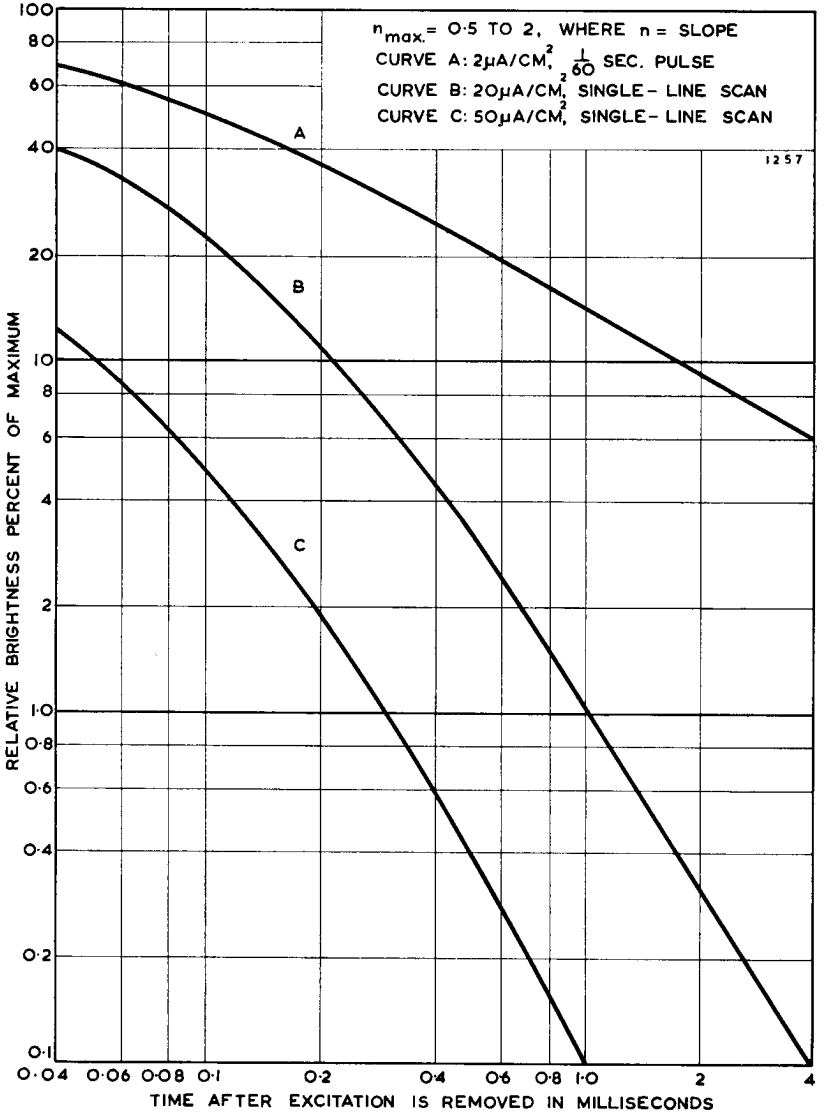
M PHOSPHOR

(Similar to P20)

ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTICS



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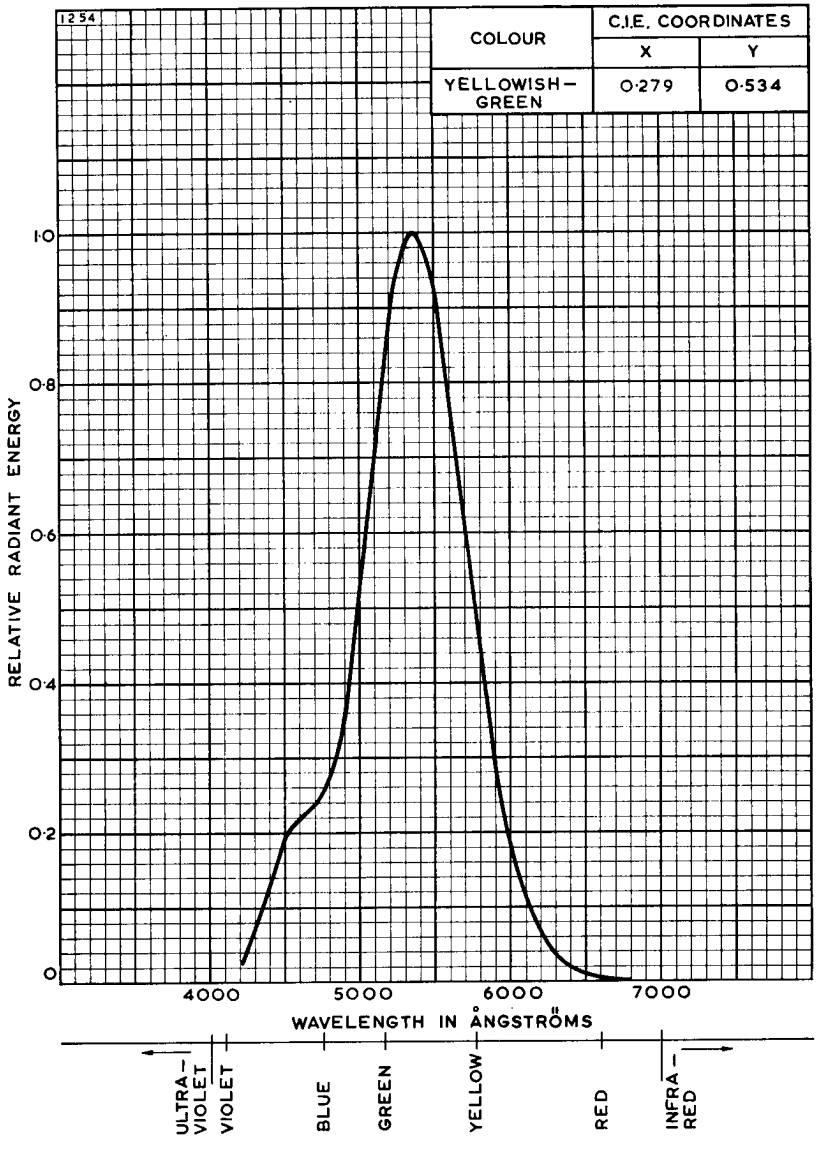
CATHODE RAY TUBES

N PHOSPHOR

(Similar to P2)

SPECTRAL OUTPUT CHARACTERISTIC



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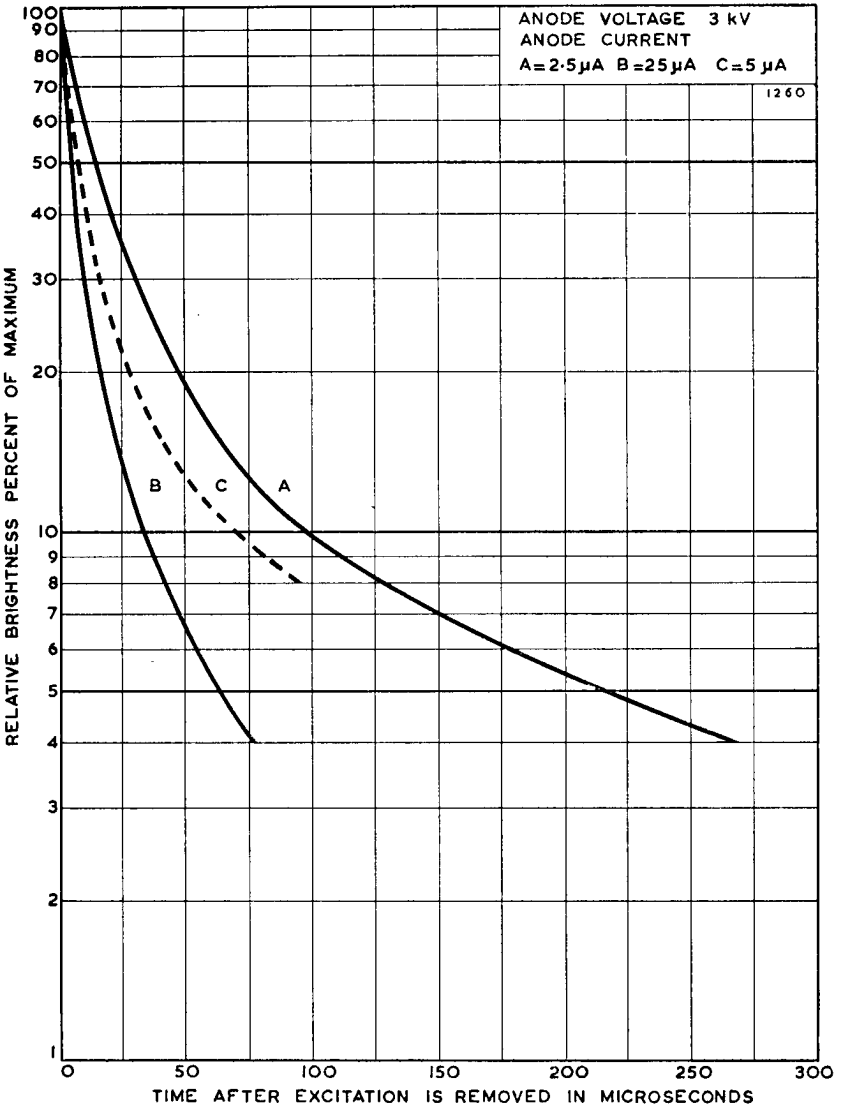
ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTICS



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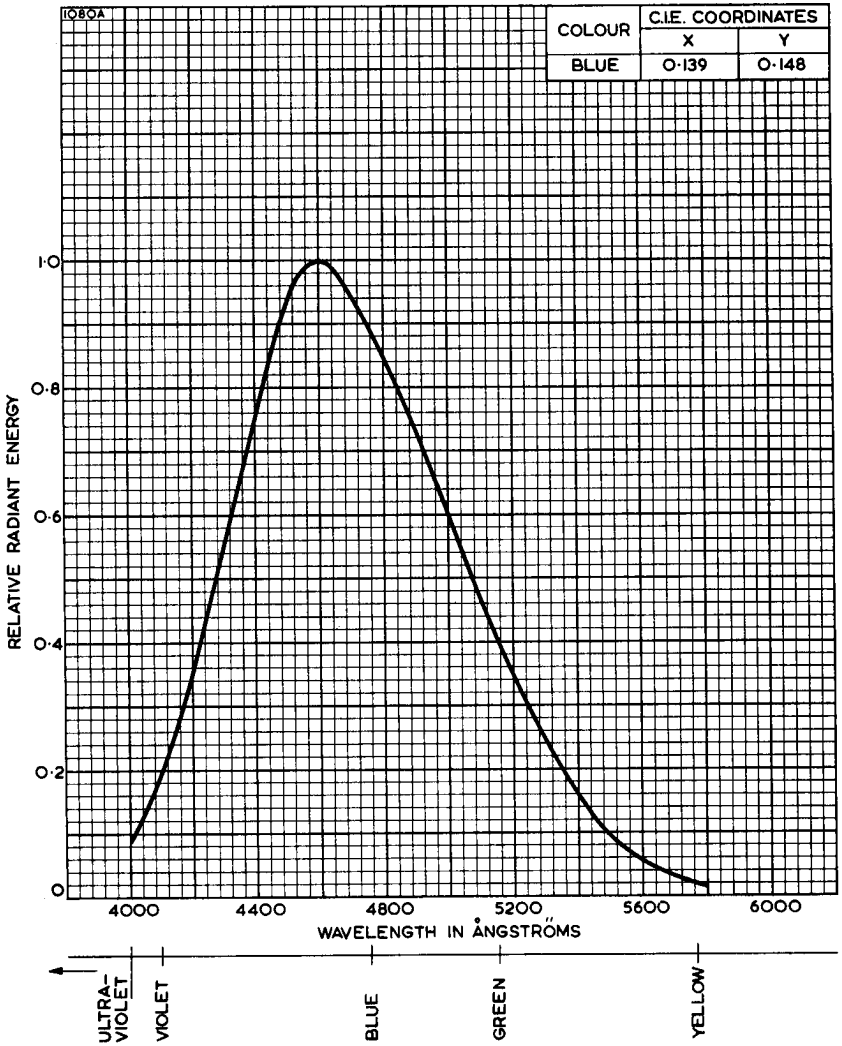
P PHOSPHOR

(Similar to P11)

SPECTRAL OUTPUT CHARACTERISTIC



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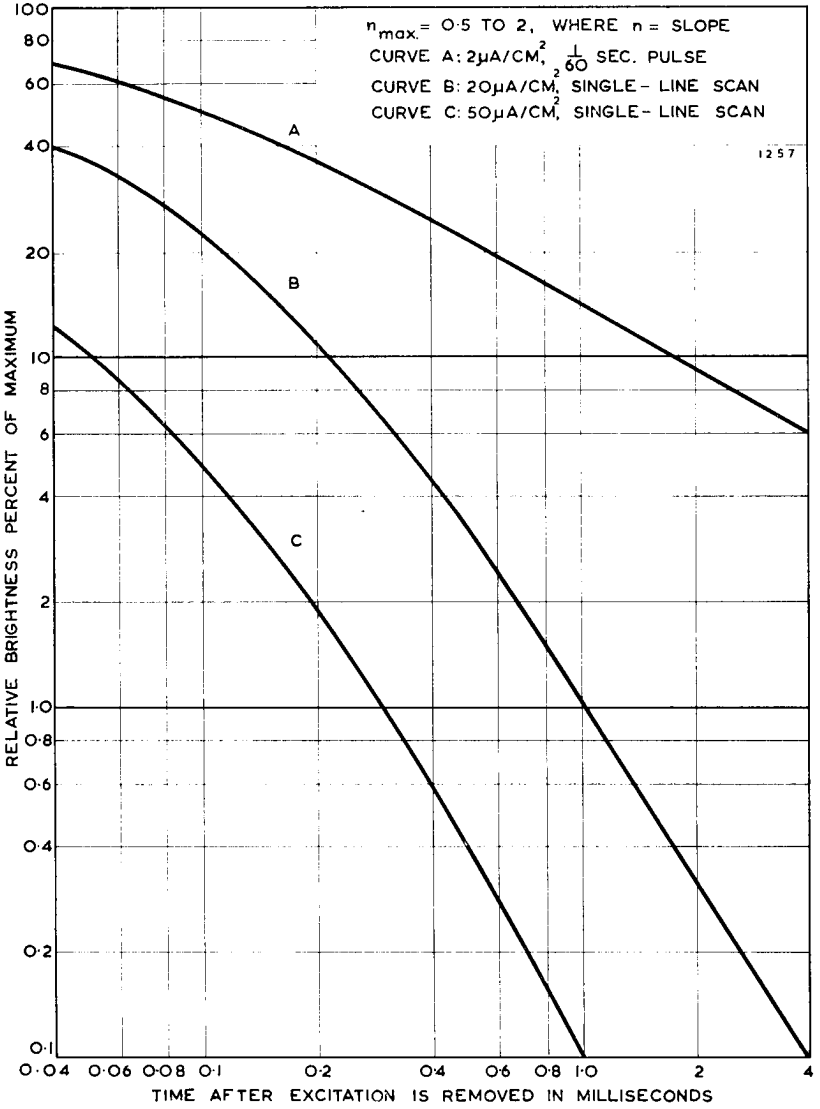
ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTICS



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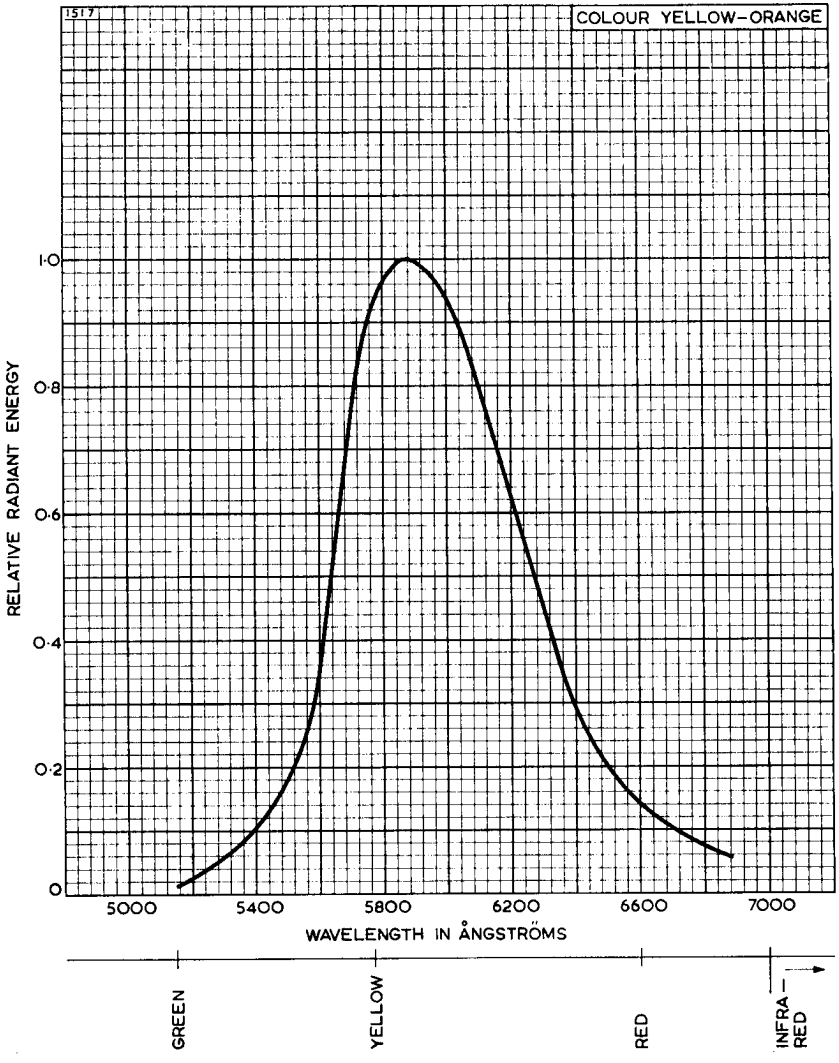
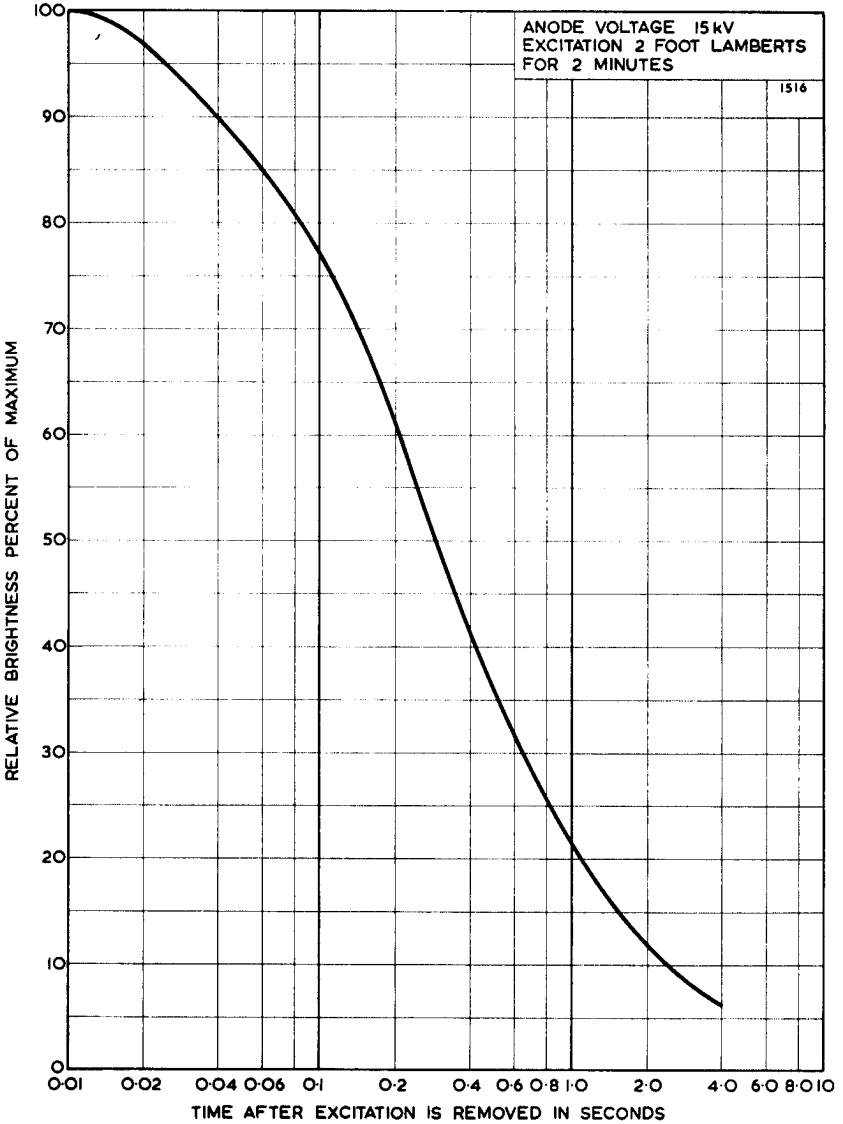
SPECTRAL OUTPUT CHARACTERISTIC



PERSISTENCE CHARACTERISTIC



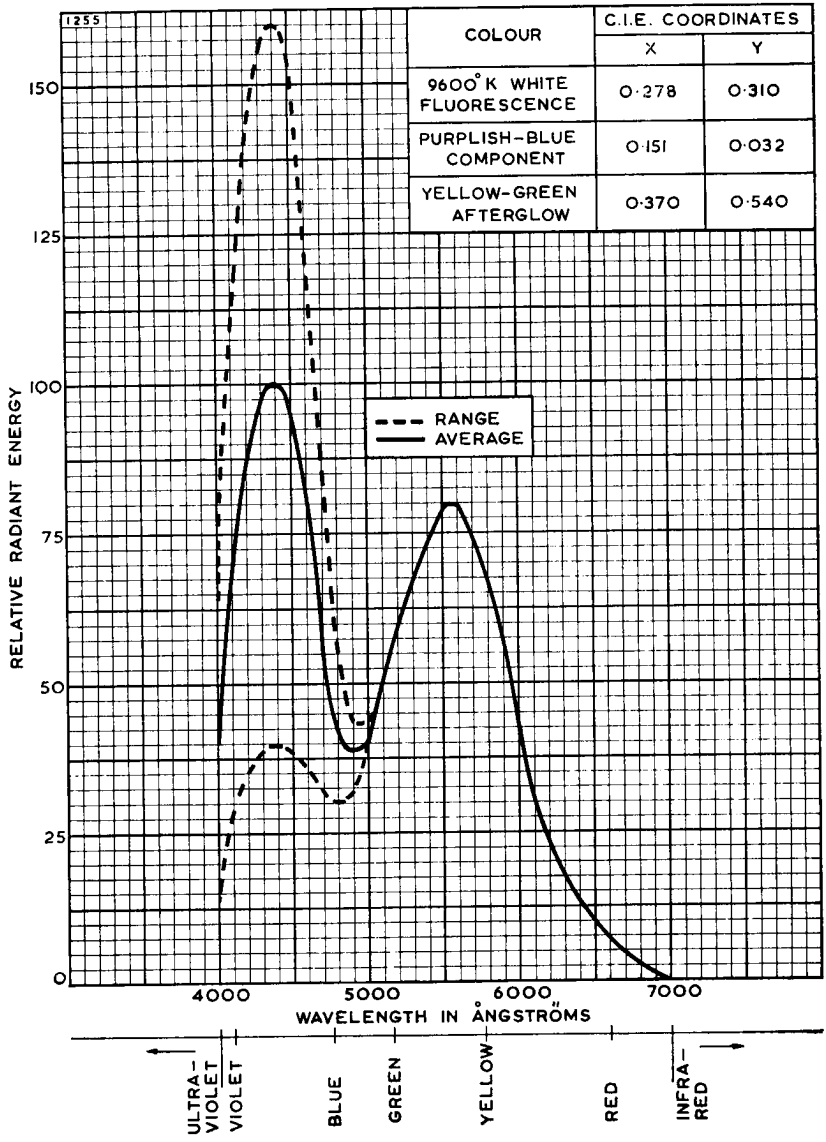
CATHODE RAY TUBES

X PHOSPHOR

(Similar to P7)

ENGLISH ELECTRIC

SPECTRAL OUTPUT CHARACTERISTIC



COLOUR	C.I.E. COORDINATES	
	X	Y
9600°K WHITE FLUORESCENCE	0·278	0·310
PURPLISH-BLUE COMPONENT	0·151	0·032
YELLOW-GREEN AFTERGLOW	0·370	0·540

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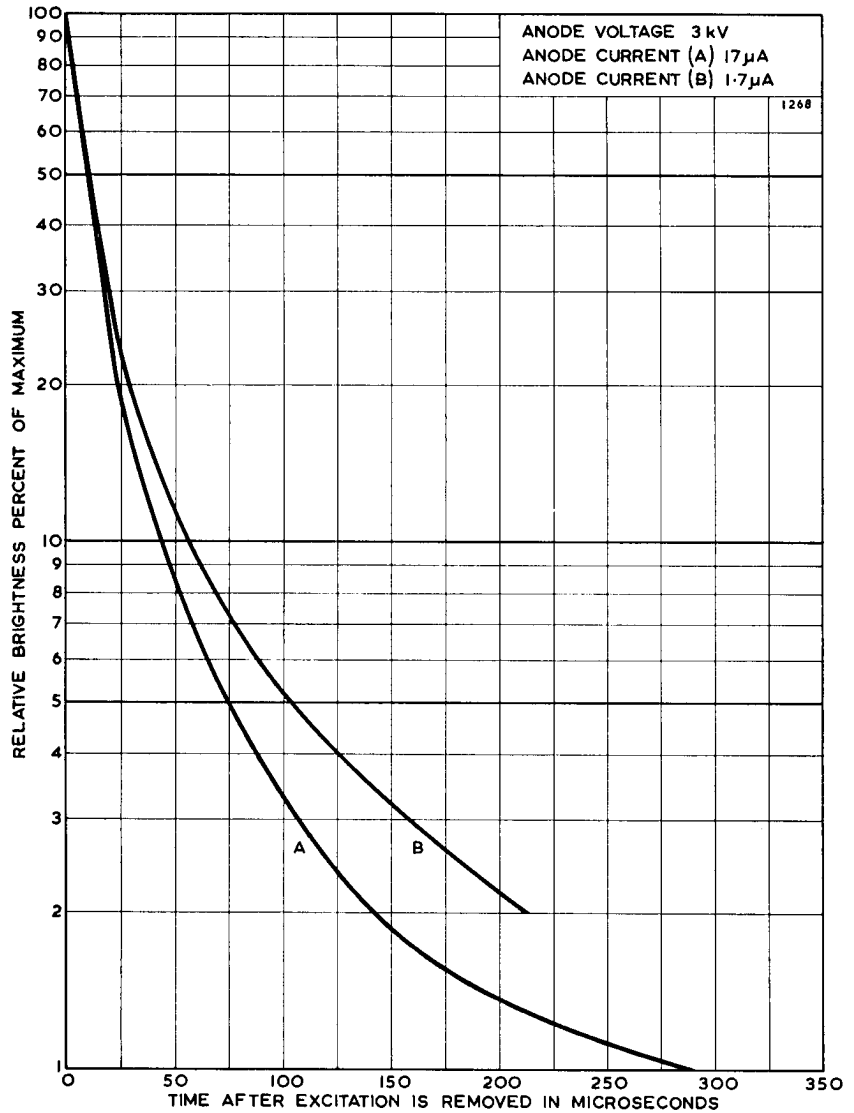
ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTICS (Purplish-blue Component)



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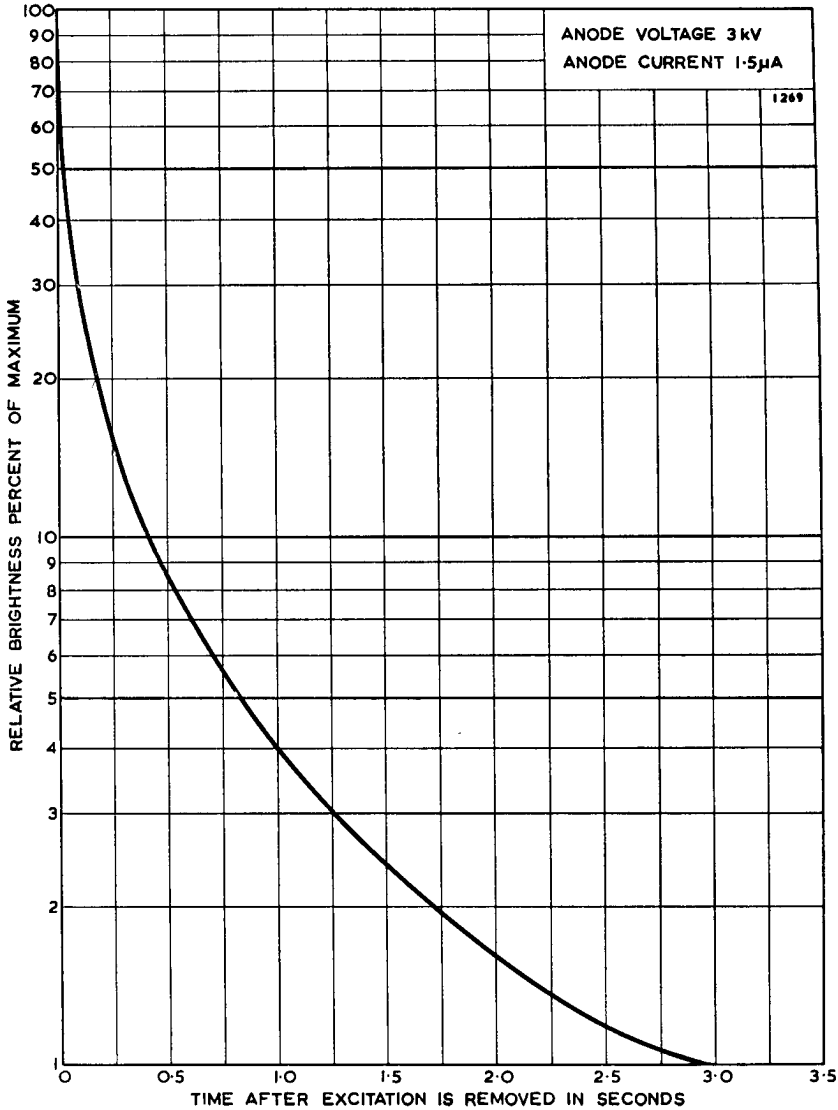
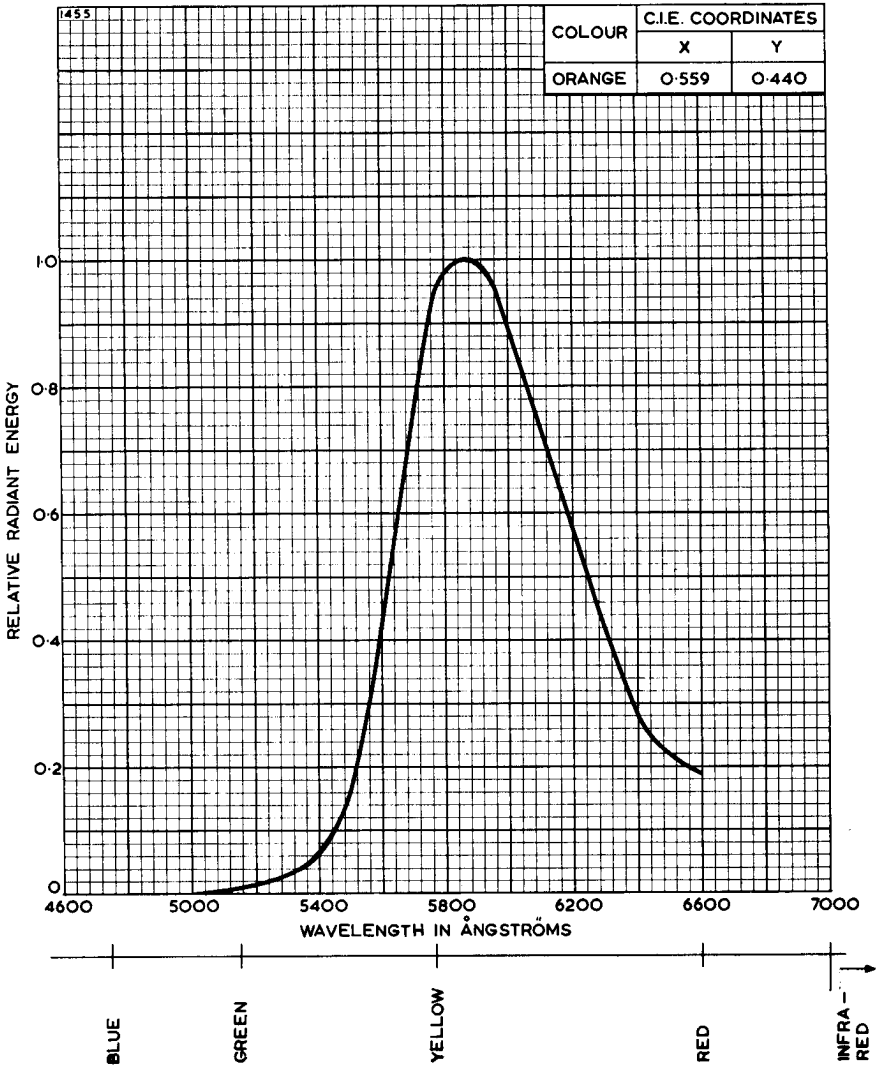
PERSISTENCE CHARACTERISTIC (Yellow-green Component)



SPECTRAL OUTPUT CHARACTERISTIC

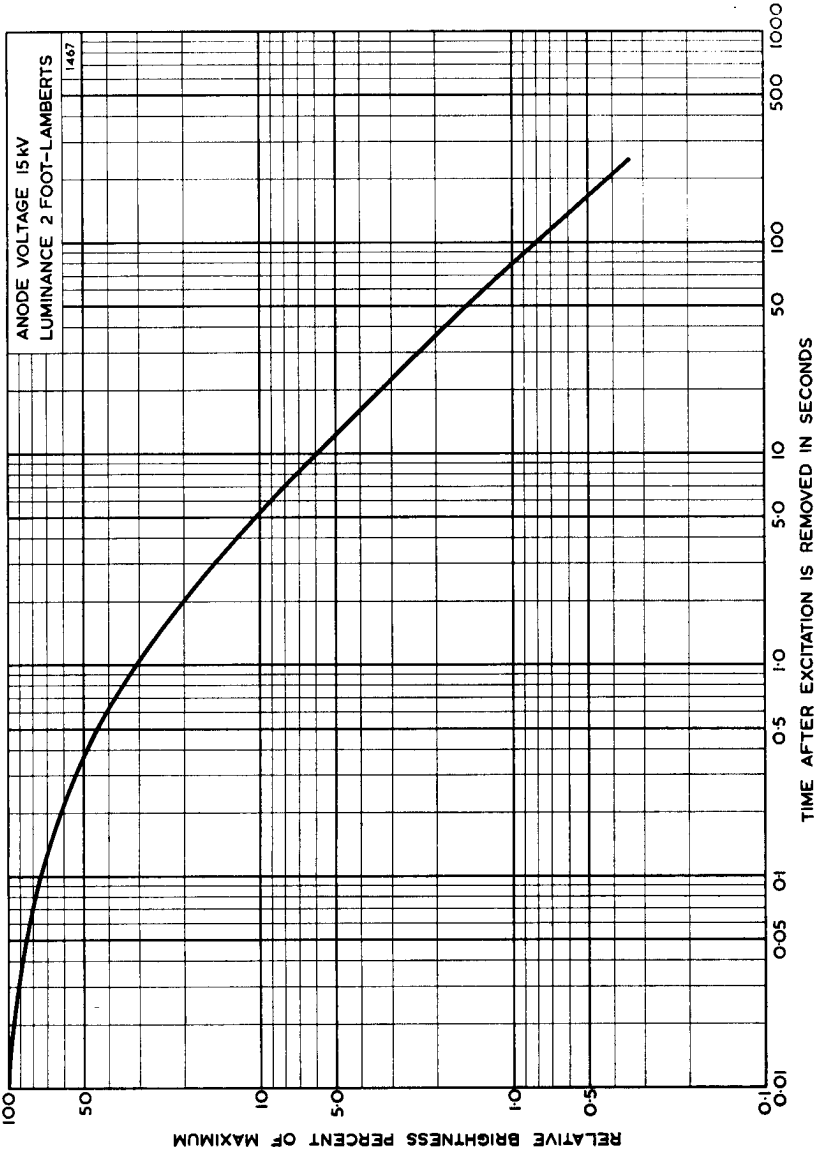


Y PHOSPHOR

(Similar to P33)

ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTIC



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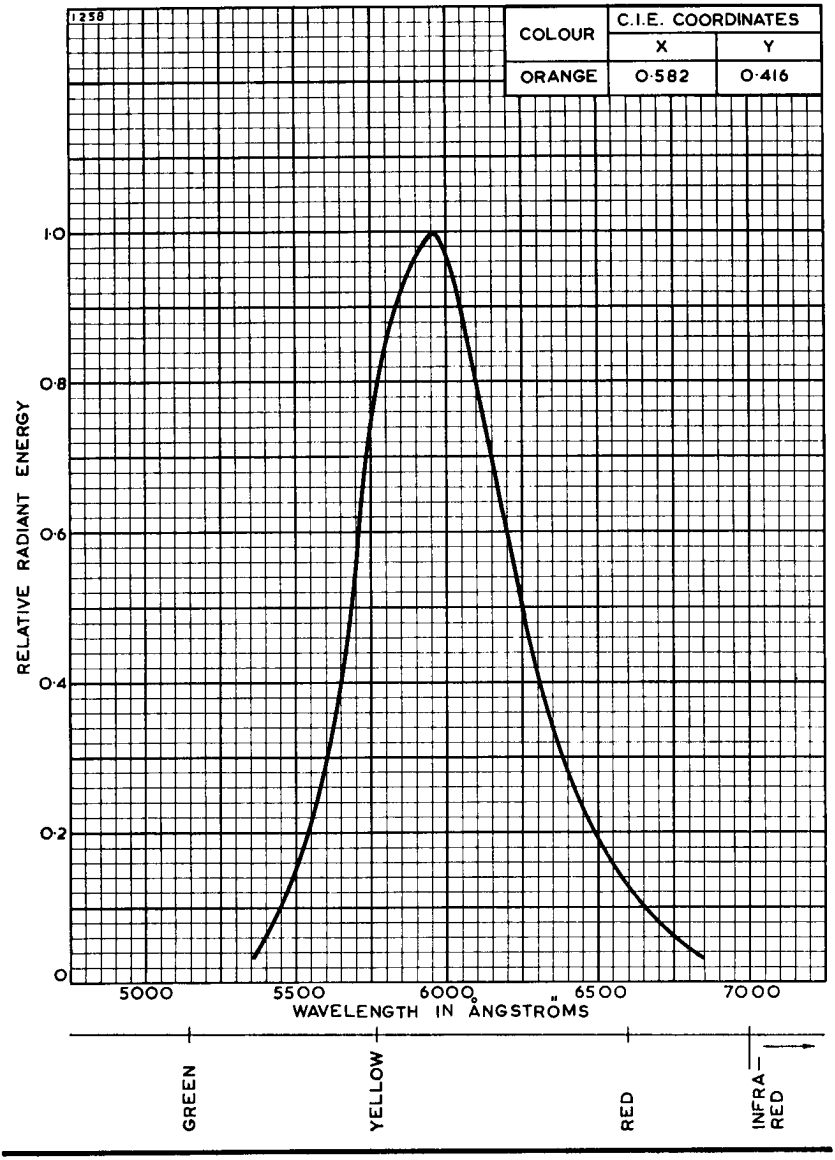
CATHODE RAY TUBES

Z PHOSPHOR

(Similar to P26)

ENGLISH ELECTRIC

SPECTRAL OUTPUT CHARACTERISTIC



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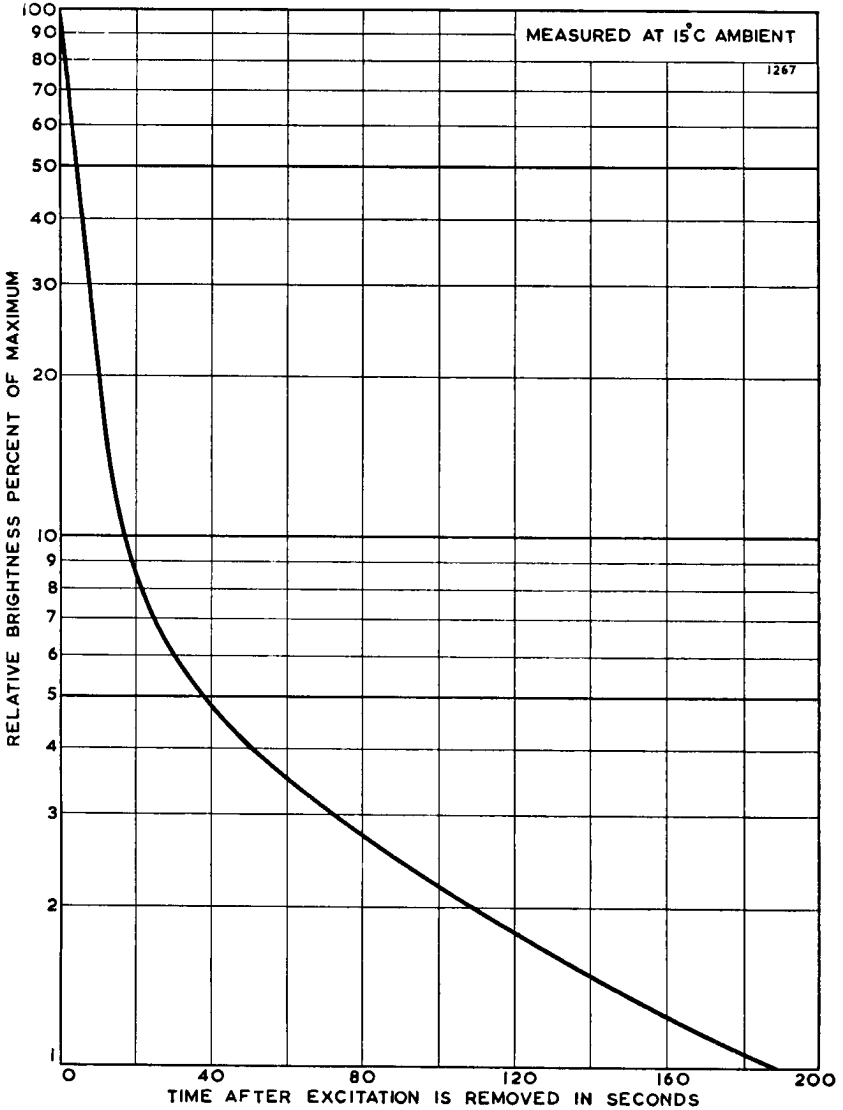
Z PHOSPHOR

(Similar to P26)

ENGLISH ELECTRIC

PERSISTENCE CHARACTERISTIC



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ENGLAND

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CATHODE RAY TUBE

T921

Service Type CV464

INTRODUCTION

The T921 is a 9-inch diameter electrostatic focus, magnetic deflection Cathode Ray Tube designed for radar applications. The fluorescent colour of the aluminium backed screen is orange, with an orange afterglow of very long persistence. See Note 1 for alternative screens.

A high proportion of the beam current is delivered to the screen and the tube gives a display of adequate brightness from the short modulation pulses encountered in short range radars.

GENERAL DATA

Electrical and General

Cathode	Indirectly Heated, Oxide Coated
Heater Voltage (a.c. or d.c.)	4·0 V
Heater Current	1·1 A Max
Screen (*See Notes* 1 *and* 2)	Aluminium Backed
Fluorescent Colour	Orange
Afterglow Colour	Orange
Afterglow Persistence	Very Long
Deflection Angle	58°
Deflection Method	Magnetic
Focusing Method	Electrostatic
Inter-electrode Capacitances:	
Grid to all other electrodes	12 pF Max
Anode 1 to all other electrodes	15 pF Max
Cathode to all other electrodes	12 pF Max

Mechanical

Overall Length	452mm (17·80 inches) Max
Overall Diameter	230mm (9 inches) Max
Neck Diameter	36mm (1·42 inches) Max
Net Weight	5 pounds (2·3 kg) Approx
Base	International Octal (B.S.448/B8–0)
Anode 3 Cap (*See Note* 3)	B.S.448/CT1
Mounting Position	Any

MAXIMUM RATINGS

(Absolute Values)

Anode 3 Voltage	13 kV Max
Anode 2 Voltage	2·15 kV Max
Anode 1 Voltage	2·20 kV Max
Grid Voltage (negative value, never positive)	200 V Max
Peak Heater to Cathode Voltage:	
Heater positive with respect to cathode	125 V Max
Heater negative with respect to cathode	125 V Max

Printed in England

TYPICAL OPERATING CONDITIONS

Anode 3 Voltage	8·0	12	kV
Anode 2 Voltage for focus (*See Note* 4)	1·25	1·95	kV
Anode 1 Voltage (*See Note* 4)	1·35	2·0	kV
Grid Voltage for cut-off	−45 to −100	−70 to −126	V

NOTES

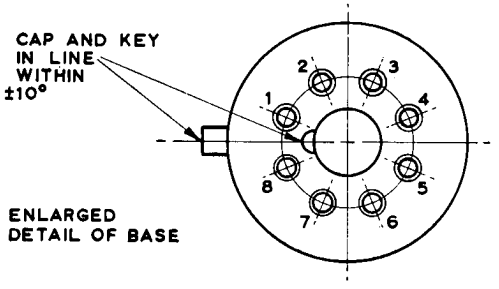
1. The T921 has an E.E.V. Z Screen which satisfies the requirements of the E.V.S. 009 Screen Specification. It can also be manufactured with alternative screens, and customers' enquiries are invited.

2. The fluoride screen is sensitive to burn and should not be operated with slow moving spots.

3. Alternatively, the T921 can be supplied with an anode cavity cap to B.S.448/CT8.

4. Anode 1 must be at least 50 volts positive with respect to anode 2 to prevent secondary electrons reaching the screen. A focus control range of at least ±15% in anode 2 voltage should be provided to facilitate adjustment by passing clearly through focus. To allow for variations in anode 3 voltage, either in design or as the result of mains fluctuations, the anode 2 voltage for focus may be taken as being approximately 16% of the anode 3 voltage.

OUTLINE DETAILS

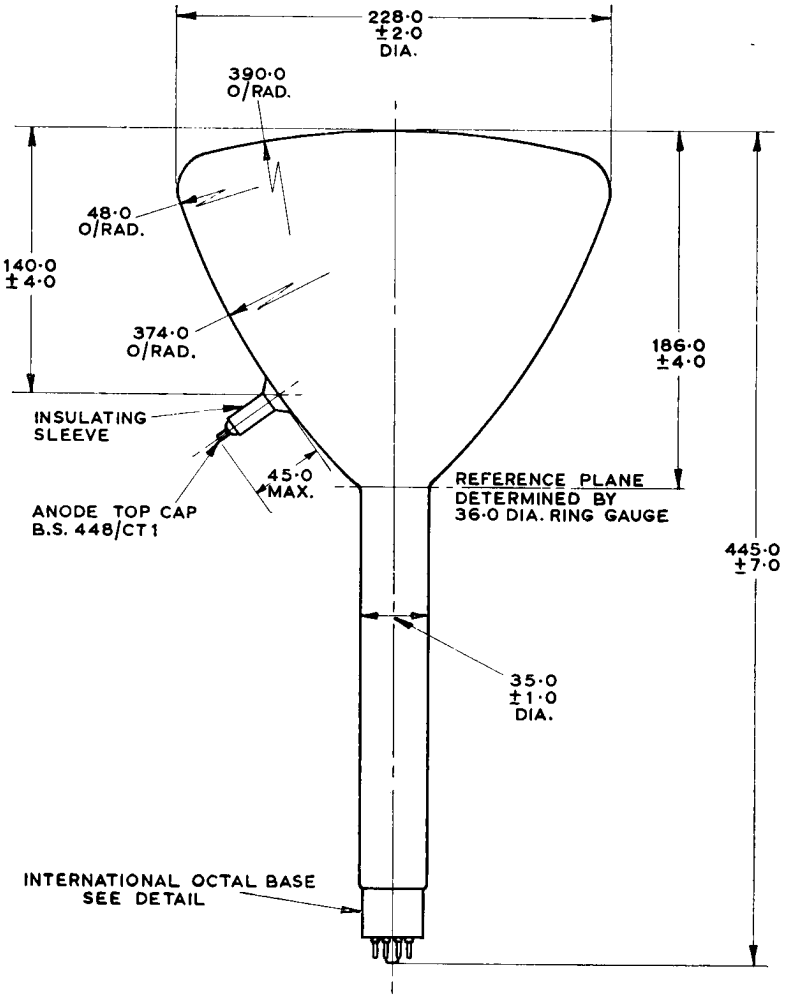


818

PIN	ELEMENT
1	NO CONNECTION
2	ANODE 1
3	ANODE 2
4	NO CONNECTION
5	GRID 1
6	CATHODE
7	HEATER
8	HEATER
CAP	ANODE 3

OUTLINE

816



ALL DIMENSIONS IN MILLIMETRES

CATHODE RAY TUBE

T922

ENGLISH ELECTRIC

Service Type CV2162

INTRODUCTION

The T922 is a 12 inch diameter electrostatic focus, magnetic deflection Cathode Ray Tube designed for radar applications. The fluorescent colour of the aluminium backed screen is orange, with an orange afterglow of very long persistence. See Note 1 for alternative screens.

A high proportion of the beam current is delivered to the screen and the tube gives a display of adequate brightness from the short modulation pulses encountered in short range radars.

GENERAL DATA

Electrical and General

Cathode	Indirectly Heated, Oxide Coated
Heater Voltage (a.c. or d.c.)	4·0 V
Heater Current	1·1 A Max
Screen (*See Notes* 1 *and* 2):	Aluminium Backed
Fluorescent Colour	Orange
Afterglow Colour	Orange
Afterglow Persistence	Very Long
Deflection Angle	50°
Deflection Method	Magnetic
Focusing Method	Electrostatic
Inter-electrode Capacitances:	
Grid to all other electrodes	12 pF Max
Anode 1 to all other electrodes	15 pF Max
Cathode to all other electrodes	12 pF Max

Mechanical

Overall Length	545mm (21·5 inches) Max
Overall Diameter	307mm (12 inches) Max
Neck Diameter	36mm (1·42 inches) Max
Net Weight	12 pounds (5·5 kg) Approx
Base	International Octal (B.S.448/B8–0)
Anode 3 Cap (*See Note* 3)	B.S 448/CT1
Mounting Position	Any

MAXIMUM RATINGS

(Absolute Values)

Anode 3 Voltage	13 kV Max
Anode 2 Voltage	2·15 kV Max
Anode 1 Voltage	2·20 kV Max
Grid Voltage (negative value, never positive)	200 V Max
Peak Heater to Cathode Voltage:	
Heater positive with respect to cathode	125 V Max
Heater negative with respect to cathode	125 V Max

TYPICAL OPERATING CONDITIONS

Anode 3 Voltage	12	kV
Anode 2 Voltage for focus (*See Note* 4)	1·95	kV
Anode 1 Voltage (*See Note* 4)	2·0	kV
Grid Voltage for cut-off	−70 to −126	V

NOTES

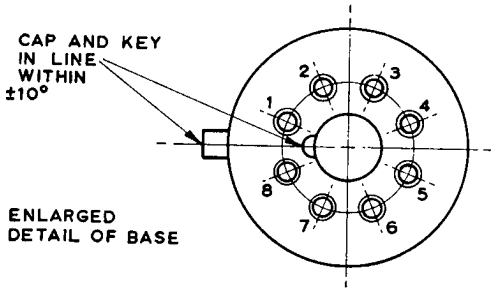
1. The T922 has an E.E.V. Z Screen which satisfies the requirements of the E.V.S. 009 Screen Specification. It can also be manufactured with alternative screens, and customers' enquiries are invited.

2. The fluoride screen is sensitive to burn and should not be operated with slow moving spots.

3. Alternatively, the T922 can be supplied with an anode cavity cap to B.S.448/CT8.

4. Anode 1 must be at least 50 volts positive with respect to anode 2 to prevent secondary electrons reaching the screen. A focus control range of at least ±15% in anode 2 voltage should be provided to facilitate adjustment by passing clearly through focus. To allow for variations in anode 3 voltage, either in design or as the result of mains fluctuations, the anode 2 voltage for focus may be taken as being approximately 16% of the anode 3 voltage.

OUTLINE DETAILS



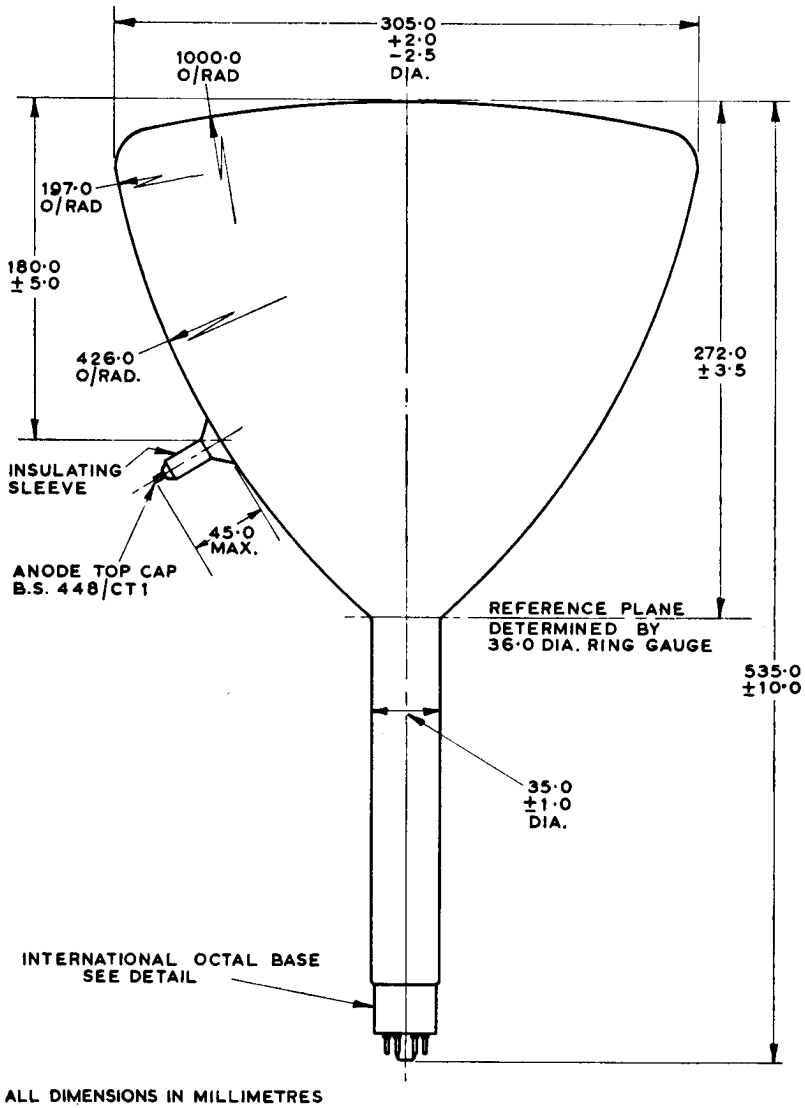
818

PIN	ELEMENT
1	NO CONNECTION
2	ANODE 1
3	ANODE 2
4	NO CONNECTION
5	GRID 1
6	CATHODE
7	HEATER
8	HEATER
CAP	ANODE 3

ENGLISH ELECTRIC

OUTLINE

817



ALL DIMENSIONS IN MILLIMETRES

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PROJECTION CATHODE RAY TUBES

T940B T940G T940R T940W

INTRODUCTION

The T940 series comprises four five-inch diameter Projection Cathode Ray Tubes with magnetic focusing and magnetic deflection, designed for applications where high brightness displays of large area are required. The four tubes differ only in their screen properties; the fluorescent colours of the screens are given by the suffix letters B, G, R, and W, denoting blue, green, red and white respectively.

GENERAL DATA

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 1)	6·3	V
Heater Current	0·66	A Max
Screen	Aluminised	
Screen Fluorescent Colour:		
T940B	Blue	
T940G	Green	
T940R (*See Note* 2)	Red	
T940W	White	
Deflection Method	Magnetic	
Deflection Angle	47	Degrees
Focusing Method	Magnetic	
Raster Dimensions	72 × 96	mm Min
Highlight Brightness (at 4·5mA peak anode current) (*See Note* 3)	6500 18 850	mcd/cm² ft-lamberts
Inter-electrode Capacitances:		
Grid to all other electrodes	10	pF
Cathode to all other electrodes	9·0	pF

Mechanical

Overall Length	17·08 inches	(434mm)	Max
Overall Diameter (excluding anode spigot)	5·34 inches	(135·5mm)	Max
Neck Diameter	1·5 inches	(38mm)	Max
Net Weight	2 pounds	(910g)	Approx
Base (*See Note* 4)			B.S.448-B12A
Anode Connector (Supplied separately. *See Note* 5)			MA151
Mounting Position			*See Note* 6

Cooling

The screen requires forced-air cooling

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MINIMUM AND MAXIMUM RATINGS
(Absolute Values)

	Min	*Max*	
Anode Voltage (*See Note* 7)	40	55	kV
Grid Voltage (negative value, never positive) ..	—	250	V
Anode Current (Mean) (*See Notes* 8 *and* 9) ..	—	500	μA
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50c/s)	—	500	kΩ
Heater to Cathode Voltage		*See Note* 10	
Magnification	—	40	

TYPICAL OPERATING CONDITIONS

Anode Voltage	50	kV
Anode Current (Peak)	4·5	mA
Anode Current (Mean)	500	μA
Grid Voltage for cut-off	−100 to −170	V
Spark Trap and External Conductive Coating (*See Note* 11)	Earth Potential	
Focus Power	*See Note* 12	
Line Width (*See Note* 13)	0·004	inch

INSULATION OF EXTERNAL COMPONENTS

The deflection and focus yokes should be insulated from the tube neck, and all corners on conducting surfaces should be rounded off. Earthed conductors should be kept away from the vicinity of the high potential end of the tube.

X-RAY WARNING

THE VOLTAGE AT WHICH THE TUBE OPERATES INVOLVES AN X-RAY HAZARD. The sheet steel casing of a typical projector in conjunction with the shielding provided by the optical and electrical components normally gives adequate protection but individual designs should be checked by measurement.

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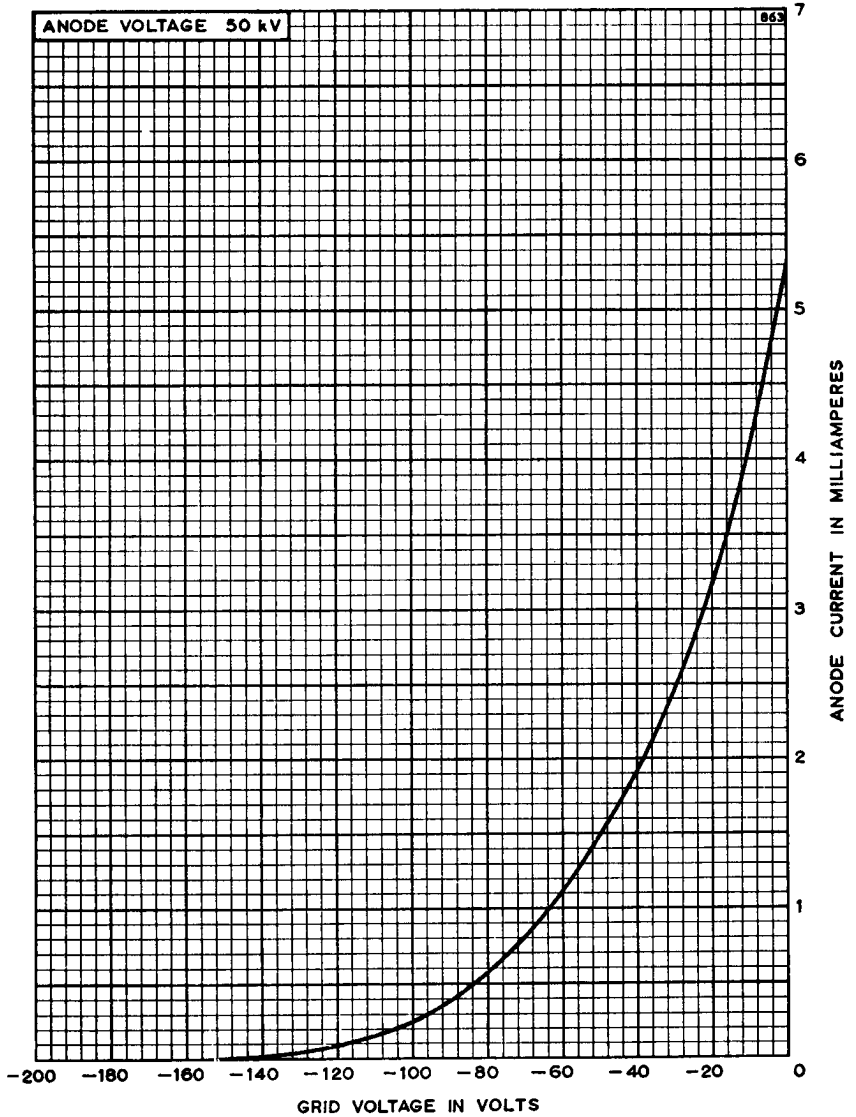
NOTES

1. The heater is suitable for parallel operation only.
2. The actual screen colour of the T940R is orange but gives red primary colour when used in conjunction with a Wratten 25 filter.
3. This highlight brightness relates to T940W.
4. The socket should not be rigidly mounted but should have flexible leads and be able to move freely. The bottom circumference of the base shell will fall within a circle having a diameter of 50mm which is centred on the perpendicular from the centre of the face plate.
5. It is recommended that the connection to the anode be made with connector type MA151, available from English Electric Valve Company Ltd. See page 7 for details.
6. The tube may be mounted in any position except with the screen downwards and the axis of the tube making an angle of less than 50° with the vertical.
7. A 50kΩ resistor should be included in the anode lead in order to avoid damage to the tube by a momentary internal arc. Before removing the tube from an equipment the screen and cone should be discharged.
8. For normal television pictures. Stationary patterns, with high peak currents concentrated in one area of the tube face and the remaining area dark, impose harmful thermal stresses on the faceplate and must be avoided.
9. Means must be provided for the instantaneous removal of beam current in the event of a failure of either one or both of the time bases. Unless such a safety device is incorporated, a failure of this type will result in the immediate destruction of the screen of the tube.
10. The heater should preferably be connected to the cathode. Applications necessitating the application of a potential between the heater and cathode are subject to engineering approval.
11. The spark trap and external conductive coating should be connected by a low impedance path to the h.t. supply return. The purpose is to isolate from the grid and its associated circuits any occasional, non-destructive, discharges which sometimes occur when starting after prolonged shut down.
12. The focus power required is equivalent to approximately 1300 ampere-turns in a shrouded focus coil with ¼-inch gap. The precise value depends on the gap position.
13. At 500μA anode current with a shrinking raster.

GRID VOLTAGE CHARACTERISTIC



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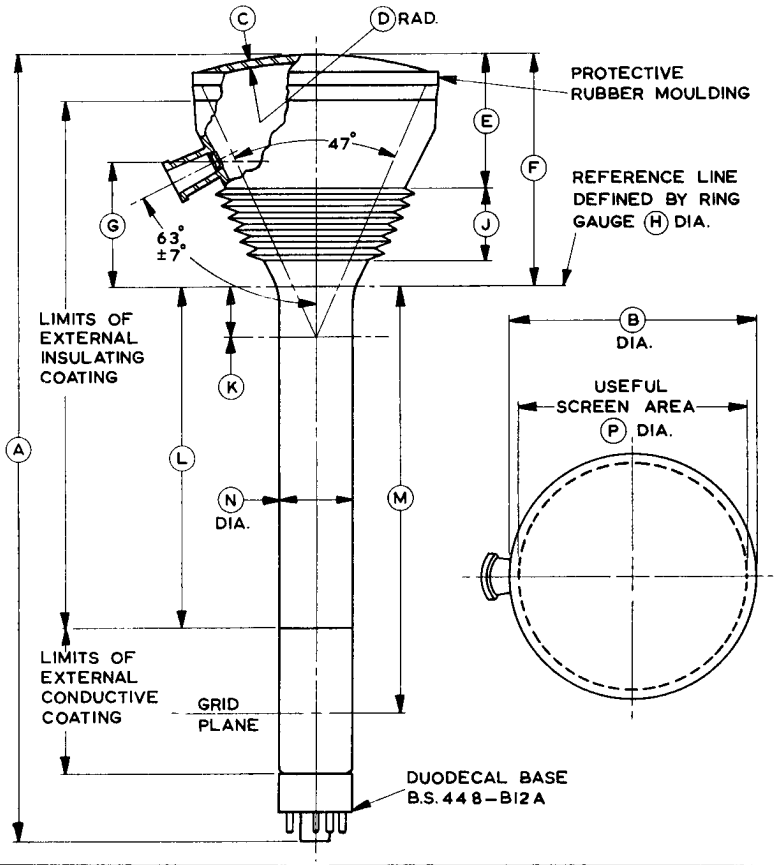
1261A

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	16·693 ± 0·394	424·0 ± 10·0	J	1·496 ± 0·039	38·0 ± 1·0
B	5·275 ± 0·059	134·0 ± 1·5	K	1·083 Max	27·5 Max
C	0·118	3·0	L	7·480 $^{+0\cdot000}_{-0\cdot197}$	190·0 $^{+0\cdot0}_{-5\cdot0}$
D	8·150 ± 0·039	207·0 ± 1·0	M	9·114 ± 0·157	231·5 ± 4·0
E	2·795 ± 0·059	71·0 ± 1·5	N	1·437 ± 0·059	36·5 ± 1·5
F	4·862 ± 0·118	123·5 ± 3·0	P	4·725 Min	120·0 Min
G	2·736 ± 0·157	69·5 ± 4·0			
H	1·500	38·1			

Inch dimensions have been derived from millimetres.

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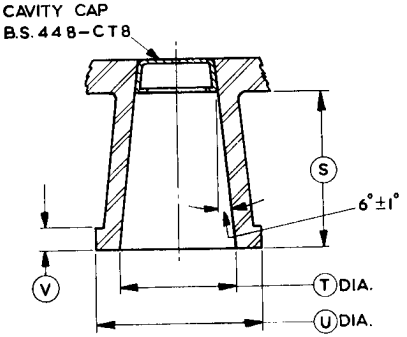
ANODE SPIGOT DETAILS

677B

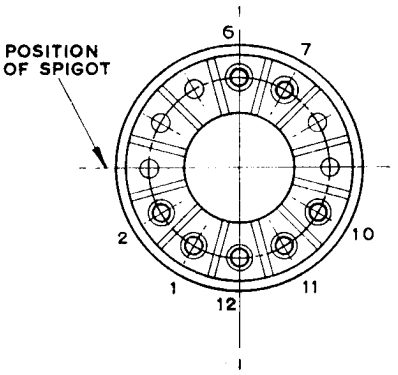


Ref.	Inches	Millimetres
S	0·925±0·098	23·5±2·5
T	0·717±0·020	18·2±0·5
U	0·984±0·016	25·0±0·4
V	0·118 Max	3·0 Max

Inch dimensions have been derived from millimetres.

BASE CONNECTIONS

678



PIN	ELEMENT
1	HEATER
2	GRID
3	OMITTED
4	OMITTED
5	OMITTED
6	NO CONNECTION
7	NO CONNECTION
8	OMITTED
9	OMITTED
10	SPARK TRAP
11	CATHODE
12	HEATER
CAP	ANODE

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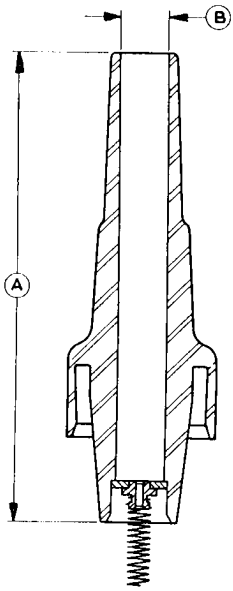
ANODE CONNECTOR MA151

1284



Ref.	Inches	Millimetres
A	3·268	83·0
B	0·330 ± 0·005	8·38 ± 0·13

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ENGLISH ELECTRIC

ABRIDGED DATA

12-inch Diameter Radar Tubes. Two sets of scan coils may be fitted for display of alpha-numeric characters in processed radar systems. The scan angle permits the use of valve or transistor scan amplifiers.

Neck Diameter	1·378 inches (35mm)	
Deflection Angle	50	Degrees
Deflection Method		Magnetic
Focus Method (*See Note* 1)		Magnetic
E.H.T. Voltage	15	kV

GENERAL DATA

Electrical and General

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 2)	6·3	V
Heater Current	0·3±10%	A
Faceplate		Clear
Screen (*See Note* 3)		Aluminised
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	8·0	pF
Cathode to all other electrodes, less than	8·0	pF

Mechanical

Overall Length	25·591 inches	(650mm)	Max
Overall Diameter	12·087 inches	(307mm)	Max
Neck Diameter	1·398 inches	(35·5mm)	Max
Net Weight	12 pounds	(5·4kg)	Approx
Base			B.S.448–B12A
Anode 2 Cavity Cap			B.S.448–CT8
Mounting Position			*See Note* 4

ENGLISH ELECTRIC

MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

(All voltages with respect to cathode)

	Min	*Max*	
Anode 2 Voltage	9·0	15·5	kV
Anode 1 Voltage	250	600	V
Grid Voltage, negative value (*See Note* 5) ..	—	250	V
Cathode Current (Mean)	—	300	μA
Heater to Cathode Voltage (*See Note* 6):			
Cathode negative	—	150	V
Cathode positive	—	200	V
Peak Heater to Cathode Voltage:			
Cathode positive (*See Note* 7)	—	410	V
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50c/s)	—	0·5	MΩ
Heater to Cathode Resistance		*See Note* 8	

TYPICAL OPERATING CONDITIONS

Anode 2 Voltage	15	kV
Anode 1 Voltage	300	V
Grid Voltage for cut-off	−30 to −90	V
Grid Drive for 50μA beam current	20 to 30	V

OPTIMUM BEAM FOCUSING

In order to obtain maximum brightness and minimum spot size, it is necessary to carry out the following procedure.

(*a*) Stray magnetic fields should be minimised in the region of the gun structure by fitting a tubular mumetal shield over the neck.

(*b*) The beam may be centred in the defining aperture by means of a small magnetic field located in the region of the grid and adjusted to give maximum brightness.

(*c*) The magnetic axis of the focus coil should be aligned with the axis of the electron beam. This may be done either by adjusting the position of the focus coil (See Method 1), or by fitting additional deflection coils to adjust the position of the beam (See Method 2). In each case a.c. focusing (see page 3) may be used to identify the optimum alignment condition.

Method 1

Adjustment of the focus coil position

The mounting of the focus coil should be such that the coil can be moved in any direction, i.e. vertically, horizontally and tilted about either the vertical or horizontal axis. An a.c. current is passed through the focus coil and the position of the coil is adjusted until the optimum alignment is reached. (*See note* below*).

Method 2

Electromagnetic deflection of the beam

Two sets of alignment coils are fitted on the tube neck, between the beam defining aperture and the focus coil (*See diagram, page* 8). Each set of coils is capable of deflecting the beam slightly in both X and Y directions. The currents in the alignment coils are adjusted to give correct alignment of the beam. (*See note* below*).

**A.C. Focusing*

An alternating current is passed through the focus coil such that the positive and negative excursions of the current each produce a focused spot. Provided there is no current through the main deflection coils, the picture on the tube faceplate will consist of a defocused area and two focused spots. The optimum focusing condition is obtained when the two focused spots coincide at the centre of the defocused spot.

NOTES

1. The focus coil should be positioned so that the focusing field is entirely on the screen side of the beam defining aperture. When using a focus coil having a short air gap, the centre of the air gap should be approximately 220mm from the reference plane.
2. The heater is suitable for series or parallel operation. In series operation the surge heater voltage must not exceed $9{\cdot}5V_{r.m.s.}$ when the supply is switched on and a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.
3. Tubes in the T953 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T953S	S*	—	Yellowish-orange	Long
T953Y	Y*	P33	Orange	Long
T953Z	Z*	P26	Orange	Very Long

*This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots.

The tube can be manufactured with alternative screens, and customers' enquiries are invited.

4. The tube may be mounted in any position except vertically with the screen downwards and the axis of the tube making an angle of less than 20° with the vertical.

5. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the period immediately after switching the equipment on or off when it may be allowed to rise to + 1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.

6. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than $20V_{r.m.s.}$

7. During a warming-up period not exceeding 45 seconds.

8. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50c/s must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.

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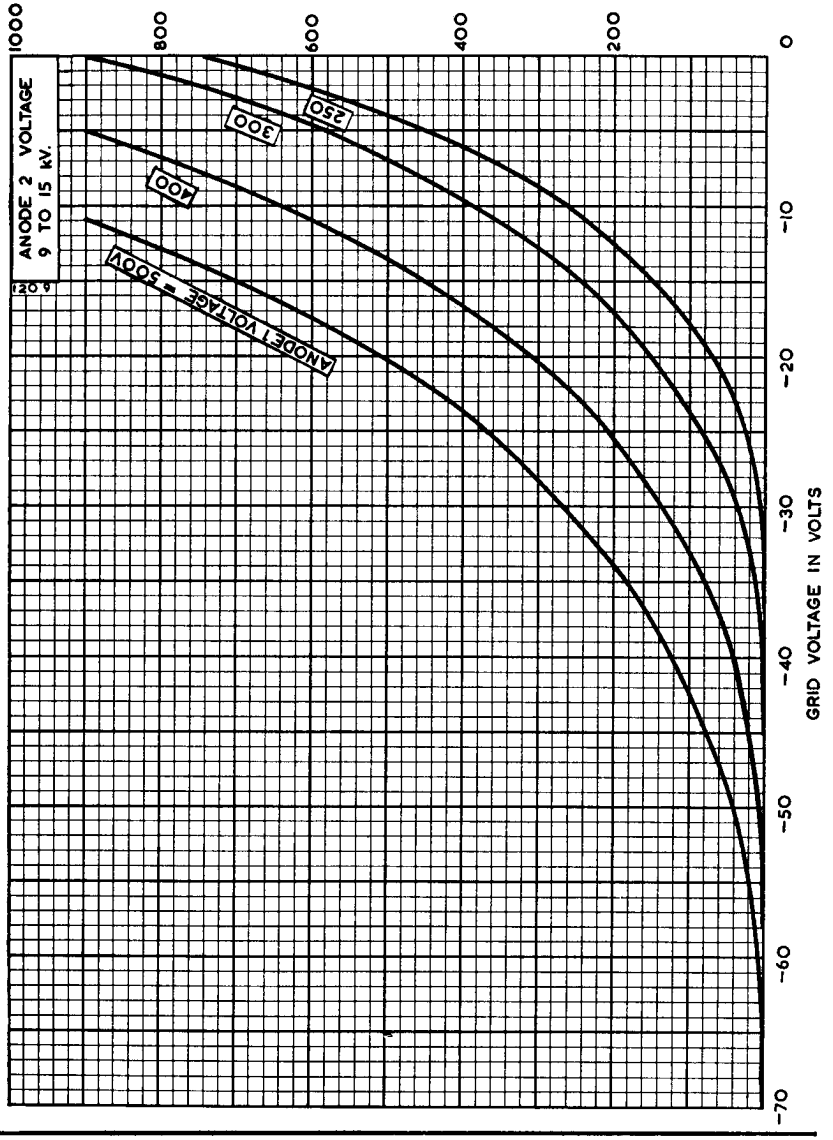
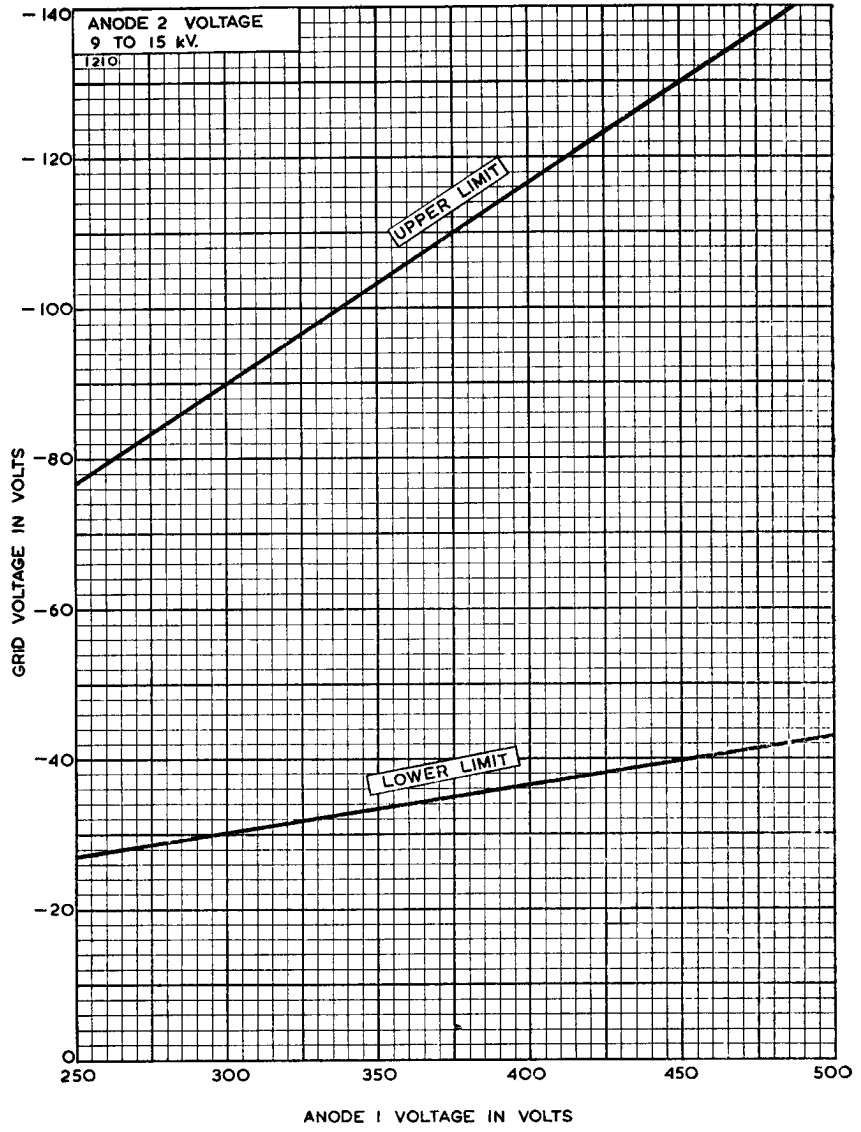
GRID VOLTAGE CHARACTERISTICS

ANODE 2 CURRENT IN MICROAMPERES



ENGLISH ELECTRIC

GRID VOLTAGE CUT-OFF LIMITS



OUTLINE

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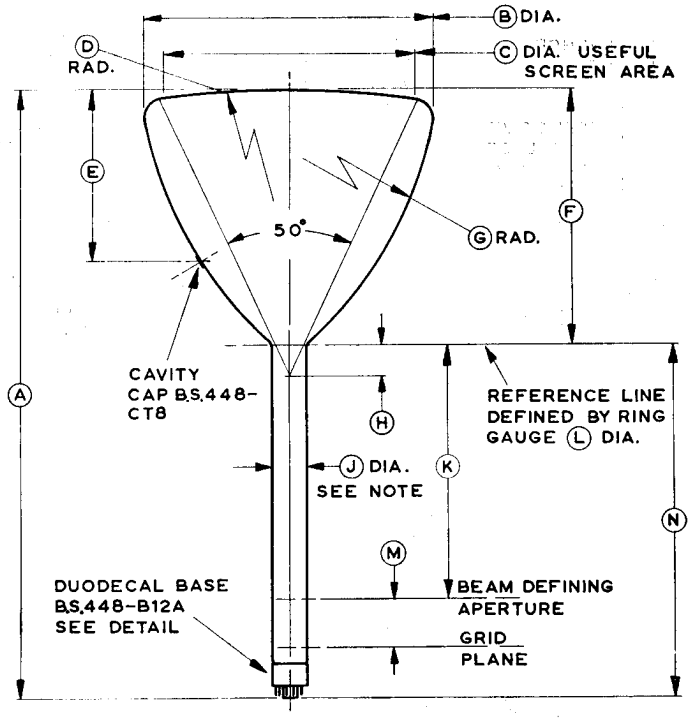


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	25·32 ± 0·28	643·0 ± 7·0	H	1·260 Max	32·0 Max
B	12·008 $^{+0·079}_{-0·098}$	305·0 $^{+2·0}_{-2·5}$	J	1·378 $^{+0·020}_{-0·039}$	35·0 $^{+0·5}_{-1·0}$
C	10·43 Min	265·0 Min	K	10·630	270
D	39·37	1000·0	L	1·417	36·00
E	7·087 ± 0·197	180·0 ± 5·0	M	1·969	50·00
F	10·71 ± 0·14	272·0 ± 3·5	N	14·606	371
G	16·77	426·0			

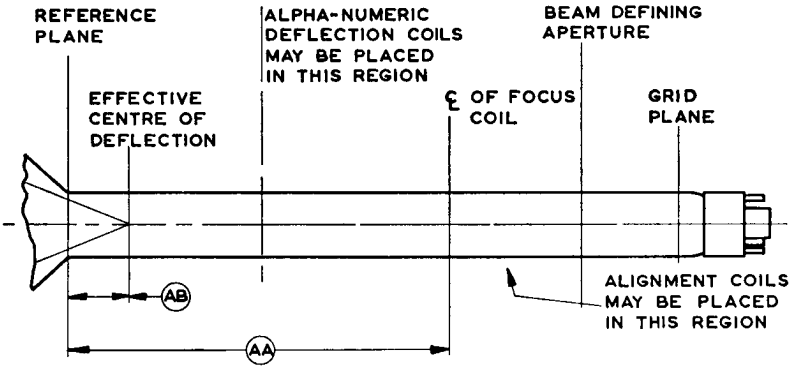
Inch dimensions have been derived from millimetres.

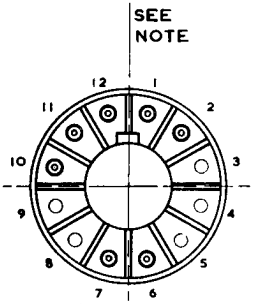
Note A ring gauge 1·417 inches (36·0mm) diameter by 3·937 inches (100mm) long will pass over base and neck to reference plane.

ENGLISH ELECTRIC

1203

OUTLINE DETAILS





Ref.	Inches	Millimetres
AA	8·661	220·0
AB	1·260 Max	32·00 Max

Inch dimensions have been derived from millimetres.

Note The anode cavity cap will be in line with the base key to within 15°.

Pin	Element	Pin	Element
1	Heater	8	Omitted
2	Grid	9	Omitted
3	Omitted	10	Anode 1
4	Omitted	11	Cathode
5	Omitted	12	Heater
6	Internal Connection	CAP	Anode 2
7	Internal Connection		

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ENGLISH ELECTRIC

ABRIDGED DATA

8½-Inch Diagonal, Rectangular Display Tubes for monitor and radar applications. They feature long necks, enabling two sets of scan coils to be fitted for display of alpha-numeric characters in computer read-out or radar systems. The narrow scan angle permits the use of valve or transistor scan amplifiers.

Focus Method (*See Note* 3)	Magnetic	
Deflection Method	Magnetic	
Deflection Angle	40	Degrees
E.H.T. Voltage	15	kV

GENERAL DATA

Electrical and General

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 1)	6·3	V
Heater Current	0·3 ± 10%	A
Screen (*See Note* 2)	Aluminised	
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	8·0	pF
Cathode to all other electrodes, less than	8·0	pF
Final anode to external coating* (this capacitance may be used for E.H.T. smoothing)	750 pF	Approx

Mechanical

Overall Length	22·25 inches (565 mm)	Max
Faceplate Diagonal	8·510 inches (216 mm)	Max
Neck Diameter	1·40 inches (35·5 mm)	Max
Net Weight	4·6 pounds (2·1 kg)	Approx
Base	B.S.448-B12A	
Anode 2 Cavity Cap	B.S.448-CT8	
Mounting Position	*See Note* 4	

*Versions are available without the external coating, but otherwise identical (T969 series).

MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

(All voltages with respect to cathode)

	Min	*Max*	
Anode 2 Voltage	9·0	16·5	kV
Anode 1 Voltage	250	600	V
Grid Voltage, negative value (*See Note* 5)	0	250	V
Heater to Cathode Voltage:			
Cathode negative	—	150	V
Cathode positive (*See Note* 6)	—	200	V
Peak Heater to Cathode Voltage:			
Cathode positive (*See Note* 7)	—	410	V
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50c/s)	—	0·5	MΩ
Heater to Cathode Resistance	—	*See Note* 8	
Anode 1 Supply Source Impedance	—	1·5	MΩ

TYPICAL OPERATING CONDITIONS

Anode 2 Voltage	15	kV
Anode 1 Voltage	300	V
Grid Voltage for cut-off	−30 to −90	V
Grid Drive for 50μA beam current	20 to 30	V

BEAM CENTRING

In order to obtain maximum brightness and the best focus spot size, stray magnetic fields must be minimised over the length of the gun structure. This may be achieved by using a tubular mumetal shield over the neck.

Where optimum performance is required, a small magnet should be used for centring the beam in the defining aperture. (Elac type BC11 is suitable). The magnet should be located in the region of the grid and its position and strength adjusted to give maximum brightness.

X-RAY WARNING

X-Rays are produced when types in the T954 series are operated with anode voltages above 16kV (absolute value). These rays can constitute a health hazard unless the tubes are adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect on the design of the tubes.

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NOTES

1. The heater is suitable for series or parallel operation. In series operation the surge heater voltage must not exceed $9{\cdot}5V_{r.m.s.}$ when the supply is switched on and a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.

2. Tubes in the T954 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T954S	S*	—	Yellowish-orange	Long
T954T	T	—	Yellow-orange	Medium
T954Y	Y*	P33	Orange	Long

The tube can be manufactured with alternative screens, and customers' enquiries are invited.

*This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots.

3. The focus coil should be positioned so that the focusing field is entirely on the screen side of the beam defining aperture. When using a focus coil having a short air gap, the centre of the air gap should be approximately 2·75 inches (70mm) from the grid plane.

4. The tube may be mounted in any position except vertically with the screen downwards and the axis of the tube making an angle of less than 20° with the vertical.

5. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the periods immediately after switching the equipment on or off, when it may be allowed to rise to + 1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.

6. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than $20V_{r.m.s.}$

7. During a warming-up period not exceeding 45 seconds.

8. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50c/s must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.

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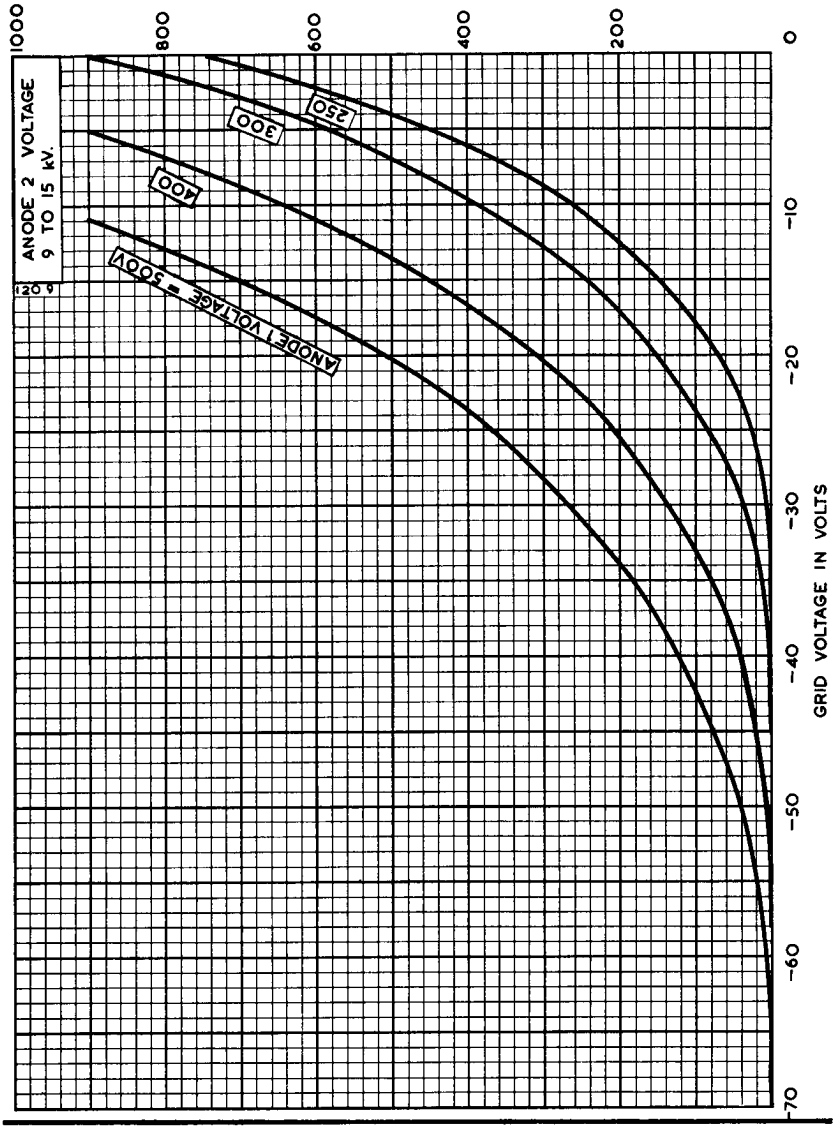
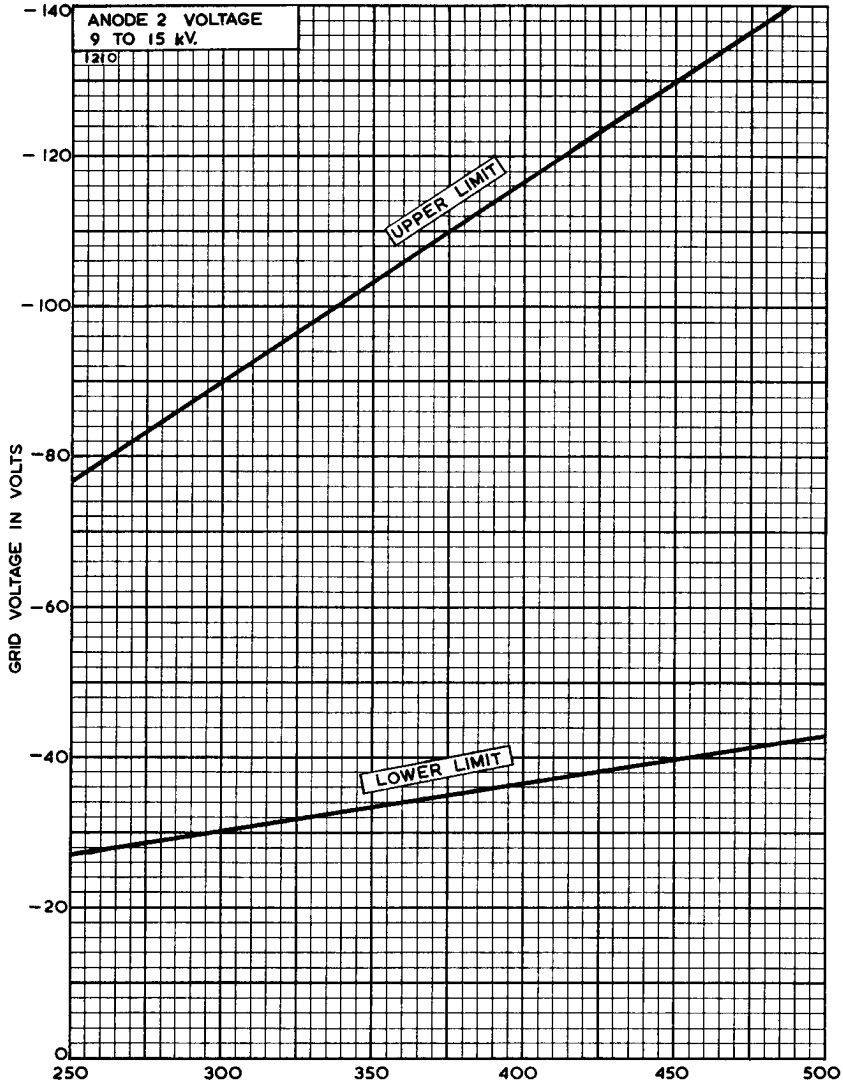
GRID VOLTAGE CHARACTERISTICS

ANODE 2 CURRENT IN MICROAMPERES



ENGLISH ELECTRIC

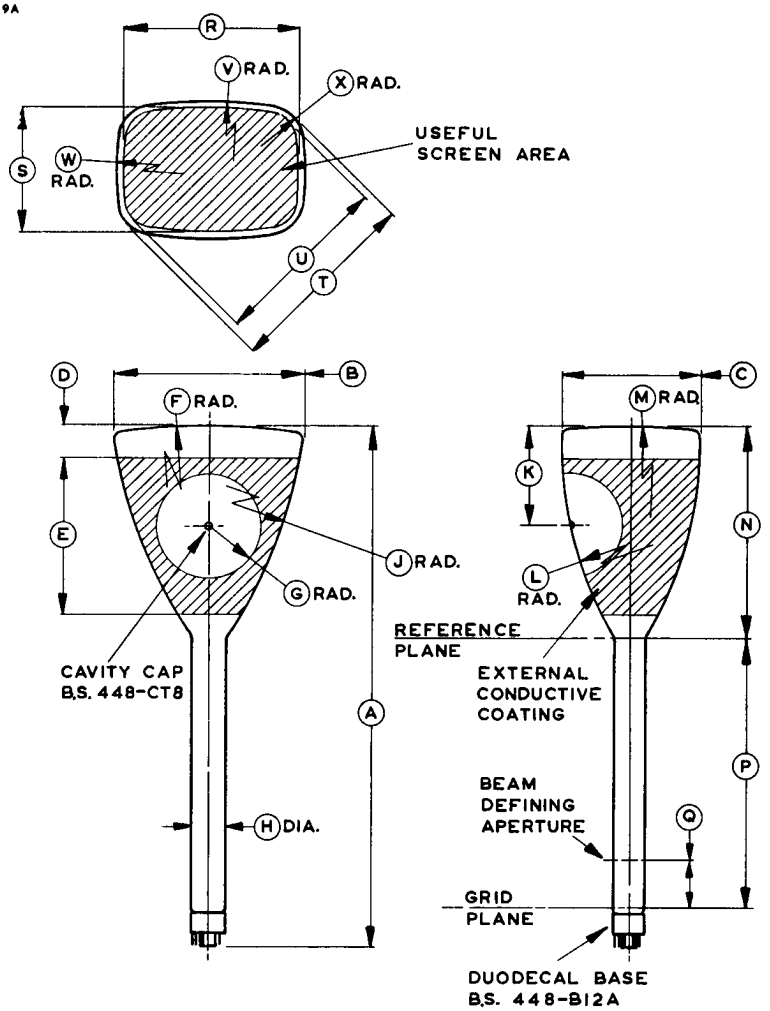
GRID VOLTAGE CUT-OFF LIMITS



ENGLISH ELECTRIC

OUTLINE

1119A



Note—A ring gauge 1·417 inches (36·0mm) diameter by 3·937 inches (100mm) long will pass over base and neck to reference plane.

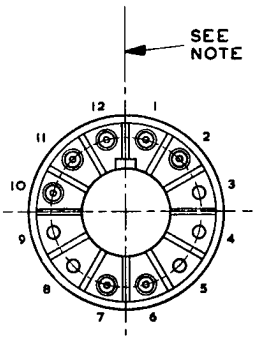
OUTLINE DIMENSIONS

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	21·970 ± 0·276	558·0 ± 7·0	M	27·00	686·0
B	7·874 ± 0·059	200·0 ± 1·5	N	8·661 ± 0·118	220·0 ± 3·0
C	6·063 ± 0·059	154·0 ± 1·5	P	11·22	285·0
D	1·299	33·0	Q	1·968 ± 0·197	50·0 ± 5·0
E	6·693	170·0	R	7·283	185·0
F	27·00	686·0	S	5·433	138·0
G	2·165	55·0	T	8·445	214·5
H	1·378 $^{+0·020}_{-0·039}$	35·0 $^{+0·5}_{-1·0}$	U	7·677	195·0
J	19·69	500·0	V	18·504	470·0
K	3·937 ± 0·197	100·0 ± 5·0	W	12·244	311·0
L	15·75	400·0	X	1·496	38·0

Inch dimensions have been derived from millimetres.

OUTLINE DETAIL

1198A



Pin	Element
1	Heater
2	Grid
3	No Pin
4	No Pin
5	No Pin
6	No Connection
7	No Connection
8	No Pin
9	No Pin
10	Anode 1
11	Cathode
12	Heater
Cavity Cap	Anode 2

Note—The anode cavity cap will be in line with the base key to within 10°.

INTRODUCTION

The T957Y and T957Z are 12-inch diameter Cathode Ray Tubes with electrostatic focus and magnetic deflection, designed for radar applications. They have spot sizes at least 40% smaller than those of T939Y and T939Z at the same beam currents, and are direct replacements for these types.

The fluorescent colour of the aluminised screen is orange with an orange afterglow; T957Y has an afterglow of long persistence and that of the T957Z is very long. See Note 1 for other screens.

The tubes give a display of adequate brightness from the short modulation pulses encountered in short range radars.

GENERAL DATA

Electrical and General

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 2)	6·3	V
Heater Current	0·3	A
Screen (*See Notes* 1 *and* 3)		Aluminised
Fluorescent Colour		Orange
Afterglow Colour		Orange
Afterglow Persistence:		
T957Y		Long
T957Z		Very Long
Deflection Method		Magnetic
Deflection Angle	50	Degrees
Focusing Method	Low Voltage Electrostatic	
Inter-electrode Capacitances:		
Grid to all other electrodes	8·0	pF Max
Cathode to all other electrodes	8·0	pF Max
Anode 2 + anode 4 to external conductive coating	1200	pF Approx

Mechanical

Overall Length	19·450 inches	(494 mm)	Max
Overall Diameter	12·087 inches	(307 mm)	Max
Neck Diameter	1·398 inches	(35·5 mm)	Max
Net Weight	12 pounds	(5·5 kg)	Approx
Base			B.S.448/B12A
Anode 2 and Anode 4 Connection			B.S.448/CT8 Cavity Cap
Mounting Position	Any, except vertical with the screen downwards and the axis of the tube making an angle of less than 20° with the vertical.		

Printed in England

MINIMUM AND MAXIMUM RATINGS

(Absolute Values. *See Note* 4)

	Min	*Max*	
Anode 2 and Anode 4 Voltage	8·0	18	kV
Anode 3 Voltage:			
Positive value	—	500	V
Negative value	—	500	V
Anode 1 Voltage	200	500	V
Grid Voltage (negative value)	1·0	200	V
Grid to Cathode Impedance (at 50c/s)	—	0·5	MΩ
Grid to Cathode Resistance	—	1·5	MΩ
Heater to Cathode Voltage:			
Heater positive with respect to cathode	—	150	V
Heater negative with respect to cathode	—	150	V
Heater to Cathode Resistance		*See Note* 5	

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	12	kV
Anode 3 Voltage (*See Note* 6)	−200 to +200	V
Anode 1 Voltage	300	V
Anode 3 Current	−15 to +15	μA
Grid Voltage for cut-off	−30 to −70	V

NOTES

1. The T957 is supplied with either an E.E.V. Y Screen with long persistence (T957Y) or an E.E.V. Z Screen with very long persistence (T957Z); the screens satisfy the requirements of E.V.S.008 and 009 Screen Specifications respectively. It can also be manufactured with other screens, and customers' enquiries are invited.
2. The heater is suitable for either series or parallel operation.
3. The fluoride screen is sensitive to burn and should not be operated with slow moving spots.
4. All voltages are with respect to the cathode.

Printed in England

5. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50c/s must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1·0MΩ.

6. An acceptable focus quality is obtained with an anode 3 voltage range of −200 to +200V. If it is required to pass through the point of focus a voltage range of at least −300 to +300V will be required.

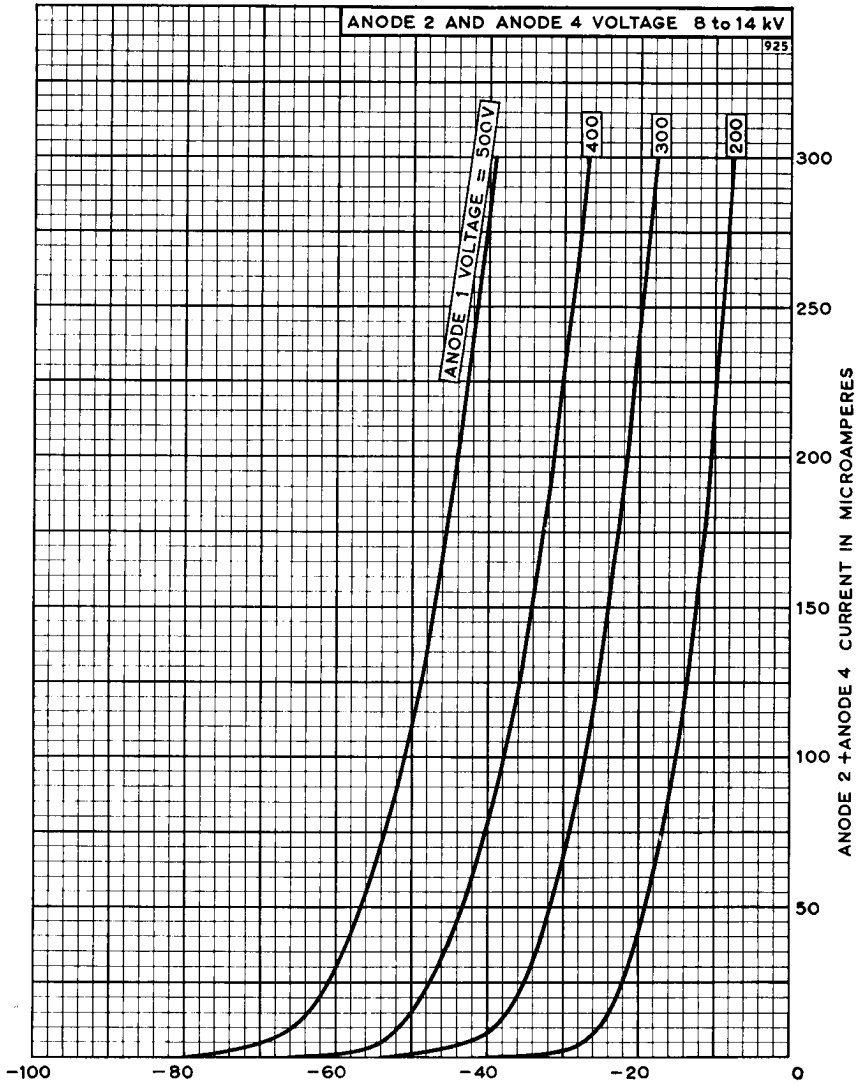
X-RAY WARNING

X-rays are produced when types T957Y and T957Z are operated with anode voltages above 16kV (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect on the design of the tube.

Printed in England

ENGLISH ELECTRIC

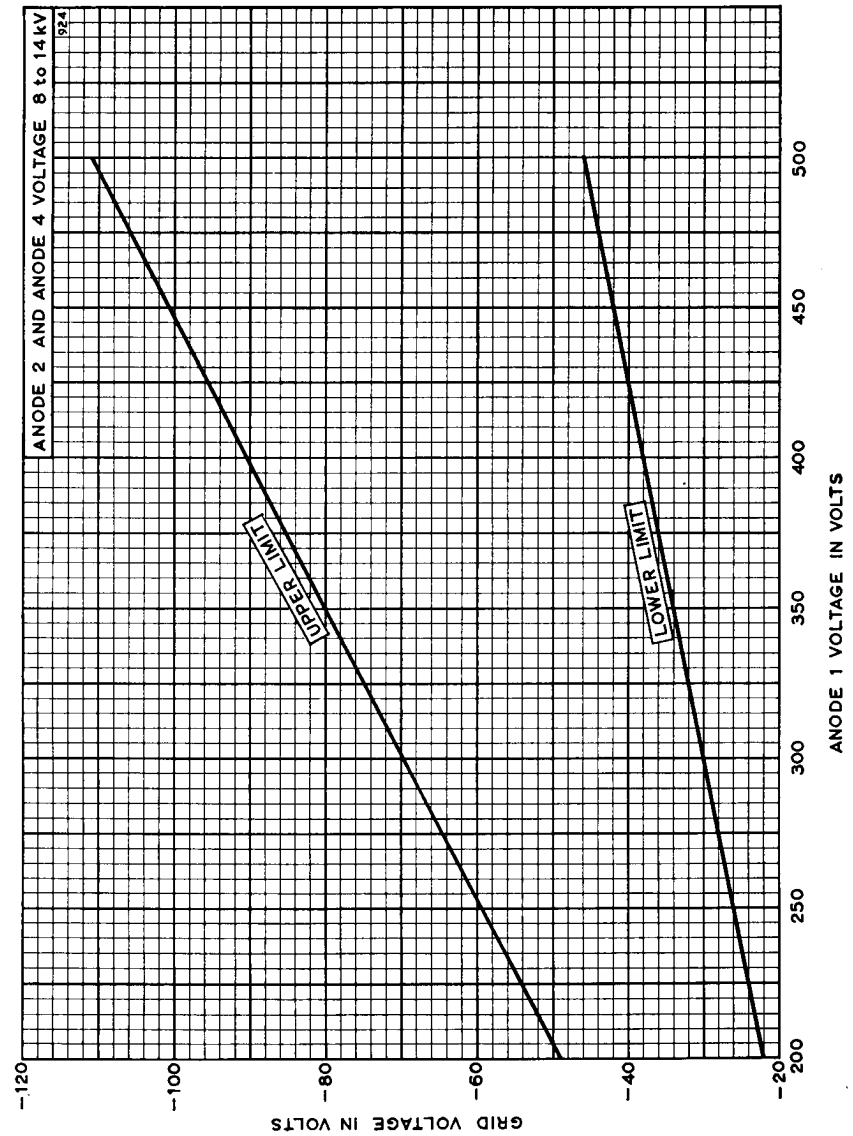
GRID VOLTAGE CHARACTERISTICS



Printed in England

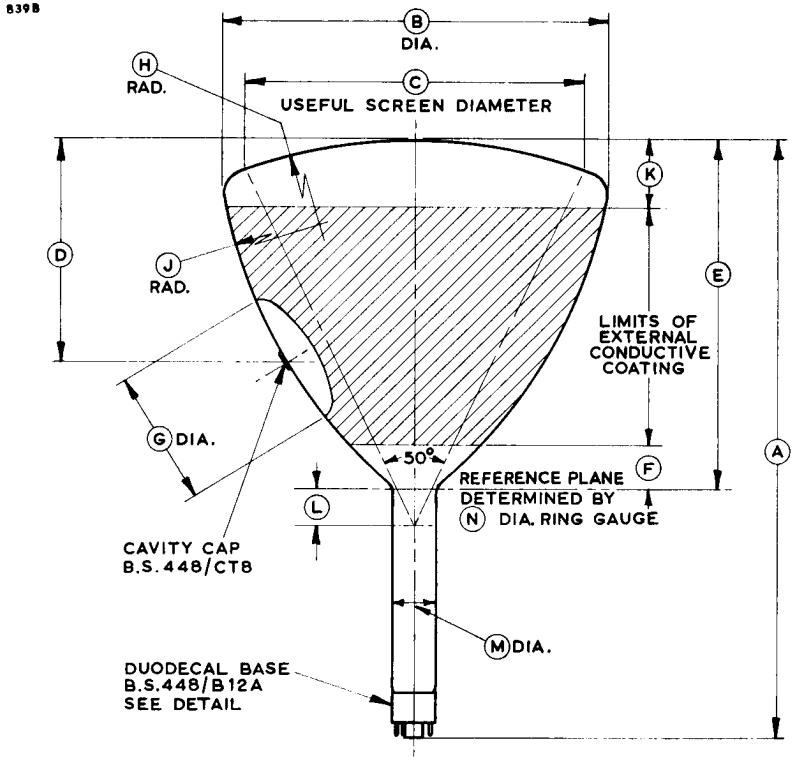
ENGLISH ELECTRIC

GRID CUT-OFF VOLTAGE LIMITS



ENGLISH ELECTRIC

OUTLINE

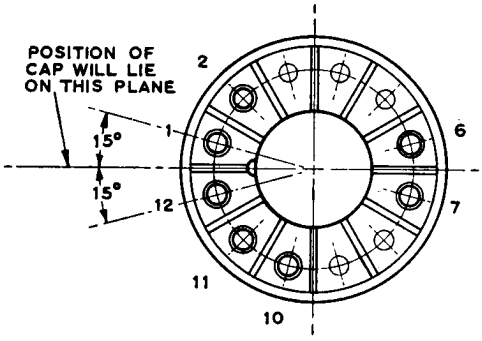


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	$19{\cdot}134^{+0{\cdot}315}_{-0{\cdot}275}$	$486{\cdot}0^{+8{\cdot}0}_{-7{\cdot}0}$	G	$4{\cdot}331 \pm 0{\cdot}394$	$110{\cdot}0 \pm 10{\cdot}0$
B	$12{\cdot}008^{+0{\cdot}079}_{-0{\cdot}098}$	$305{\cdot}0^{+2{\cdot}0}_{-2{\cdot}5}$	H	39·370	1000·0
C	10·433	265·0	J	16·772	426·0
D	$7{\cdot}087 \pm 0{\cdot}197$	$180{\cdot}0 \pm 5{\cdot}0$	K	1·968	50·0
E	$10{\cdot}709 \pm 0{\cdot}138$	$272{\cdot}0 \pm 3{\cdot}5$	L	1·260	32·0
F	1·417	36·0	M	1·339 to 1·398	34·0 to 35·5
			N	1·417	36·0

Inch dimensions have been derived from millimetres.

Printed in England

OUTLINE DETAILS



840

PIN	ELEMENT
1	HEATER
2	GRID
3	OMITTED
4	OMITTED
5	OMITTED
6	ANODE 3
7	INTERNAL CONNECTION
8	OMITTED
9	OMITTED
10	ANODE 1
11	CATHODE
12	HEATER
CAP	ANODE 2 & ANODE 4

Printed in England

RADAR TUBE

T958Z

ENGLISH ELECTRIC

ABRIDGED DATA

16-inch diameter radar tube.

Neck Diameter	1·378 inches (35mm)
Deflection Angle	50 Degrees
Deflection Method	Magnetic
Focus Method	Electrostatic
E.H.T. Voltage	12 kV

GENERAL

Electrical and General

Cathode	Indirectly Heated, Oxide Coated
Heater Voltage (*See Note* 1)	6·3 V
Heater Current	0·3 A
Screen (*See Notes* 2 *and* 3)	Aluminised
Fluorescent Colour	Orange
Persistence	Very Long
Inter-electrode Capacitances:	
Grid to all other electrodes	8·0 pF Max
Cathode to all other electrodes	8·0 pF Max
Anode 2+Anode 4 to external conductive coating	1200 pF Approx

Mechanical

Overall Length	24·02 inches (610 mm) Max
Overall Diameter	16·14 inches (410 mm) Max
Neck Diameter	1·398 inches (35·5 mm) Max
Net Weight	24 pounds (11 kg) Approx
Base	B.S.448–B12A
Anode 2 and Anode 4 Connection	B.S.448–CT8 Cavity Cap
Mounting Position	Any, except vertical with the screen downwards and the axis of the tube making an angle of less than 20° with the vertical.

MAXIMUM AND MINIMUM RATINGS

(Absolute Values. *See Note* 4)

	Min	*Max*	
Anode 2 and Anode 4 Voltage	8·0	18	kV
Anode 3 Voltage:			
Positive value	—	500	V
Negative value	—	500	V
Anode 1 Voltage	200	500	V
Grid Voltage (negative value)	1·0	200	V
Grid to Cathode Impedance (at 50Hz) ..	—	0·5	MΩ
Grid to Cathode Resistance	—	1·5	MΩ
Heater to Cathode Voltage:			
Heater positive with respect to cathode ..	—	150	V
Heater negative with respect to cathode ..	—	150	V
Heater to Cathode Resistance		*See Note* 5	

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	12	kV
Anode 3 Voltage (*See Note* 6)	−200 to +200	V
Anode 1 Voltage	300	V
Anode 3 Current	−15 to +15	μA
Grid Voltage for cut-off	−30 to −70	V

NOTES

1. The heater is suitable for either series or parallel operation.
2. The T958 is supplied with an EEV Z Screen which has very long persistence and satisfies the requirements of E.V.S. 009 screen specification. It can also be manufactured with other screens, and customers' enquiries are invited.
3. The fluoride screen is sensitive to burn and should not be operated with slow moving spots.

4. All voltages are with respect to the cathode.

5. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50Hz must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1·0MΩ.

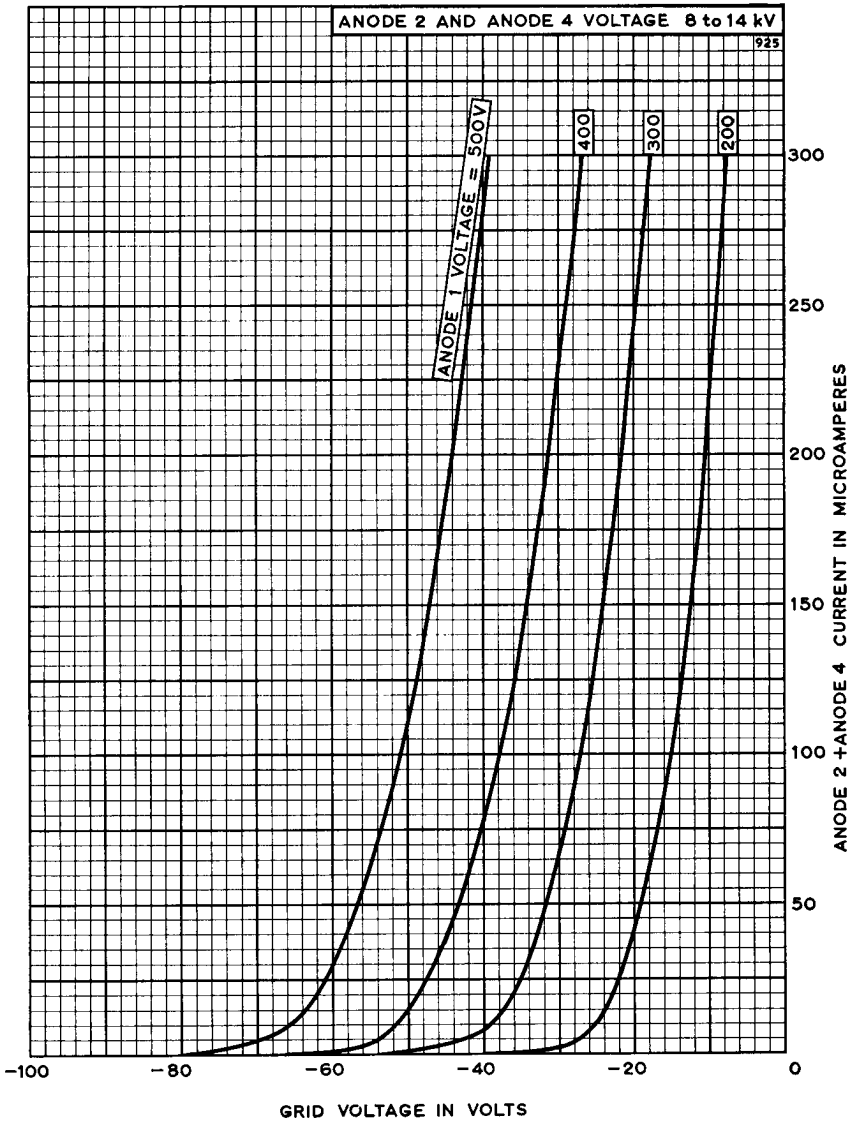
6. An acceptable focus quality is obtained with an anode 3 voltage range of −200 to +200V. If it is required to pass through the point of focus a voltage range of at least −300 to +300V will be required.

X-RAY WARNING

X-rays are produced when T958Z is operated with anode voltages above 16kV (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect on the design of the tube.

ENGLISH ELECTRIC

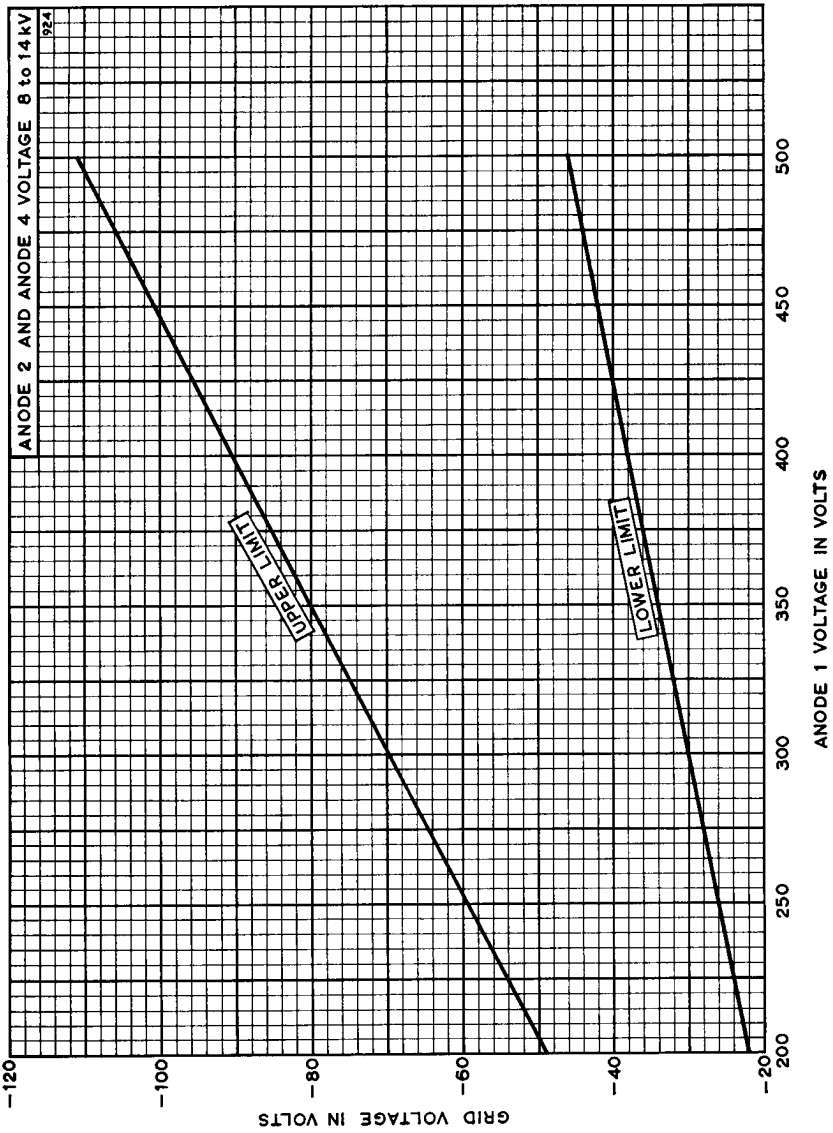
GRID VOLTAGE CHARACTERISTICS



Printed in England

ENGLISH ELECTRIC

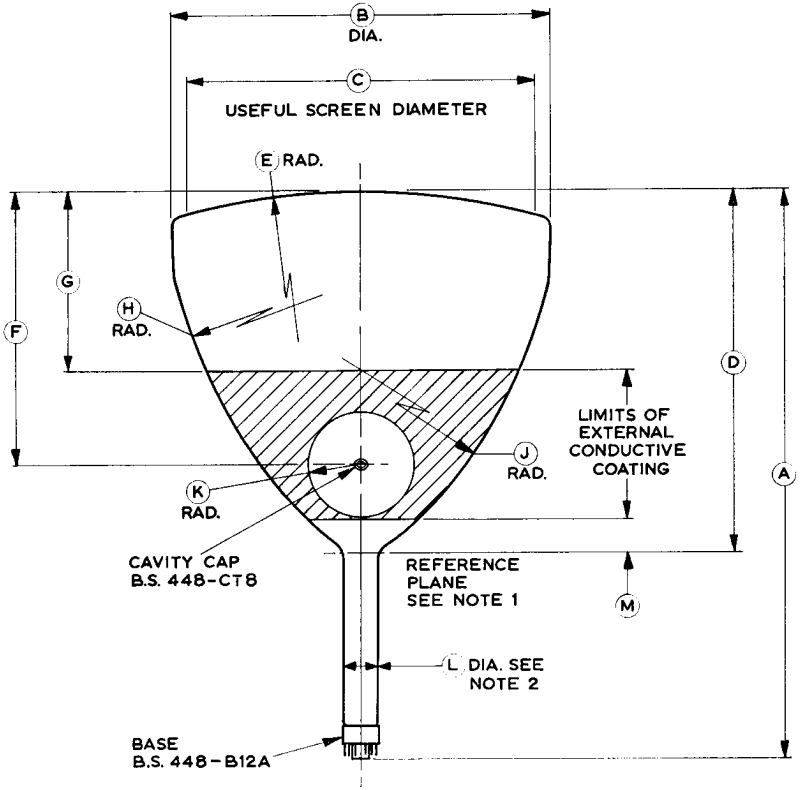
GRID CUT-OFF VOLTAGE LIMITS



Printed in England

OUTLINE

1135



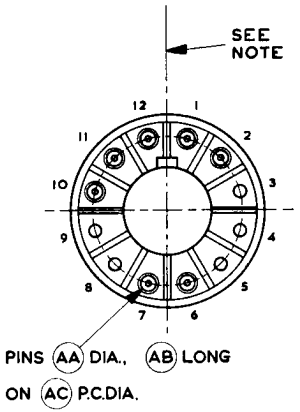
Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	23·622 ± 0·394	600 ± 10·0	H	23·504	597·0
B	15·984 ± 0·157	406·0 ± 4·0	J	16·732	425·0
C	14·685 Min	373·0 Min	K	2·165 ± 0·197	55·0 ± 5·0
D	14·961 ± 0·157	380·0 ± 4·0	L	1·378 $^{+0·020}_{-0·040}$	35·0 $^{+0·5}_{-1·0}$
E	27·560	700·0	M	1·417 ± 0·236	36·0 ± 6·0
F	11·417 ± 0·394	290·0 ± 10·0			
G	7·480 ± 0·394	190·0 ± 10·0			

Inch dimensions have been derived from millimetres.

ENGLISH ELECTRIC

OUTLINE DETAILS

11988



Pin	Element
1	Heater
2	Grid
3	No Pin
4	No Pin
5	No Pin
6	Anode 3
7	Internal Connection
8	No Pin
9	No Pin
10	Anode 1
11	Cathode
12	Heater
Cavity Cap	Anode 2 & Anode 4

Ref.	Inches	Millimetres
AA	0·098 ± 0·003	2·362 ± 0·076
AB	0·410 Max	10·41 Max
AC	1·063	27·00

Millimetre dimensions have been derived from inches.

Note The anode cavity cap will be in line with the base key to within 15°.

OUTLINE NOTES

1. Reference plane determined by 36·0mm diameter ring gauge.
2. A ring gauge 36·0mm diameter by 100mm long will pass over base and neck to reference plane.

MONITOR TUBE

T960W

ABRIDGED DATA

Television Camera Viewfinder or Picture Monitor tube with 7-inch diagonal flat faceplate and high light output screen.

Deflection Angle	65	Degrees
Deflection Method		Magnetic
Focus Method		Electrostatic
E.H.T. Voltage	14	kV

GENERAL

Electrical and General

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 1)	11·5	V
Heater Current	0·15 ± 10%	A
Faceplate	Flat, clear glass	
Screen	Aluminised	
Fluorescent Colour	White	
Persistence	Short	
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	10	pF
Cathode to all other electrodes, less than	8·0	pF
Final Anode to external conductive coating	350	pF Approx

Mechanical

Overall Length	9·291 inches	(236 mm)	Max
Faceplate Diagonal	6·929 inches	(176 mm)	Max
Neck Diameter	1·157 inches	(29·4 mm)	Max
Net Weight	2 pounds	(0·9 kg)	Approx
Base (*See Note* 2)			B8H
Final Anode Connection			B.S.448–CT8
Mounting Position			*See Note* 3

Printed in England

MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

(All voltages with respect to cathode)

	Min	*Max*	
Anode 2 and Anode 4 Voltage	10	16	kV
Anode 3 Voltage:			
positive value	—	800	V
negative value	—	500	V
Anode 1 Voltage	250	500	V
Anode 1 Supply Source Impedance	—	1·5	MΩ
Grid Voltage, negative value (*See Note* 4)	0	200	V
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50c/s)	—	0·5	MΩ
Cathode Current (Mean)	—	150	μA
Heater to Cathode Voltage (*See Note* 5)	—	200	V
Peak Heater to Cathode Voltage:			
Cathode positive (*See Note* 6)	—	400	V
Heater to Cathode Resistance			*See Note* 7

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	14	kV
Anode 3 Voltage (*See Note* 8)	0 to +400	V
Anode 3 Current	−15 to +15	μA
Anode 1 Voltage	400	V
Grid Voltage for cut-off	−30 to −80	V
Resolution		*See Note* 9

BEAM CENTRING

In order to obtain maximum brightness and the best focus spot size, stray magnetic fields must be minimised over the length of the gun structure. This may be achieved by using a tubular mumetal shield over the neck.

Where optimum performance is required, a small magnet should be used for centring the beam in the defining aperture. The magnet should be located in the region of the grid and its position and strength adjusted to give maximum brightness.

→Indicates a change

NOTES

1. The heater is suitable for series or parallel operation. In series operation the surge heater voltage must not exceed $16V_{r.m.s.}$ when the supply is switched on and a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.

2. The tube should not be supported by the base alone and under no circumstances should the socket be used for support purposes.

3. The tube may be mounted in any position except with the screen down and the axis of the tube making an angle of less than 20° with the vertical.

4. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the period immediately after switching the equipment on or off when it may be allowed to rise to +1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.

5. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than $20V_{r.m.s.}$

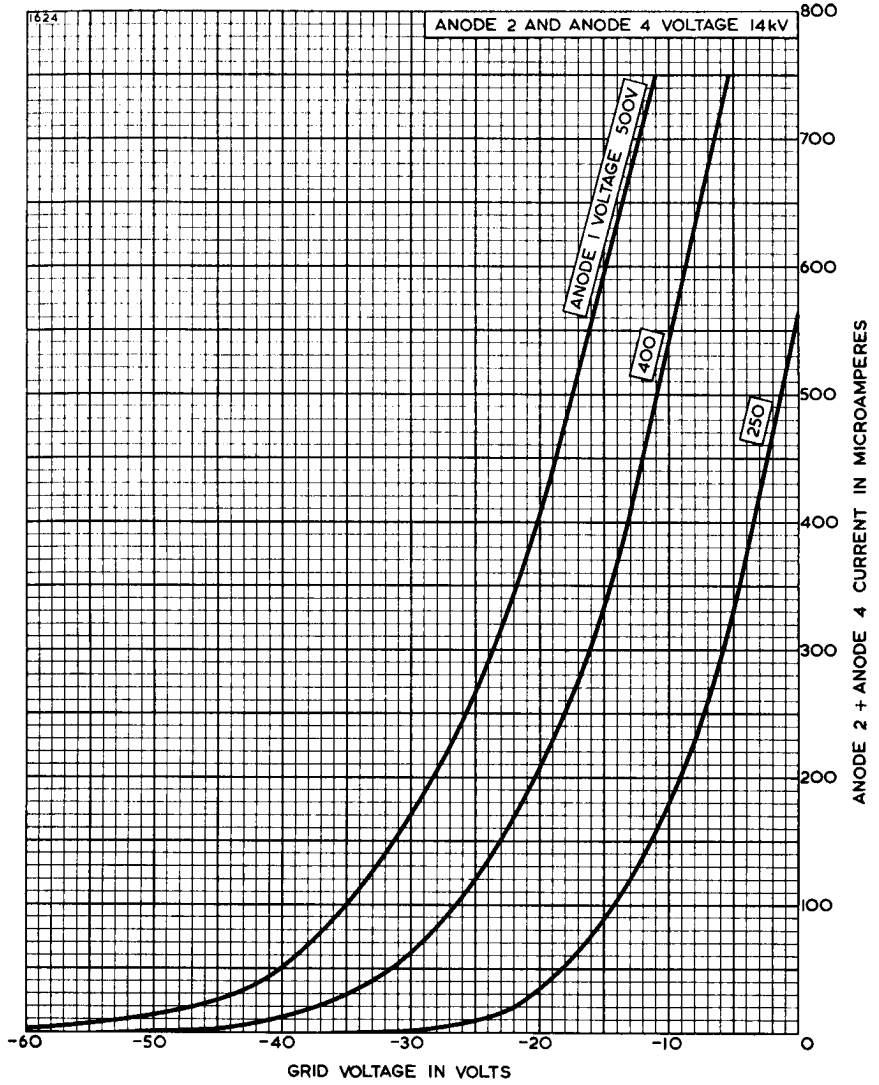
6. During a warming-up period not exceeding 45 seconds.

7. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50c/s must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.

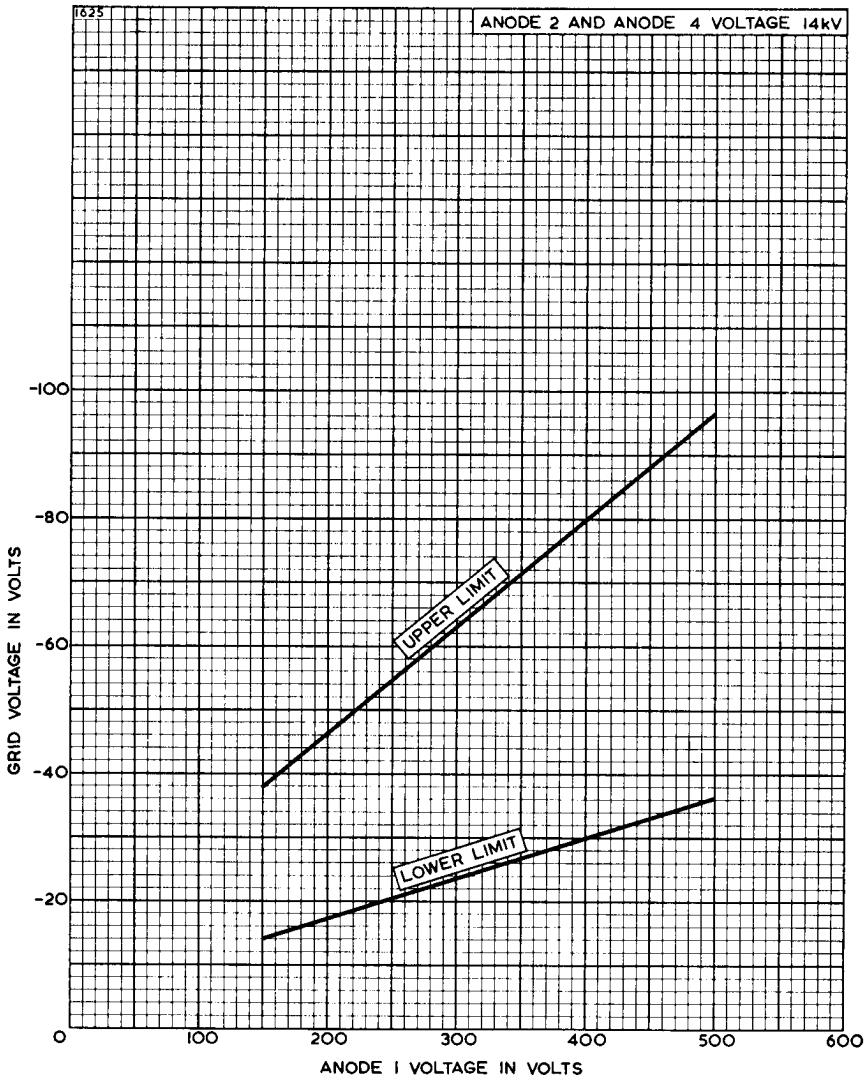
8. An acceptable focus quality will be obtained with an anode 3 voltage range of 0 to +400V. If it is required to pass through the point of focus a voltage range of at least −100 to +500V will be required.

9. The resolution at the centre of the screen (measured at an anode 2 and anode 4 voltage of 14kV and anode 1 voltage of 400V) is equal to or better than 625 lines. The tube will resolve a minimum of 625 lines based on a picture height of 99mm and measured at a brightness of 200ft-lamberts with the anode 3 voltage adjusted to give the smallest and roundest spot.

GRID VOLTAGE CHARACTERISTICS

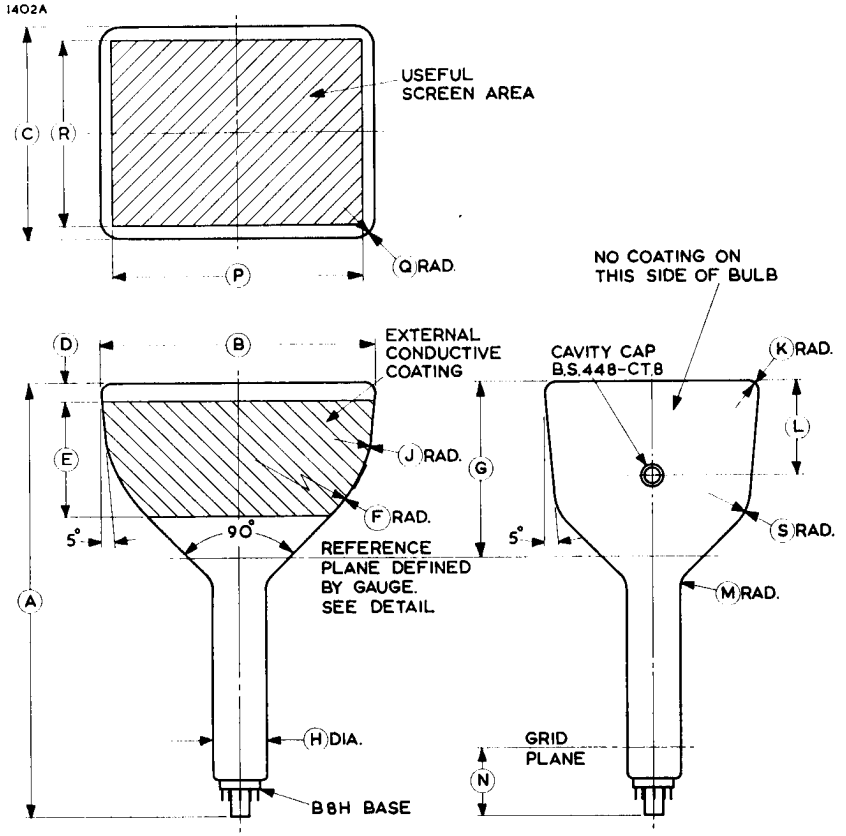


GRID CUT-OFF VOLTAGE LIMITS



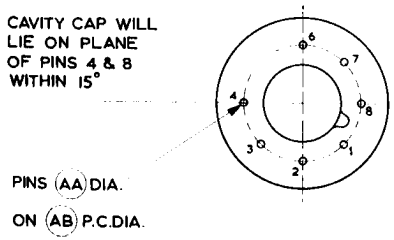
ENGLISH ELECTRIC

OUTLINE



OUTLINE DETAILS

1407



Pin	Connection
1	Heater
2	Internal Connection
3	Anode 1
4	Anode 3
5	No Pin
6	Grid
7	Cathode
8	Heater
Cap	Anode 2 & Anode 4

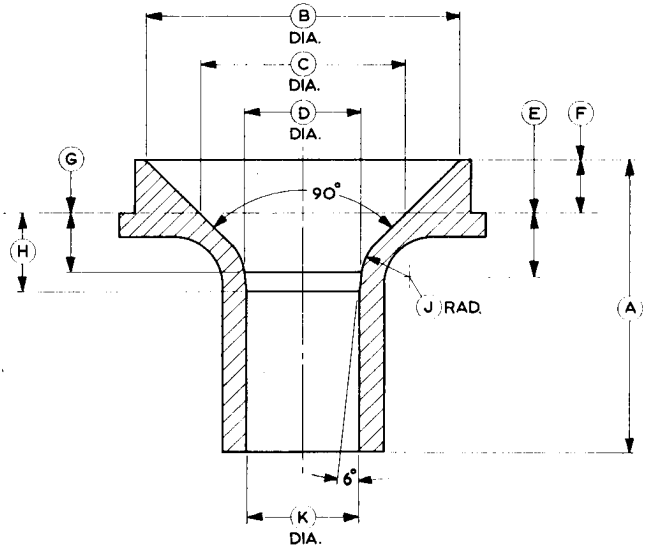
OUTLINE DIMENSIONS

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	9·055 ± 0·236	230·0 ± 6·0	L	1·969 ± 0·236	50·0 ± 6·0
B	5·709 ± 0·118	145·0 ± 3·0	M	0·394	10·0
C	4·409 ± 0·118	112·0 ± 3·0	N	1·417	36·0
D	0·394 ± 0·118	10·0 ± 3·0	P	5·197 Min	132·0 Min
E	2·402 ± 0·118	61·0 ± 3·0	Q	0·394	10·0
F	3·150	80·0	R	3·898 Min	99·0 Min
G	3·661 ± 0·157	93·0 ± 4·0	S	0·984	25·0
H	1·126 ± 0·031	28·6 ± 0·8	AA*	0·040	1·02
J	1·024	26·0	AB*	0·600	15·24
K	0·236	6·0			

Inch dimensions have been derived from millimetres except where indicated thus*.

REFERENCE LINE GAUGE

1406



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	3·063 ± 0·016	77·80 ± 0·40	G	0·613 ± 0·004	15·57 ± 0·10
B	3·248 ± 0·004	82·50 ± 0·10	H	0·815 ± 0·004	20·70 ± 0·10
C	2·122 ± 0·002	53·90 ± 0·05	J	0·500 ± 0·004	12·70 ± 0·10
D	1·211 ± 0·003	30·75 ± 0·07	K	$1{\cdot}168^{+0{\cdot}003}_{-0{\cdot}000}$	$29{\cdot}67^{+0{\cdot}07}_{-0{\cdot}00}$
E	0·665 ± 0·004	16·90 ± 0·10			
F	0·563 ± 0·004	14·30 ± 0·10			

Inch dimensions have been derived from millimetres.

Service Type CV6113 (T963D)

ABRIDGED DATA

12-inch diameter radar tubes for use with valve or transistor scan amplifiers. Two sets of scan coils may be fitted for alpha-numeric character display in processed radar and computer read-out systems. The T963D or Y will give flicker-free images at low repetition frequencies for computer read-out; T963Y is more suitable for very low repetition frequencies.

These tubes offer higher resolution and mechanical accuracy than the T953 series, which have a similar outline.

Neck Diameter	1·378 inches	(35 mm)
Deflection Angle	50	Degrees
Deflection Method		Magnetic
Focus Method (*See Note* 1)		Magnetic
E.H.T. Voltage	15	kV

GENERAL DATA

Electrical

Cathode	Indirectly Heated, Oxide Coated
Heater Voltage (*See Note* 2)	6·3 V
Heater Current	0·3 ± 10% A
Faceplate	Clear
Screen (*See Note* 3)	Aluminised
Inter-electrode Capacitances:	
Grid to all other electrodes, less than	12 pF
Cathode to all other electrodes, less than	12 pF

Mechanical

Overall Length	25·197 inches (640mm)	Max
Overall Diameter	12·087 inches (307mm)	Max
Useful Screen Diameter	9·843 inches (250mm)	Min
Maximum Neck Diameter	Determined by neck gauge page 9	
Net Weight	12 pounds (5·4kg) Approx	
Base	B.S.448–B12A	
Final Anode Connection	Cavity Cap B.S.448–CT8	
Mounting Position	*See Note* 4	

MAXIMUM AND MINIMUM RATINGS
(Absolute Values)
(All voltages with respect to cathode)

	Min	*Max*	
Anode 2 Voltage	9·0	15·5	kV
Anode 1 Voltage	250	600	V
Grid Voltage, negative value (*See Note* 5)	0	250	V
Heater to Cathode Voltage (*See Note* 6):			
Cathode negative	—	150	V
Cathode positive	—	200	V
Peak Heater to Cathode Voltage:			
Cathode positive (*See Note* 7)	—	410	V
Cathode Current (Mean)	—	150	μA
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50c/s)	—	0·5	MΩ
Heater to Cathode Resistance		*See Note* 8	

TYPICAL OPERATING CONDITIONS

Anode 2 Voltage	15	kV
Anode 1 Voltage	300	V
Focus Coil (*See Note* 1)	540	Ampere-turns
Grid Voltage for cut-off	−60 to −150	V
Grid Drive for 50μA beam current	20 to 40	V
Line Width (*See Note* 9)	0·2	mm
Astigmatism (*See Note* 10)	20	% Max

OPTIMUM BEAM FOCUSING

In order to obtain maximum brightness and minimum spot size, it is necessary to carry out the following procedure.

(*a*) Stray magnetic fields should be minimised in the region of the gun structure by fitting a tubular mumetal shield over the neck.

(*b*) The beam may be centred in the defining aperture by a small magnet, located in the region of the grid and adjusted to give maximum brightness.

(*c*) The magnetic axis of the focus coil should be aligned with the electron beam. This may be done either by adjusting the position of the focus coil (See Method 1), or by fitting additional deflection coils to adjust the position of the beam (See Method 2). In each case a.c. focusing (*See page* 3) may be used to identify the optimum alignment condition.

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Method 1

Adjustment of the focus coil position

The mounting of the focus coil should be such that the coil can be moved in any direction, i.e., vertically, horizontally and tilted about either the vertical or horizontal axis. An a.c. current is passed through the focus coil and the position of the coil is adjusted until the optimum alignment is reached. (*See A.C. Focusing note * below*).

Method 2

Electromagnetic deflection of the beam

Two sets of alignment coils are fitted on the tube neck, between the beam defining aperture and the focus coil (*See diagram, page* 8). Each set of coils is capable of deflecting the beam slightly in both X and Y directions. The currents in the alignment coils are adjusted to give correct alignment of the beam. (*See A.C. Focusing note * below*).

**A.C. Focusing*

An alternating current is passed through the focus coil such that the positive and negative excursions of the current each produce a focused spot. Provided there is no current through the main deflection coils, the picture on the tube faceplate will consist of a defocused area and two focused spots. The optimum focusing condition is obtained when the two focused spots coincide at the centre of the defocused spot.

NOTES

1. The focus coil should be positioned so that the focusing field is entirely on the screen side of the beam defining aperture. When using a focus coil having a short air gap, the centre of the air gap should be approximately 220mm from the reference plane.
2. The heater is suitable for series or parallel operation. In series operation the surge heater voltage must not exceed $9{\cdot}5V_{r.m.s.}$ when the supply is switched on and a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.
3. Tubes in the T963 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T963D	D*	E.V.S.007	Yellow-orange	Long
T963Y	Y*	P33	Orange	Long
T963Z	Z*	P26	Orange	Very Long

*This is a fluoride screen which is sensitive to burn and should not be operated with slow-moving spots.

The tube can be manufactured with alternative screens, and customers' enquiries are invited.

4. The tube may be mounted in any position except with the screen down and the axis of the tube making an angle of less than 20° with the vertical.

5. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the period immediately after switching the equipment on or off when it may be allowed to rise to + 1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.

6. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than $20V_{r.m.s.}$

7. During a warming-up period not exceeding 45 seconds.

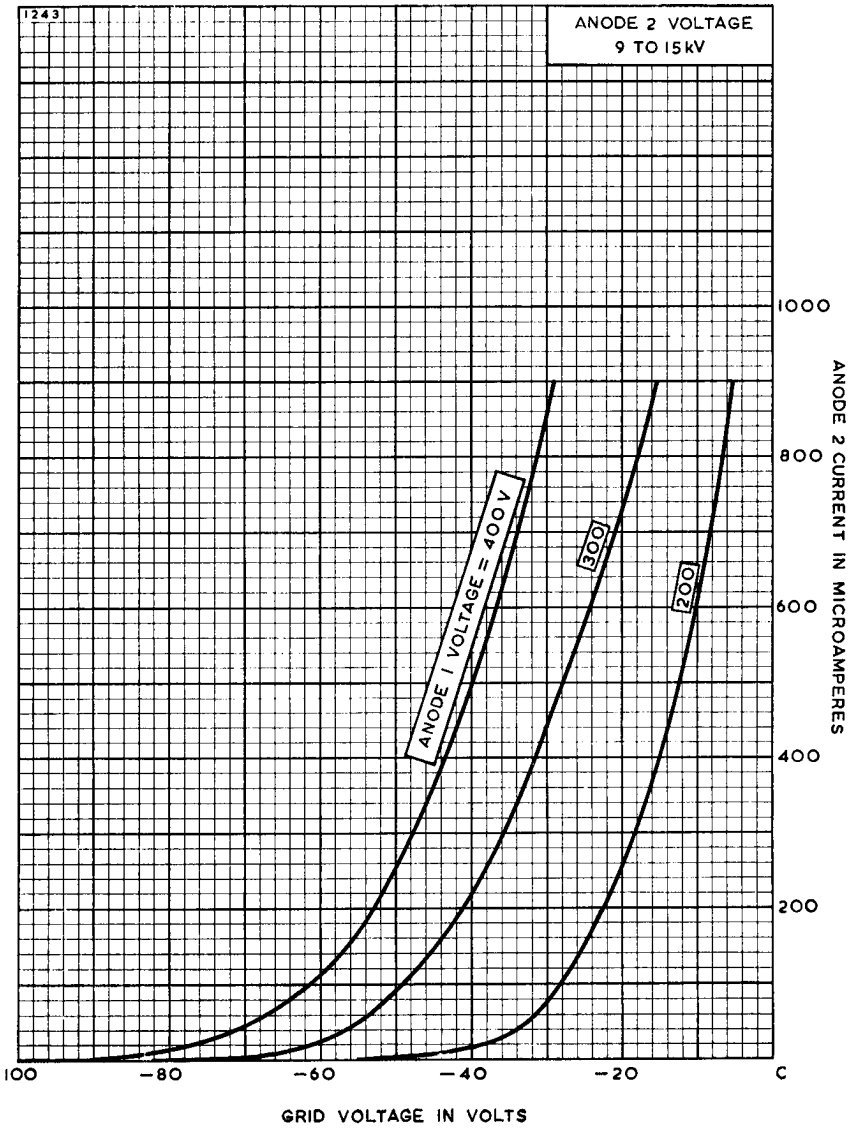
8. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50c/s must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.

9. Measured under the following conditions:
   Pulsed line 250mm long
   Pulse length 100μsec
   Pulse repetition rate 50p.p.s.
   Beam current 50μA (peak)
   Modulation pulses and deflection waveform synchronised
   Line width measured with a microscope as in K1001/5.A.5.7.2.2.

10. Measured under the following conditions:
    Undeflected, focused, pulsed spot
    Pulse length 0·1μsec
    Pulse repetition rate 50p.p.s.
    Beam current 50μA (peak).

ENGLISH ELECTRIC

GRID VOLTAGE CHARACTERISTICS



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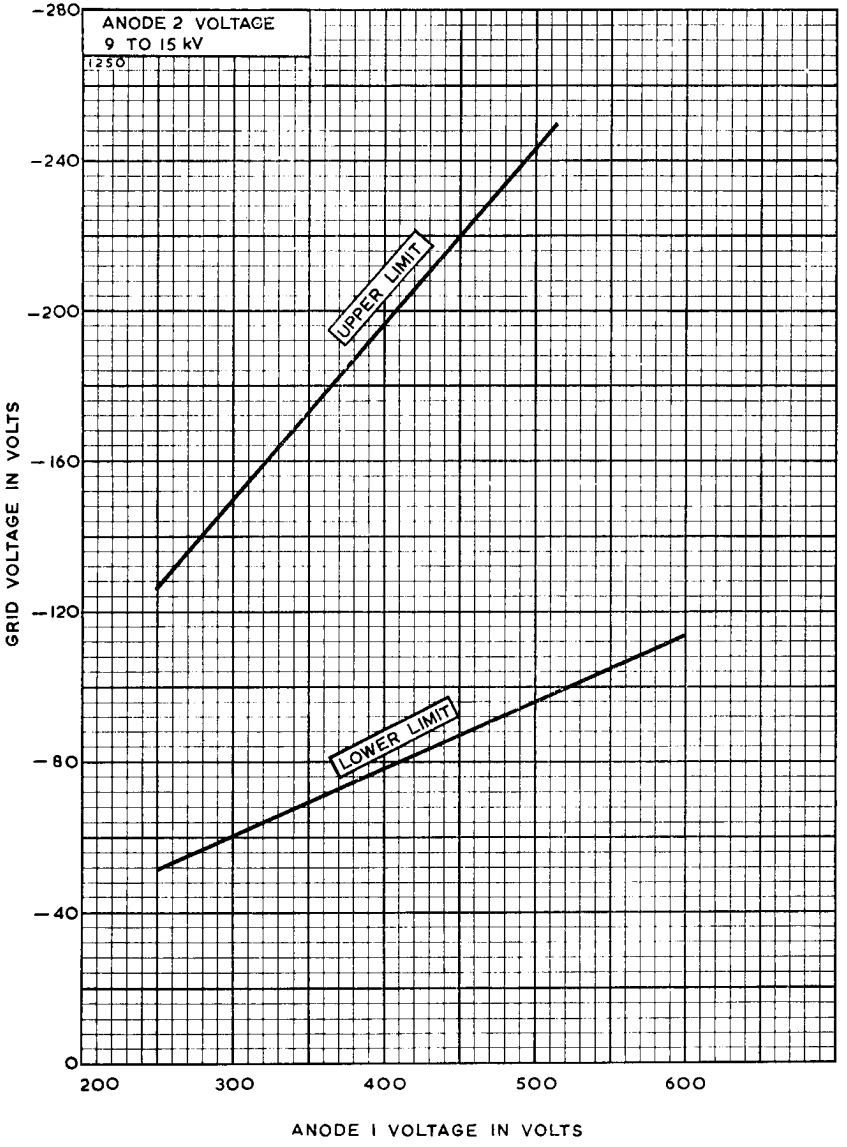
GRID VOLTAGE CUT-OFF LIMITS



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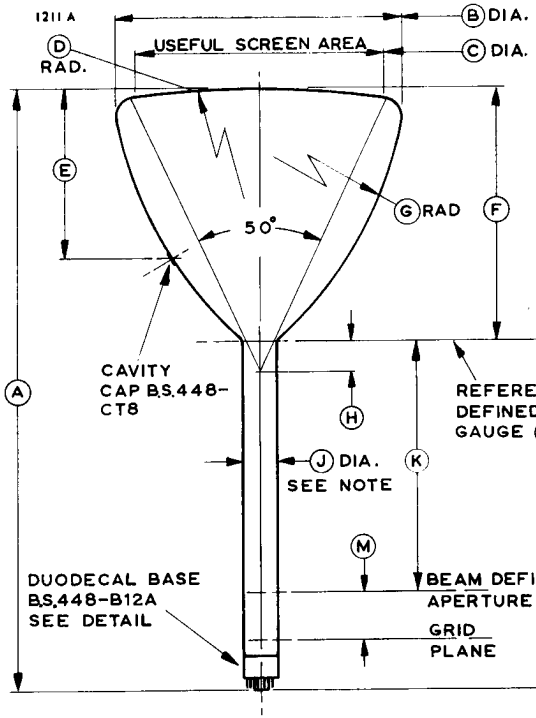
OUTLINE



Bulb Ring Gauges

Ring Gauge Diameter (mm)	Distance from centre of Tube Face (mm)
280	93 ± 10
230	150 ± 9
180	191 ± 8
130	222 ± 7
80	249 ± 6

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	25·000 ± 0·197	635·0 ± 5·0	H	1·260 Max	32·0 Max
B	12·008 ± 0·079	305·0 ± 2·0	J	1·378 $^{+0·020}_{-0·039}$	35·0 $^{+0·5}_{-1·0}$
C	9·843 Min	250·0 Min	K	10·787	274·0
D	39·370 ± 3·937	1000 ± 100	L	1·417	36·0
E	7·087 ± 0·197	180·0 ± 5·0	M	1·772	45·0
F	10·709 ± 0·138	272·0 ± 3·5	N	14·291	363
G	16·772	426·0			

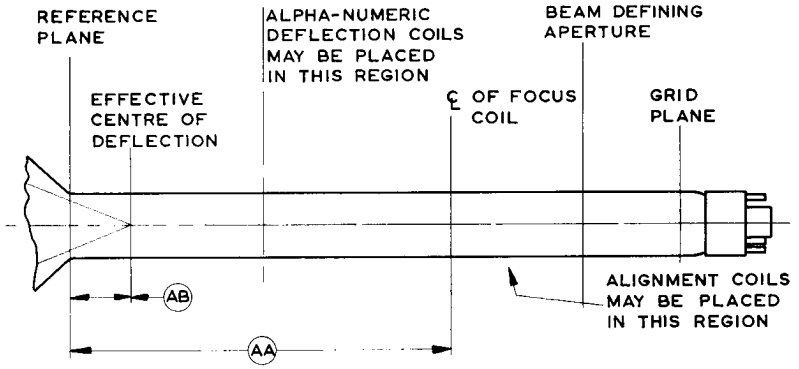
Inch dimensions have been derived from millimetres.

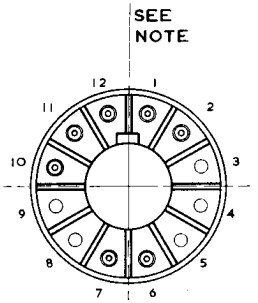
NOTE The mean axis of the neck will pass within 2mm from the geometric centre of the tube face and within 1° of a normal to a plane tangential to the geometric centre of the tube face. The tangential plane is determined by a 3 point spherometer gauge concentric with the tube face.

ENGLISH ELECTRIC

OUTLINE DETAILS

1203





Ref.	Inches	Millimetres
AA	8·661	220
AB	1·260 Max	32·0 Max

Inch dimensions have been derived from millimetres.

Note. The anode cavity cap will be in line with the base key to within 15°.

Pin	Element	Pin	Element
1	Heater	8	No Pin
2	Grid	9	No Pin
3	No Pin	10	Anode 1
4	No Pin	11	Cathode
5	No Pin	12	Heater
6	No Connection	Cavity	
7	No Connection	Cap	Anode 2

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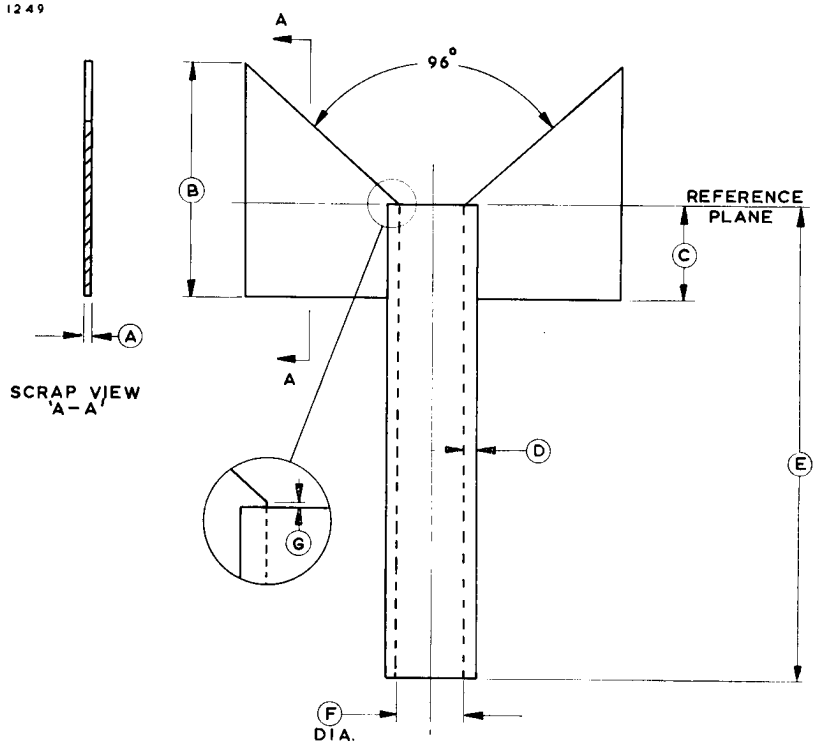
NECK GAUGE



The gauge shown above will pass freely over base and neck to the reference line, and when rotated through 360° the blades of the gauge will contact the flared neck at the reference line only.

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	0·125	3·18	E	9·843 ± 0·039	250·0 ± 1·0
B	4·921 ± 0·039	125·0 ± 1·0	F	1·417 $^{+0·003}_{-0·000}$	36·00 $^{+0·08}_{-0·00}$
C	1·969 ± 0·039	50·0 ± 1·0	G	0·C00 $^{+0·002}_{-0·000}$	0·00 $^{+0·05}_{-0·00}$
D	0·252 ± 0·012	6·4 ± 0·3			

Inch dimensions have been derived from millimetres except dimension A.

ABRIDGED DATA

8½-inch Diameter Radar Tubes intended primarily for marine radar P.P.I. displays. The narrow scan angle permits the use of valve or transistor scan amplifiers.

Neck Diameter	1·378 inches (35 mm)	
Deflection Angle	41	Degrees
Deflection Method		Magnetic
Focus Method		Electrostatic
E.H.T. Voltage	16	kV

GENERAL DATA

Electrical and General

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 1)	6·3	V
Heater Current	0·3 ± 10%	A
Screen (*See Note* 2)		Aluminised
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	8·0	pF
Cathode to all other electrodes, less than	8·0	pF
Anode 2 + Anode 4 to external conductive coating (*See Note* 3)	1000	pF

Mechanical

Overall Length	18·110 inches (460 mm)	Max
Overall Diameter	8·524 inches (216·5 mm)	Max
Useful Screen Diameter	7·756 inches (197 mm)	Min
Neck Diameter	1·400 inches (35·5 mm)	Max
Net Weight	5¾ pounds (2·6 kg)	Approx
Base (*See Note* 4)		B8H
Anode 2 and Anode 4 Connection	B.S.448-CT8 Cavity Cap	
Mounting Position (*See Note* 4)		Any

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MAXIMUM AND MINIMUM RATINGS

(Absolute Values. *See Note* 5)

	Min	*Max*	
Anode 2 and Anode 4 Voltage (*See Note* 6) ..	8·0	18	kV
Anode 3 Voltage:			
Positive value	—	1·0	kV
Negative value	—	0·5	kV
Anode 1 Voltage	0·2	0·8	kV
Grid Voltage (negative value)	1·0	200	V
Grid to Cathode Impedance (at 50c/s)	—	0·5	MΩ
Grid to Cathode Resistance	—	1·5	MΩ
Heater to Cathode Voltage:			
Heater positive with respect to cathode			
D.C.	—	150	V
Peak	—	250	V
Heater negative with respect to cathode			
D.C.	—	150	V
Peak	—	300	V
Heater to Cathode Resistance		*See Note* 7	

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	.. 12 to 16	kV
Anode 3 Voltage	.. 0 to 400	V
Anode 1 Voltage	.. 600	V
Anode 3 Current	−15 to +15	μA
Anode 1 Current (positive or negative)	.. 15	μA
Grid Voltage for visual cut-off	−32 to −48	V
Cathode Voltage for visual cut-off (*See Note* 8) ..	.. 30 to 45	V

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NOTES

1. The heater is suitable for either series or parallel operation. In series operation, the surge heater voltage when switching on must not exceed 9·5$V_{r.m.s.}$ and a current limiting device may be required in the circuit to reduce the surge voltage below this value.
2. Tubes in the T964 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T964Y	Y*	P33	Orange	Long
T964Z	Z*	P26	Orange	Very Long

The tube can be manufactured with alternative screens, and customers' enquiries are invited.

*This is fluoride screen which is sensitive to burn and should not be operated with slow moving spots.

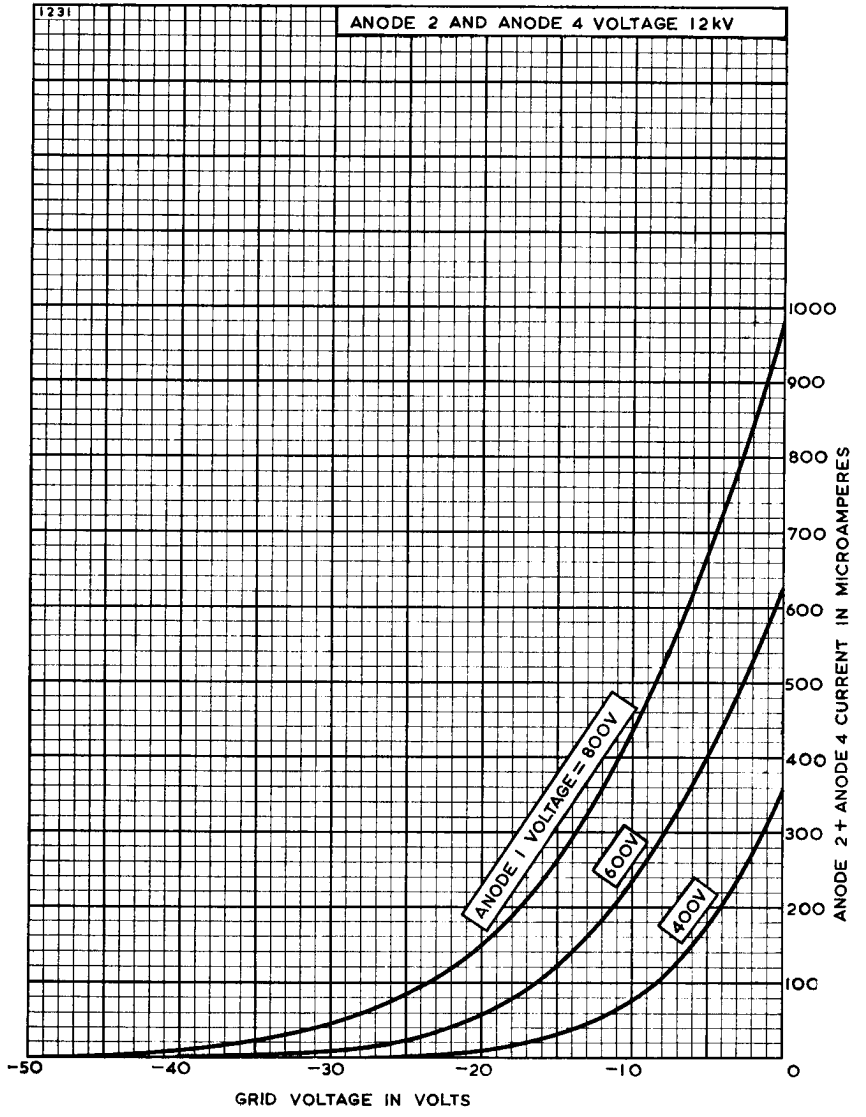
3. The capacitance of anode 2 and anode 4 to the external conductive coating may be used to provide smoothing for the e.h.t. supply.
4. The tube should not be supported by the base alone and under no circumstances should the socket be used for support purposes.
5. All voltages are with respect to cathode except where otherwise specified.
6. The associated equipment should be adequately protected against damage caused by possible high voltage flashovers inside the tube.
7. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50c/s must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.
8. For cathode modulation, all voltages are with respect to the grid.

X-RAY WARNING

X-rays are produced when the T964 is operated above 16kV (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect upon the design of the tube.

ENGLISH ELECTRIC

GRID VOLTAGE CHARACTERISTICS



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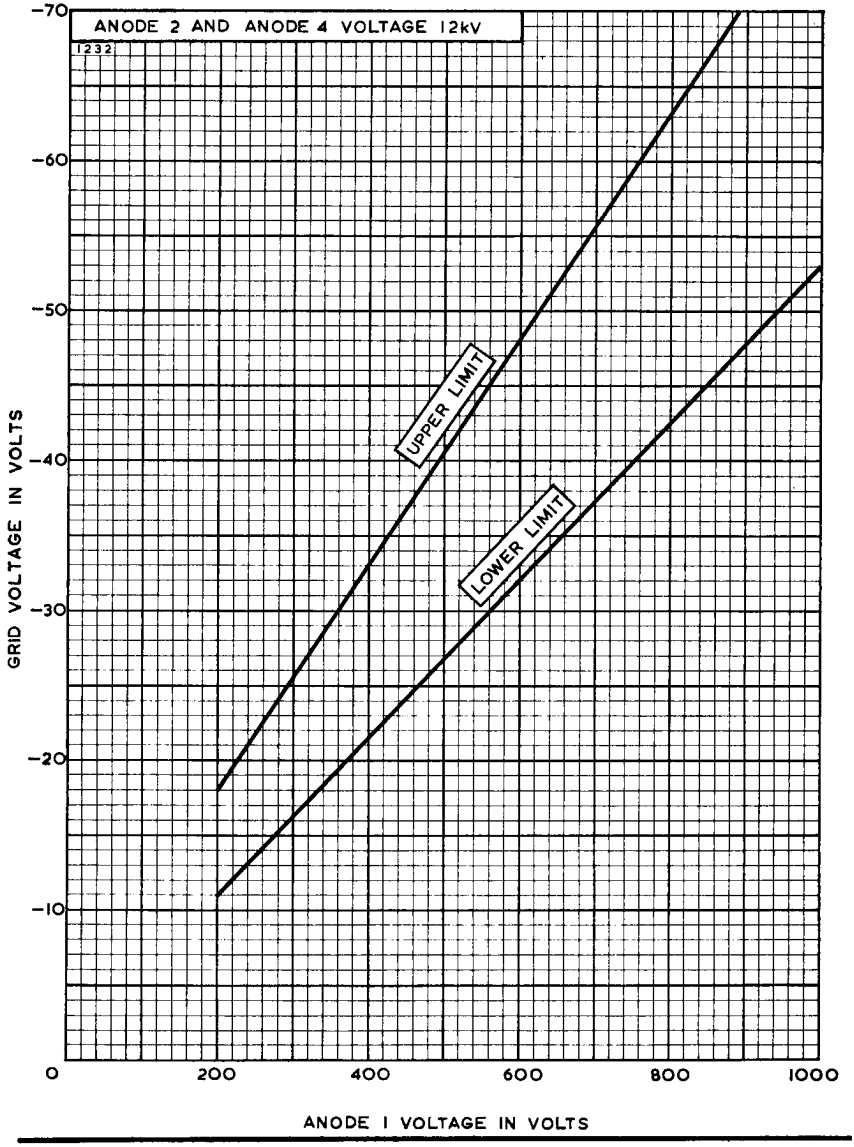
GRID CUT-OFF VOLTAGE LIMITS



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OUTLINE

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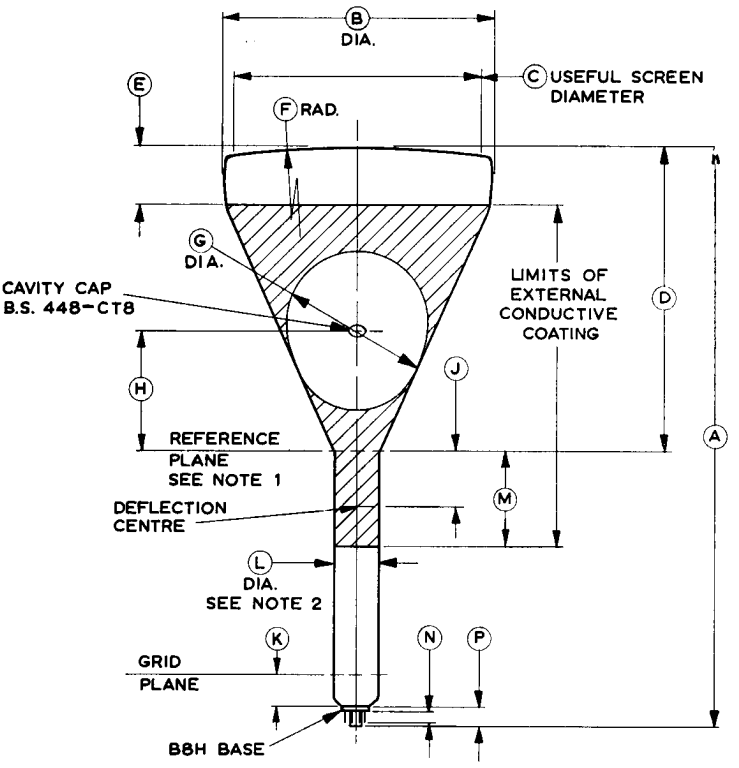

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	18·110 Max	460·0 Max	J	1·240 Max	31·5 Max
B	8·425 ± 0·098	214·0 ± 2·5	K	0·984	25·0
C	7·756 Min	197·0 Min	L	1·378 +0·020 −0·039	35·0 +0·5 −1·0
D	9·449 ± 0·157	240·0 ± 4·0	M	2·953 ± 0·197	75·0 ± 5·0
E	1·772 ± 0·197	45·0 ± 5·0	N	0·333 Max	8·46 Max
F	33·460	850·0	P	0·630	16·0
G	4·331 ± 0·394	110·0 ± 10·0			
H	3·780 ± 0·157	96·0 ± 4·0			

Inch dimensions have been derived from millimetres.

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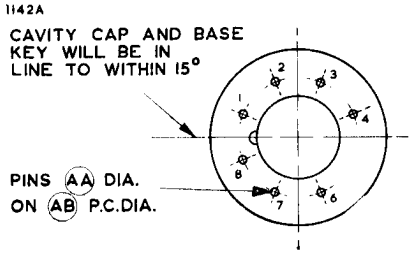

Ref.	Inches	Millimetres
AA	0·040	1·02
AB	0·600	15·24

Millimetre dimensions have been derived from inches.

Pin	Element
1	Heater
2	Internal Connection
3	Anode 1
4	Anode 3
5	No Pin
6	Grid
7	Cathode
8	Heater
Cavity Cap	Anode 2 and Anode 4

OUTLINE NOTES

1. The Reference Plane is determined by the position where 36·0mm internal diameter ring gauge rests.
2. A ring gauge 36·0mm internal diameter × 100·0mm long will pass over the neck and base to the reference plane.

ABRIDGED DATA

12-inch Diameter Radar Tubes intended primarily for marine radar P.P.I. displays. The narrow scan angle permits the use of valve or transistor scan amplifiers.

Neck Diameter	1·378 inches (35mm)
Deflection Angle	40 Degrees
Deflection Method	Magnetic
Focus Method	Electrostatic
E.H.T. Voltage	16 kV

GENERAL

Electrical and General

Cathode	Indirectly Heated, Oxide Coated
Heater Voltage (*See Note* 1)	6·3 V
Heater Current	0·3±10% A
Screen (*See Note* 2)	Aluminised
Inter-electrode Capacitances:	
Grid to all other electrodes, less than	8·0 pF
Cathode to all other electrodes, less than	8·0 pF
Anode 2 and Anode 4 to external conductive coating (*See Note* 3)	1500 pF

Mechanical

Overall Length	22·560 inches (573 mm) Max
Overall Diameter	12·090 inches (307 mm) Max
Useful Screen Diameter	10·430 inches (265 mm) Min
Neck Diameter	1·400 inches (35·5 mm) Max
Net Weight	13½ pounds (6·2 kg) Approx
Base (*See Note* 4)	B8H
Anode 2 and Anode 4 Connection	B.S.448–CT8 Cavity Cap
Mounting Position (*See Note* 4)	Any

MAXIMUM AND MINIMUM RATINGS

(Absolute Values. *See Note* 5)

	Min	*Max*	
Anode 2 and Anode 4 Voltage (*See Note* 6) ..	8·0	17	kV
Anode 3 Voltage:			
Positive value	—	1·0	kV
Negative value	—	0·5	kV
Anode 1 Voltage	0·2	0·8	kV
Grid Voltage (negative value)	1·0	200	V
Grid to Cathode Impedance (at 50Hz) ..	—	0·5	MΩ
Grid to Cathode Resistance	—	1·5	MΩ
Heater to Cathode Voltage:			
Heater positive with respect to cathode			
D.C.	—	150	V
Peak	—	250	V
Heater negative with respect to cathode			
D.C.	—	150	V
Peak	—	300	V
Heater to Cathode Resistance		.. *See Note* 7	

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	12 to 16	kV
Anode 3 Voltage	.. −75 to +325	V
Anode 3 Current (positive or negative)	15	μA
Anode 1 Voltage	550	V
Anode 1 Current (positive or negative)	15	μA
Grid Voltage for visual cut-off	−38 to −62	V
Cathode Voltage for visual cut-off (*See Note* 8) ..	36 to 58	V

NOTES

1. The heater is suitable for either series or parallel operation. In series operation, the surge heater voltage when switching on must not exceed $9{\cdot}5V_{r.m.s.}$ and a current limiting device may be required in the circuit to reduce the surge voltage below this value.

2. Tubes in the T965 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T965Y	Y*	P33	Orange	Long
T965Z	Z*	P26	Orange	Very Long

The tube can be manufactured with alternative screens, and customers' enquiries are invited.

*This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots.

3. The capacitance of anode 2 and anode 4 to the external conductive coating may be used to provide smoothing for the e.h.t. supply.
4. The tube should not be supported by the base alone and under no circumstances should the socket be used for support purposes.
5. All voltages are with respect to cathode except where otherwise specified.
6. The associated equipment should be adequately protected against damage caused by possible high voltage flashovers inside the tube.
7. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50Hz must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1·0MΩ.
8. For cathode modulation, all voltages are with respect to the grid.

X-RAY WARNING

X-rays are produced when the T965 is operated above 16kV (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect upon the design of the tube.

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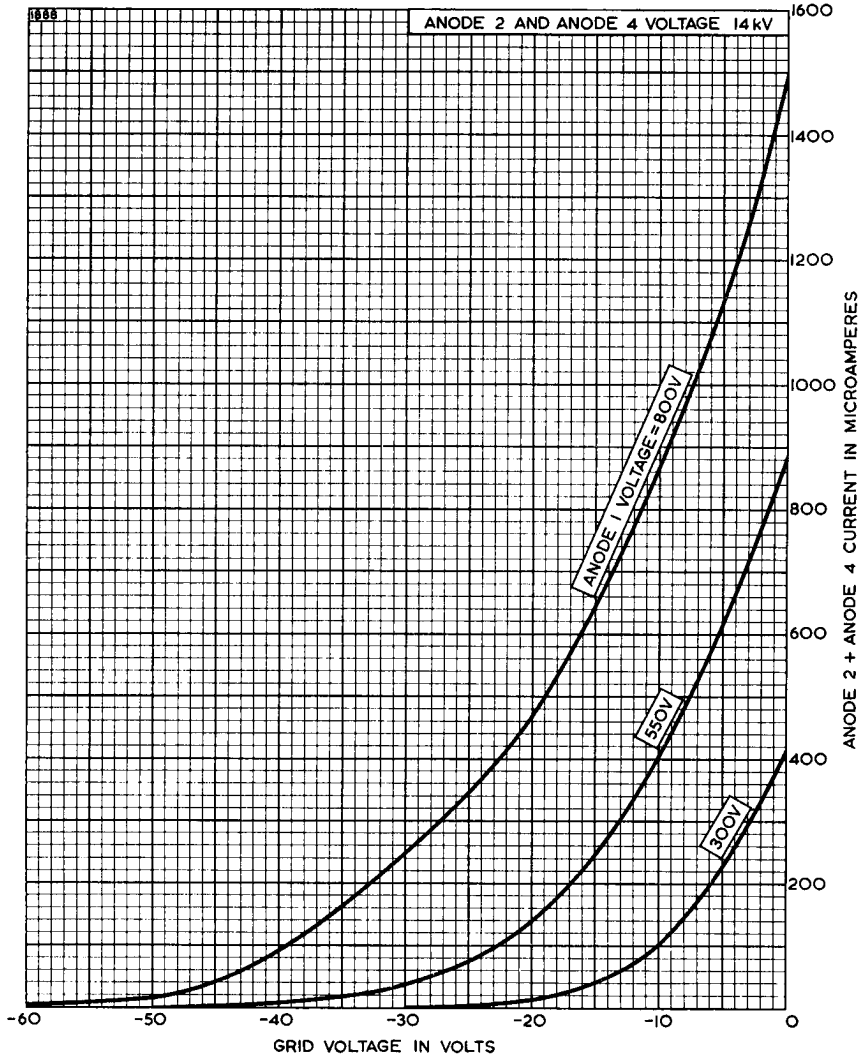
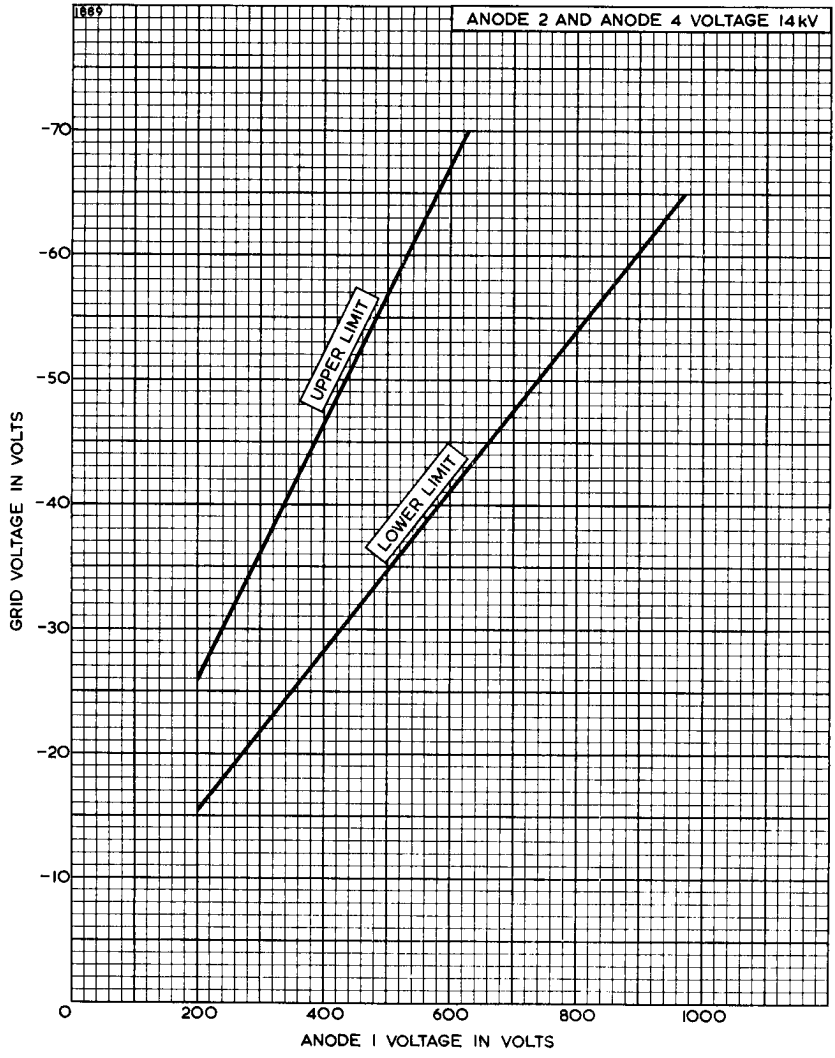
GRID VOLTAGE CHARACTERISTICS



ENGLISH ELECTRIC

GRID CUT-OFF VOLTAGE LIMITS



ENGLISH ELECTRIC

OUTLINE

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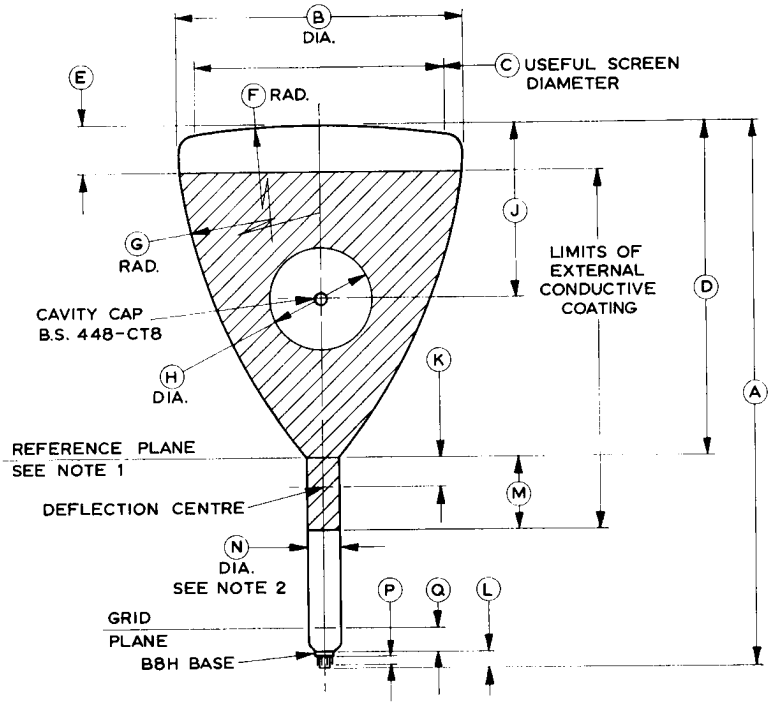

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	22·560 Max	573·0 Max	J	7·244 ± 0·118	184·0 ± 3·0
B	12·010 $^{+0·080}_{-0·100}$	305·0 $^{+2·0}_{-2·5}$	K	1·240 Max	31·5 Max
C	10·430 Min	265·0 Min	L	0·630	16·0
D	13·900 ± 0·180	353·0 ± 4·5	M	3·543 ± 0·197	90·0 ± 5·0
E	1·969	50·0	N	1·378 $^{+0·020}_{-0·039}$	35·0 $^{+0·5}_{-1·0}$
F	39·370	1000	P	0·333 Max	8·46 Max
G	23·620	600·0	Q	0·984	25·0
H	4·331 ± 0·394	110·0 ± 10·0			

Inch dimensions have been derived from millimetres.

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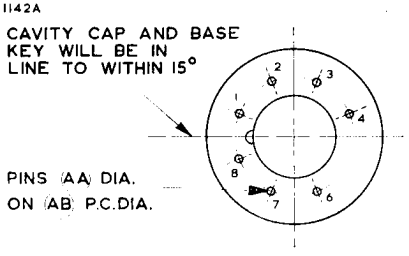
OUTLINE DETAILS



Ref.	Inches	Millimetres
AA	0·040	1·02
AB	0·600	15·24

Millimetre dimensions have been derived from inches.

Pin	Element
1	Heater
2	Internal Connection
3	Anode 1
4	Anode 3
5	No Pin
6	Grid
7	Cathode
8	Heater
Cavity Cap	Anode 2 and Anode 4

OUTLINE NOTES

1. The Reference Plane is determined by the position where 36·0mm internal diameter ring gauge rests.
2. A ring gauge 36·0mm internal diameter × 100·0mm long will pass over the neck and base to the reference plane.

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ABRIDGED DATA

7-inch diameter tubes with triode guns and optical quality flat faceplates. Designed for use in flying spot scanner applications.

Neck Diameter	1·378 inches	(35 mm)
Deflection Angle (to scan nominal diameter of 165mm)	42	Degrees
Deflection Method		Magnetic
Focus Method (*See Note* 1)		Magnetic
E.H.T. Voltage	25	kV

GENERAL

Electrical and General

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	4·0	V
Heater Current	550±10%	mA
Faceplate		Clear
Screen (*See Note* 2)		Aluminised
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	9·0	pF
Cathode to all other electrodes, less than	9·0	pF
Final Anode to external conductive coating	1500	pF Approx

Mechanical

Overall Length	21·339 inches	(542 mm)	Max
Overall Diameter	7·441 inches	(189 mm)	Max
Normality of Faceplate to Neck Axis			90°±30′
Faceplate Thickness	0·354±0·039 inch	(9·0±1·0mm)	
Nominal Screen Diameter	6·496 inches	(165mm)	
Useful Screen Areas			*See Note* 3
Neck Diameter	1·398 inches	(35·5 mm)	Max
Net Weight	4·5 pounds	(2·1 kg)	Approx
Base			B.S.448–B8O
Final Anode Connection			B.S.448–CT8
Mounting Position			*See Note* 4

Cooling

The faceplate may require forced-air cooling when the tube is used at high ratings.

MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

(All voltages with respect to cathode)

	Min	*Max*	
Anode 1 Voltage	20	35	kV
Grid Voltage, negative value (*See Note* 5)	—	250	V
Heater to Cathode Voltage (*See Note* 6):			
Cathode negative	—	150	V
Cathode positive	—	200	V
Peak Heater to Cathode Voltage:			
Cathode positive (*See Note* 7)	—	410	V
Cathode Current (Mean) (*See Note* 8)	—	330	μA
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50c/s)	—	0·5	MΩ
Heater to Cathode Resistance		*See Note* 9	

TYPICAL OPERATING CONDITIONS

Anode Voltage	25	kV
Spark Trap and External Conductive Coating (*See Note* 10)	Earth Potential	
Grid Voltage for cut-off	−75 to −125	V
Grid Drive for 100μA beam current	25 to 41	V
Focus Power	*See Note* 11	
Line Width (*See Note* 12):		
by shrinking raster method	0·14	mm
by measuring microscope method	0·17	mm

OPTIMUM BEAM FOCUSING

In order to obtain minimum spot size, the magnetic axis of the focus coil should be aligned with the electron beam. This may be done either by adjusting the position of the focus coil (*See Method* 1), or by fitting additional deflection coils to adjust the position of the beam (*See Method* 2). In each case a.c. focusing (*See page* 3) may be used to identify the optimum alignment condition.

Method 1

Adjustment of the focus coil position

The mounting of the focus coil should be such that the coil can be moved in any direction, i.e. vertically, horizontally and tilted about either the vertical or horizontal axis. An a.c. current is passed through the focus coil and the position of the coil is adjusted until the optimum alignment is reached. (*See* * *A.C. Focusing.*)

Printed in England

Method 2

Electromagnetic deflection of the beam

Two sets of alignment coils are fitted on the tube neck, between the cathode and the focus coil. Each set of coils is capable of deflecting the beam slightly in both X and Y directions. The currents in the alignment coils are adjusted to give correct alignment of the beam. (*See* * *A.C. Focusing.*)

**A.C. Focusing*

An alternating current is passed through the focus coil such that the positive and negative excursions of the current each produce a focused spot. Provided there is no current through the main deflection coils, the picture on the tube faceplate will consist of a defocused area and two focused spots. The optimum focusing condition is obtained when the two focused spots coincide at the centre of the defocused spot.

Change of Screen Characteristics During Life

During the first 5 hours of operation the afterglow persistence decreases and this is accompanied by a decrease in light output due to the phosphor ageing. The raster should be overscanned during initial setting up and ageing, to avoid a variation in light output across the final raster.

X-RAY WARNING

X-Rays are produced when tubes in the T966 series are operated with anode voltages above 16kV (absolute value). These rays can constitute a health hazard unless the tubes are adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect on the design of the tubes.

NOTES

1. The centre of the air gap of the focus coil should be approximately 110mm from the reference plane.
2. Tubes in the T966 series have screens with the following characteristics

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T966A	A	P24	Green	1μsec to 10% approx.
T966C	C	P16	Bluish-purple	0·1μsec to 10% approx.

Printed in England

3. The useful screen area is defined by the optical quality requirements of the screen; several sizes are available as follows:

Raster Size	Orientation	Scanning Standard	Code
102×76mm	0±15°	405 625	4/4 4/6
94×70mm	0±15°	405 625	5/4 5/6
105×40mm	45±15°	405 625	6/4 6/6

The orientation of the raster is referred to a plane containing the anode contact and the tube axis. It is defined by the angle between this plane and the plane containing the mid points of the longer sides of the raster and the tube axis. This angle is measured in an anti-clockwise direction from the plane of the anode contact, viewed from the screen end.

Other quality areas can be supplied to special order.

The code reference is added to the tube type number in order to identify a particular variant, e.g. T966A–6/4.

4. The tube may be mounted in any position except with the screen down and the axis of the tube making an angle of less than 50° with the vertical.

5. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the period immediately after switching the equipment on or off when it may be allowed to rise to +1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.

6. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than $20V_{r.m.s.}$ The heater should preferably be connected to the cathode.

7. During a warming-up period not exceeding 45 seconds.

8. Means must be provided for the instantaneous removal of beam current in the event of a failure of either or both time bases. Unless such a safety device is incorporated, a failure of this type will result in the immediate destruction of the screen of the tube.

9. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50c/s must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.

Printed in England

10. The spark trap and external conductive coating should be connected by a low impedance path to the h.t. supply return. The purpose of this is to isolate from the grid and its associated circuits any occasional, non-destructive discharges which sometimes occur when starting after prolonged shutdown.

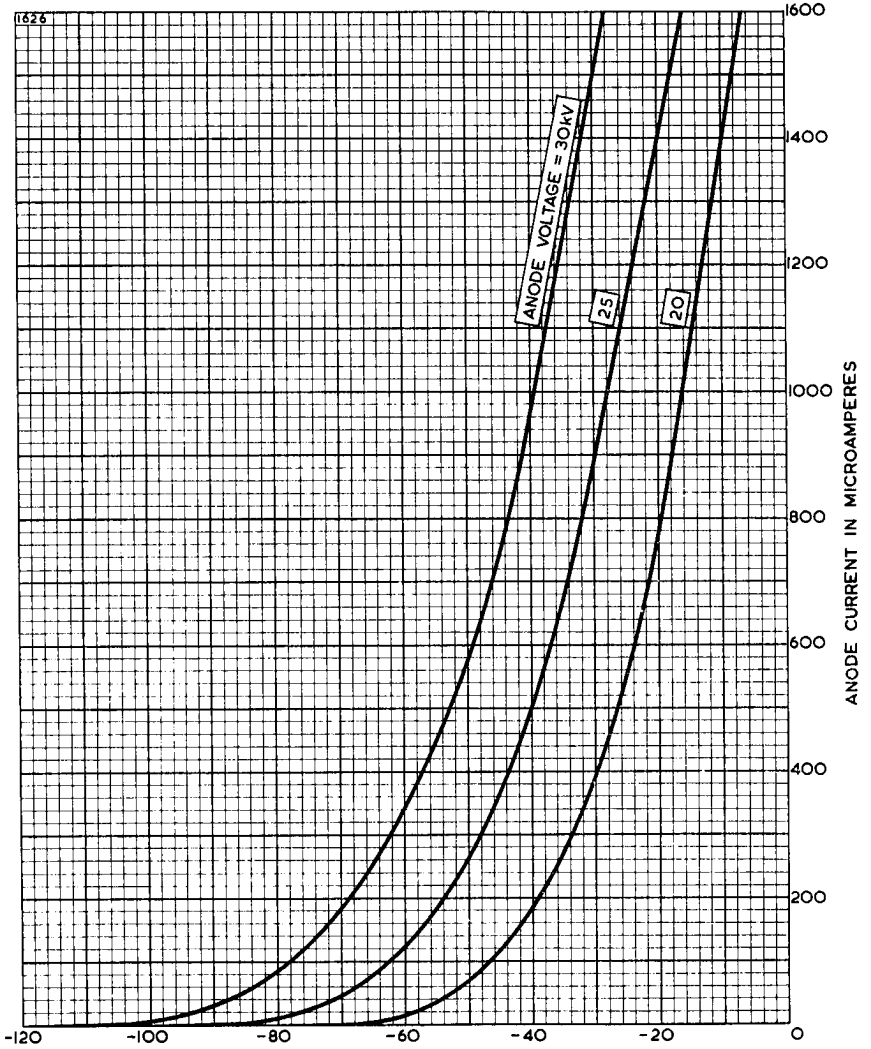
11. The focus power required is equivalent to approximately 800 ampere-turns using a long gap focus coil.

12. Measured under the following conditions:
    Pulsed line 100mm long
    Pulse length 100μsec
    Pulse repetition rate 50p.p.s.
    Beam current 100μA peak.

    The method used for line width measurement with a microscope is as in K1001.

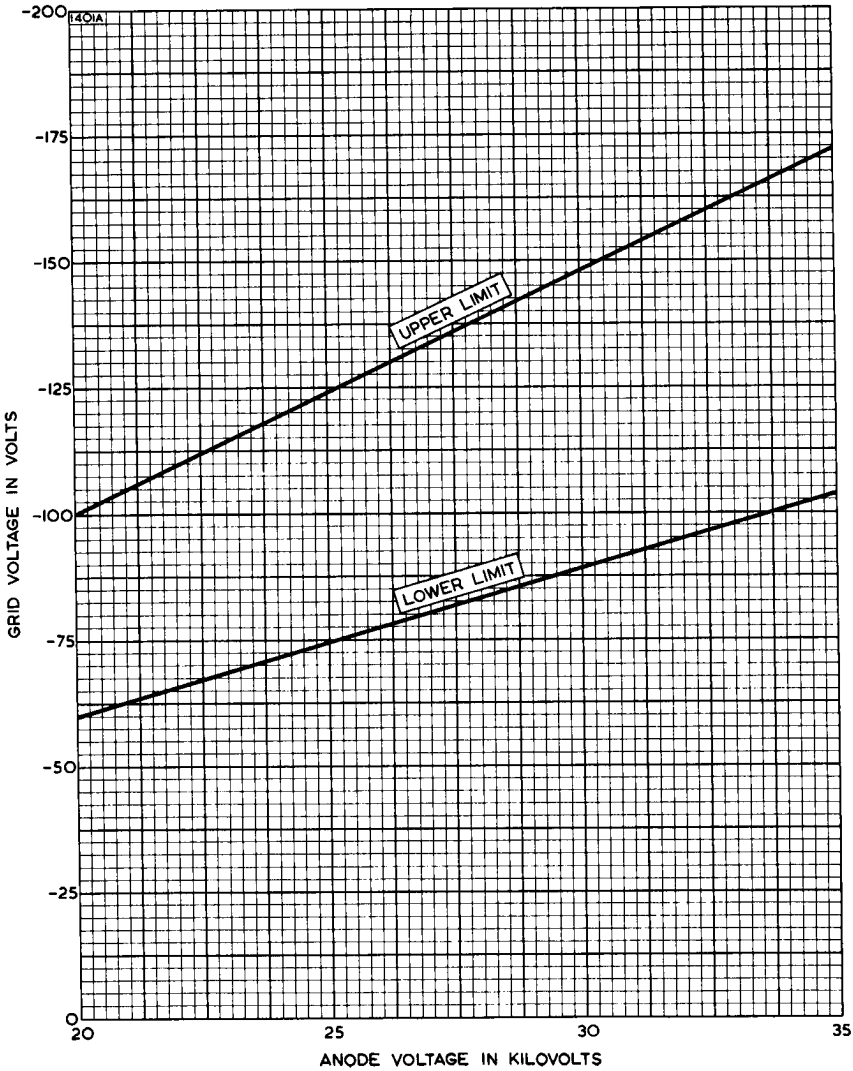
Printed in England

GRID VOLTAGE CHARACTERISTICS

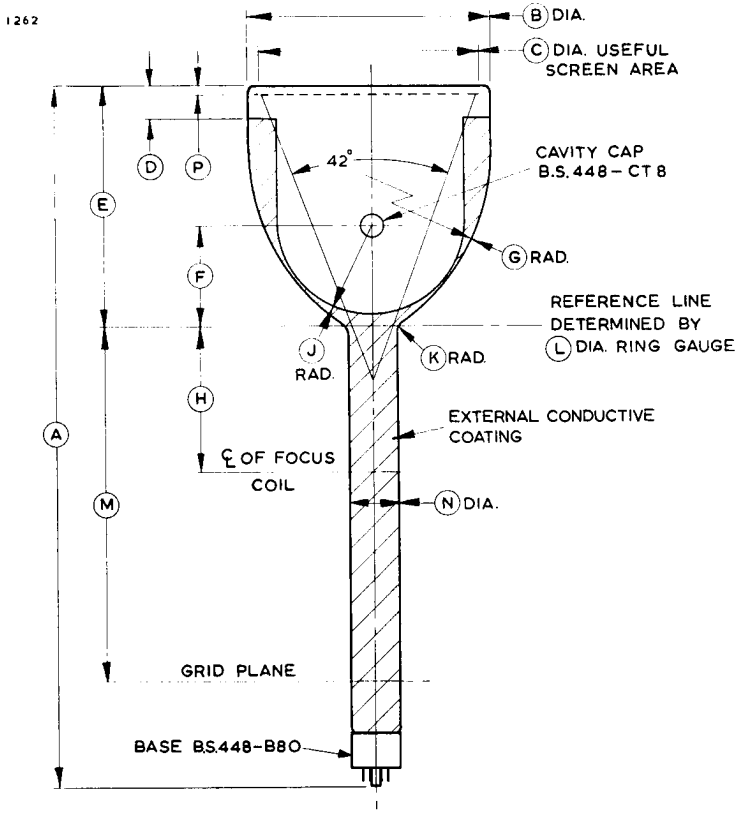


Printed in England

GRID VOLTAGE CUT-OFF LIMITS



OUTLINE

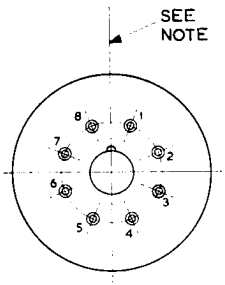


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	20·945 ± 0·394	532·0 ± 10·0	J	3·346	85·0
B	7·284 ± 0·157	185·0 ± 4·0	K	0·354	9·00
C	6·496	165·0	L	1·417	36·0
D	0·984 ± 0·394	25·0 ± 10·0	M	10·669	271·0
E	7·165 ± 0·157	182·0 ± 4·0	N	$1{\cdot}378^{+0{\cdot}020}_{-0{\cdot}039}$	$35{\cdot}0^{+0{\cdot}5}_{-1{\cdot}0}$
F	2·992 ± 0·157	76·0 ± 4·0	P	0·354 ± 0·039	9·00 ± 1·00
G	6·299	160·0			
H	4·331	110·0			

Inch dimensions have been derived from millimetres.

OUTLINE DETAIL

1629



Pin	Element
1	Spark Trap and External Conductive Coating
2	Heater
3	No Connection
4	No Connection
5	Grid
6	No Connection
7	Heater
8	Cathode
Cap	Anode

Note. The base key will be in line with the Cavity Cap to within $\pm 15°$.

Printed in England

ABRIDGED DATA

16-inch diameter radar tubes for use with valve or transistor scan amplifiers. Two sets of scan coils may be fitted for alpha-numeric character display.

Neck Diameter	1·378 inches (35mm)	
Deflection Angle	50	Degrees
Deflection Method		Magnetic
Focus Method (*See Note* 1)		Magnetic
E.H.T. Voltage	15	kV

GENERAL

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 2)	6·3	V
Heater Current	0·3 ± 10%	A
Faceplate		Clear
Screen (*See Note* 3)		Aluminised
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	12	pF
Cathode to all other electrodes, less than	12	pF

Mechanical

Overall Length	29·646 inches	(753 mm)	Max←
Overall Diameter	16·142 inches	(410 mm)	Max
Useful Screen Diameter	14·567 inches	(370 mm)	Min
Neck Diameter (*See Page* 9)	1·398 inches	(35·5 mm)	Max
Net Weight	24 pounds	(11 kg)	Approx
Base			B.S.448–B12A
Final Anode Connection			Cavity Cap B.S.448–CT8
Mounting Position			*See Note* 4

← Indicates a change

ENGLISH ELECTRIC

MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

(All voltages with respect to cathode)

	Min	*Max*	
Anode 2 Voltage	9·0	15·5	kV
Anode 1 Voltage	250	600	V
Grid Voltage, negative value (*See Note* 5) ..	0	250	V
Heater to Cathode Voltage (*See Note* 6):			
Cathode negative	—	150	V
Cathode positive	—	200	V
Peak Heater to Cathode Voltage:			
Cathode positive (*See Note* 7)	—	410	V
Cathode Current (Mean)	—	150	μA
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50c/s)	—	0·5	MΩ
Heater to Cathode Resistance		*See Note* 8	

TYPICAL OPERATING CONDITIONS

Anode 2 Voltage	15	kV
Anode 1 Voltage	300	V
Grid Voltage for cut-off	−30 to −70	V
Grid Drive for 100μA beam current ..	20 to 35	V
Line Width (*See Note* 9)	0·35	mm
Astigmatism (*See Note* 10)	20	% Max

OPTIMUM BEAM FOCUSING

In order to obtain maximum brightness and minimum spot size, it is necessary to carry out the following procedure.

(*a*) Stray magnetic fields should be minimised in the region of the gun structure by fitting a tubular mumetal shield over the neck.

(*b*) The beam may be centred in the defining aperture by a small magnet, located in the region of the grid and adjusted to give maximum brightness.

(*c*) The magnetic axis of the focus coil should be aligned with the electron beam. This may be done either by adjusting the position of the focus coil (*See Method* 1), or by fitting additional deflection coils to adjust the position of the beam (*See Method* 2). In each case a.c. focusing (*See Page* 3) may be used to identify the optimum alignment condition.

Printed in England

Method 1

Adjustment of the focus coil position

The mounting of the focus coil should be such that the coil can be moved in any direction, i.e. vertically, horizontally and tilted about either the vertical or horizontal axis. An a.c. current is passed through the focus coil and the position of the coil is adjusted until the optimum alignment is reached. (*See Note * below*).

Method 2

Electromagnetic deflection of the beam

Two sets of alignment coils are fitted on the tube neck, between the beam defining aperture and the focus coil (*See Diagram, Page* 8). Each set of coils is capable of deflecting the beam slightly in both X and Y directions. The currents in the alignment coils are adjusted to give correct alignment of the beam. (*See Note * below*).

**A.C. Focusing*

An alternating current is passed through the focus coil such that the positive and negative excursions of the current each produce a focused spot. Provided there is no current through the main deflection coils, the picture on the tube faceplate will consist of a defocused area and two focused spots. The optimum focusing condition is obtained when the two focused spots coincide at the centre of the defocused spot.

NOTES

1. The focus coil should be positioned so that the focusing field is entirely on the screen side of the beam defining aperture. When using a focus coil having a short air gap, the centre of the air gap should be approximately 170mm from the reference plane.
2. The heater is suitable for series or parallel operation. In series operation the surge heater voltage must not exceed $9{\cdot}5V_{r.m.s.}$ when the supply is switched on and a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.
3. Tubes in the T970 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T970D	D*	E.V.S.007	Yellow-orange	Long
T970Y	Y*	P33	Orange	Long
T970Z	Z*	P26	Orange	Very Long

*This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots.

The tube can be manufactured with alternative screens, and customers'

enquiries are invited.

4. The tube may be mounted in any position except with the screen down and the axis of the tube making an angle of less than 20° with the vertical.

5. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the period immediately after switching the equipment on or off, when it may be allowed to rise to +1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.

6. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than $20V_{r.m.s.}$

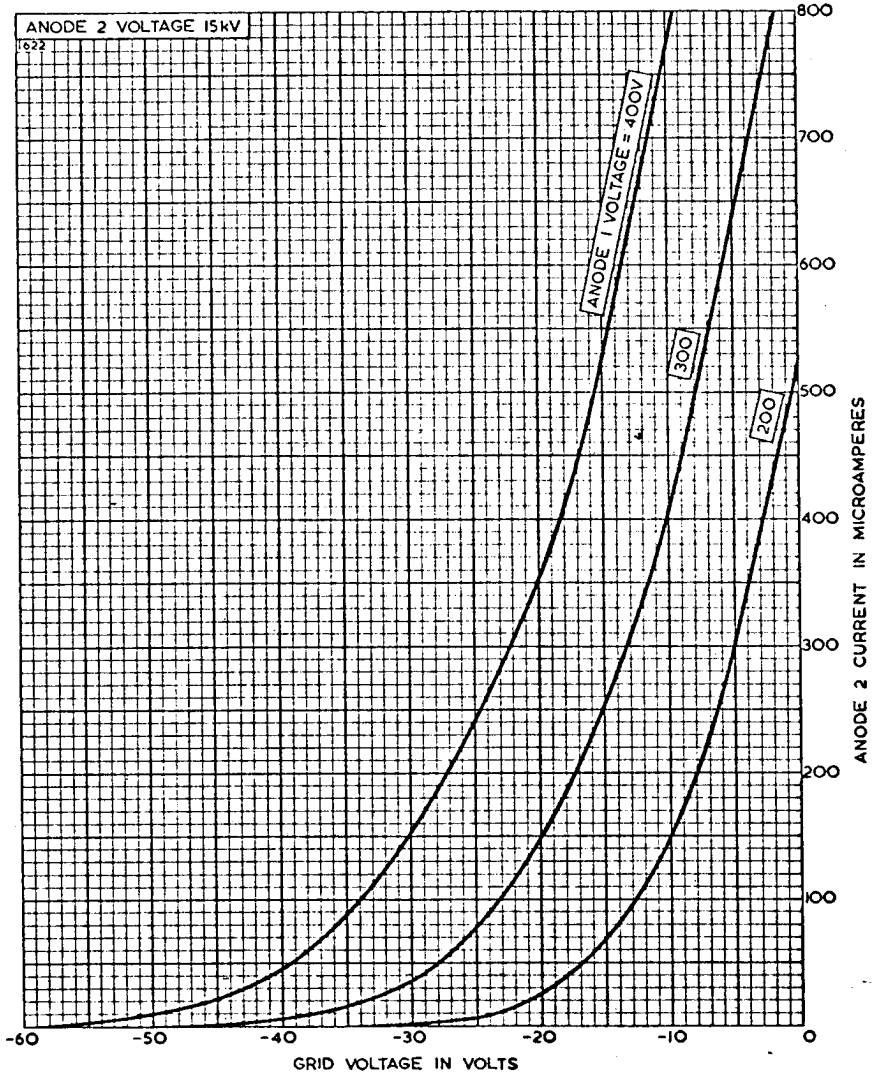
7. During a warming-up period not exceeding 45 seconds.

8. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50c/s must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.

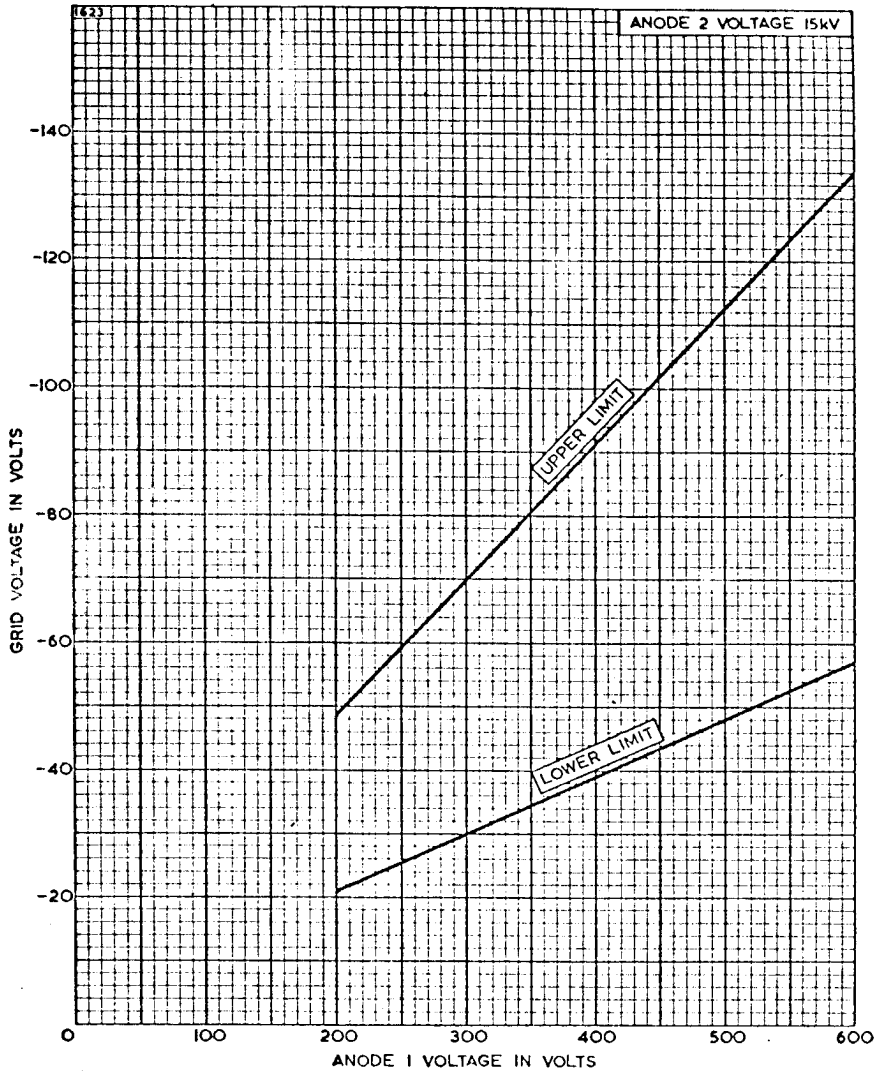
9. Measured under the following conditions:
   Pulsed line 370mm long
   Pulse length 100μsec
   Pulse repetition rate 50p.p.s.
   Beam current 100μA (peak)
   Modulation pulses and deflection waveform synchronised
   Line width measured with a microscope as in K1001/5.A.5.7.2.2.

10. Measured under the following conditions:
    Undeflected, focused, pulsed spot
    Pulse length 0·1μsec
    Pulse repetition rate 50p.p.s.
    Beam current 100μA (peak).

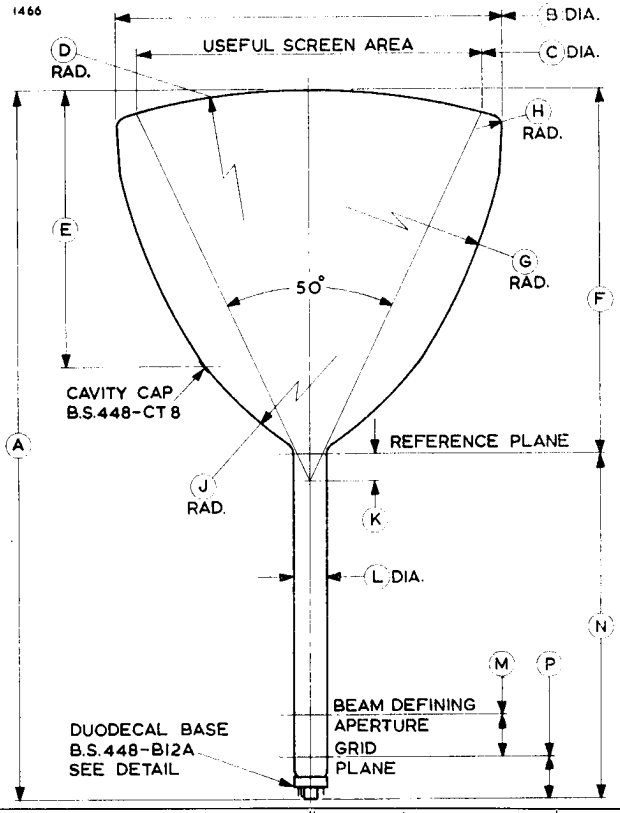
GRID VOLTAGE CHARACTERISTICS



GRID VOLTAGE CUT-OFF LIMITS



OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	29·252 ± 0·394	743·0 ± 10·0	J	16·732	425·0 ←
B	15·984 ± 0·157	406·0 ± 4·0	K	1·260 Max	32·0 Max
C	14·567 Min	370·0 Min	L	1·378 $^{+0·020}_{-0·039}$	35·0 $^{+0·5}_{-1·0}$
D	27·560	700·0	M	1·772	45·0
E	11·417 ± 0·394	290·0 ± 10·0	N	14·291 ± 0·236	363·0 ± 6·0 ←
F	14·961 ± 0·157	380·0 ± 4·0	P	1·732	44·0
G	23·504	597·0			
H	0·472	12·0			

Inch dimensions have been derived from millimetres.

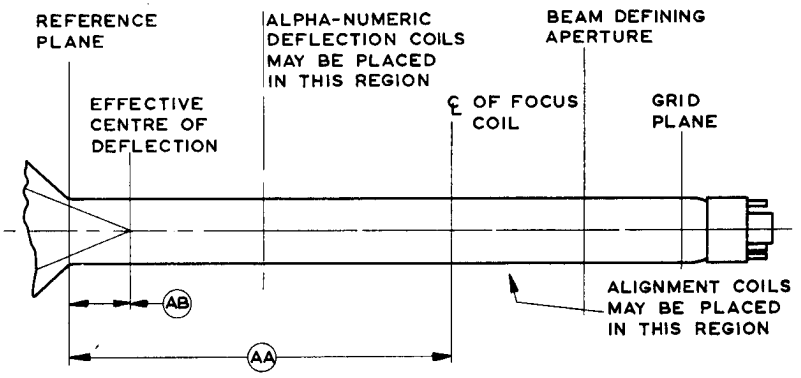
Note The mean axis of the neck will pass within 3mm of the geometric centre of the tube face and within 1° of a normal to a plane tangential to the geometric centre of the tube face.

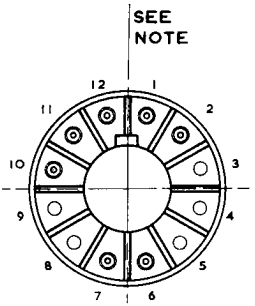
← Indicates a change

ENGLISH ELECTRIC

OUTLINE DETAILS

1203





Ref.	Inches	Millimetres
AA	6·693	170
AB	1·260 Max	32·0 Max

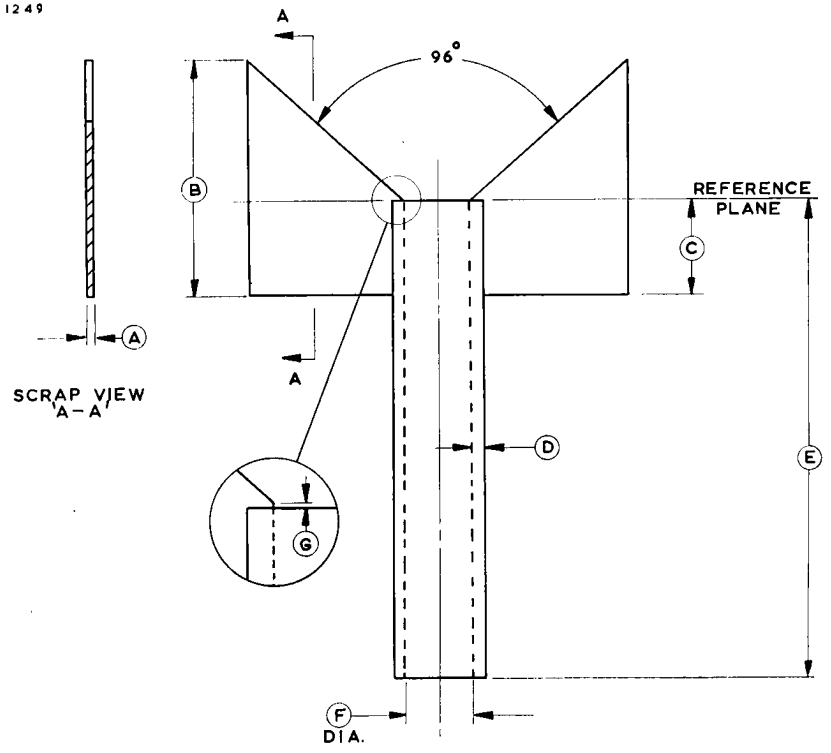
Inch dimensions have been derived from millimetres.

Note The anode cavity cap will be in line with the base key to within 15°.

Pin	Element	Pin	Element
1	Heater	8	No Pin
2	Grid	9	No Pin
3	No Pin	10	Anode 1
4	No Pin	11	Cathode
5	No Pin	12	Heater
6	No Connection	Cavity	
7	No Connection	Cap	Anode 2

Printed in England

NECK GAUGE



The gauge shown above will pass freely over base and neck to the reference line, and when rotated through 360° the blades of the gauge will contact the flared neck at the reference line only.

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	0·125	3·18	F	$1{\cdot}417^{+0{\cdot}003}_{-0{\cdot}000}$	$36{\cdot}0^{+0{\cdot}08}_{-0{\cdot}00}$
B	$4{\cdot}921 \pm 0{\cdot}039$	$125{\cdot}0 \pm 1{\cdot}0$			
C	$1{\cdot}969 \pm 0{\cdot}039$	$50{\cdot}0 \pm 1{\cdot}0$	G	$0{\cdot}000^{+0{\cdot}002}_{-0{\cdot}000}$	$0{\cdot}00^{+0{\cdot}05}_{-0{\cdot}00}$
D	$0{\cdot}252 \pm 0{\cdot}012$	$6{\cdot}4 \pm 0{\cdot}3$			
E	$9{\cdot}843 \pm 0{\cdot}039$	$250{\cdot}0 \pm 1{\cdot}0$			

Inch dimensions have been derived from millimetres except dimension A.

Printed in England

ABRIDGED DATA

12-inch Diameter Radar Tubes intended primarily for marine radar P.P.I. displays. The narrow scan angle permits the use of valve or transistor scan amplifiers.

Neck Diameter	1·378	inches (35 mm)
Deflection Angle	40	Degrees
Deflection Method		Magnetic
Focus Method		Electrostatic
E.H.T. Voltage	16	kV

GENERAL DATA

Electrical and General

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 1)	6·3	V
Heater Current	0·3±10%	A
Screen (*See Note* 2)		Aluminised
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	8·0	pF
Cathode to all other electrodes, less than	8·0	pF
Anode 2 and Anode 4 to external conductive coating (*See Note* 3)	1500	pF

Mechanical

Overall Length	22·560 inches	(573 mm)	Max
Overall Diameter	12·090 inches	(307 mm)	Max
Useful Screen Diameter	10·430 inches	(265 mm)	Min
Neck Diameter	1·400 inches	(35·5 mm)	Max
Net Weight	13½ pounds	(6·2 kg)	Approx
Base (*See Note* 4)			B8H
Anode 2 and Anode 4 Connection			B.S.448–CT8 Cavity Cap
Mounting Position (*See Note* 4)			Any

ENGLISH ELECTRIC

MAXIMUM AND MINIMUM RATINGS

(Absolute Values. *See Note* 5)

	Min	*Max*	
Anode 2 and Anode 4 Voltage (*See Note* 6) ..	8·0	18	kV
Anode 3 Voltage:			
Positive value	—	1·0	kV
Negative value	—	0·5	kV
Anode 1 Voltage	0·2	0·8	kV
Grid Voltage (negative value)	1·0	200	V
Grid to Cathode Impedance (at 50c/s)	—	0·5	MΩ
Grid to Cathode Resistance	—	1·5	MΩ
Heater to Cathode Voltage:			
Heater positive with respect to cathode			
D.C.	—	150	V
Peak	—	250	V
Heater negative with respect to cathode			
D.C.	—	150	V
Peak	—	300	V
Heater to Cathode Resistance		*See Note* 7	

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	12 to 16	kV
Anode 3 Voltage	−200 to +200	V
Anode 3 Current (positive or negative)	15	μA
Anode 1 Voltage	600	V
Anode 1 Current (positive or negative)	15	μA
Grid Voltage for visual cut-off	−40 to −85	V
Cathode Voltage for visual cut-off (*See Note* 8) ..	43 to 82	V

NOTES

1. The heater is suitable for either series or parallel operation. In series operation, the surge heater voltage when switching on must not exceed $9{\cdot}5V_{r.m.s.}$ and a current limiting device may be required in the circuit to reduce the surge voltage below this value.

2. Tubes in the T974 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T974Y	Y*	P33	Orange	Long
T974Z	Z*	P26	Orange	Very Long

The tube can be manufactured with alternative screens, and customers' enquiries are invited.

*This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots.

3. The capacitance of anode 2 and anode 4 to the external conductive coating may be used to provide smoothing for the e.h.t. supply.

4. The tube should not be supported by the base alone and under no circumstances should the socket be used for support purposes.

5. All voltages are with respect to cathode except where otherwise specified.

6. The associated equipment should be adequately protected against damage caused by possible high voltage flashovers inside the tube.

7. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50c/s must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.

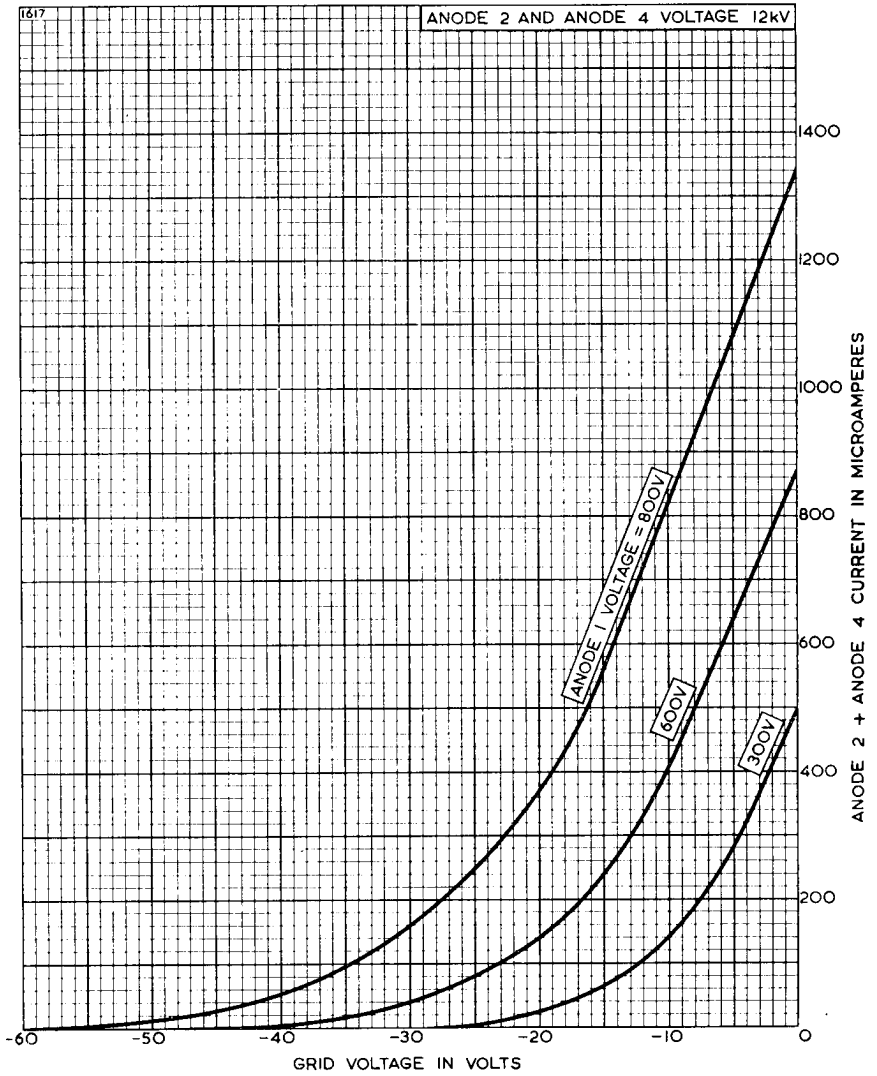
8. For cathode modulation, all voltages are with respect to the grid.

X-RAY WARNING

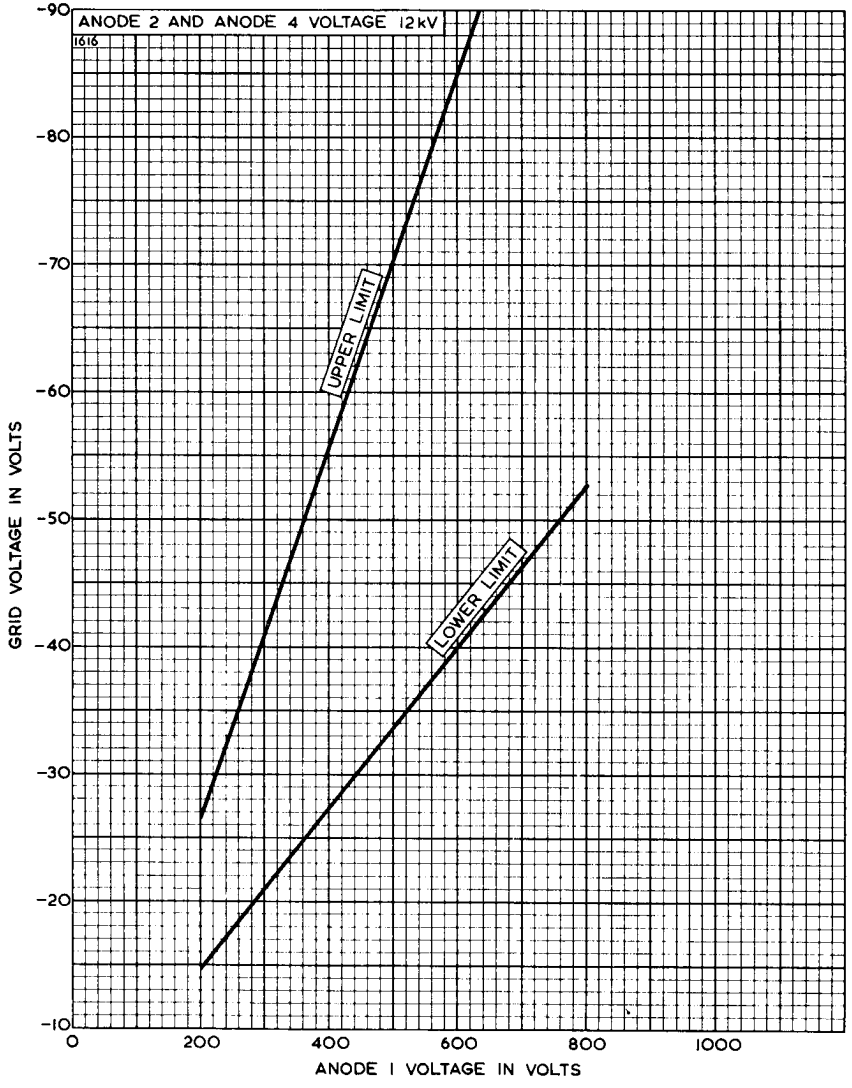
X-rays are produced when the T974 is operated above 16kV (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect upon the design of the tube.

ENGLISH ELECTRIC

GRID VOLTAGE CHARACTERISTICS

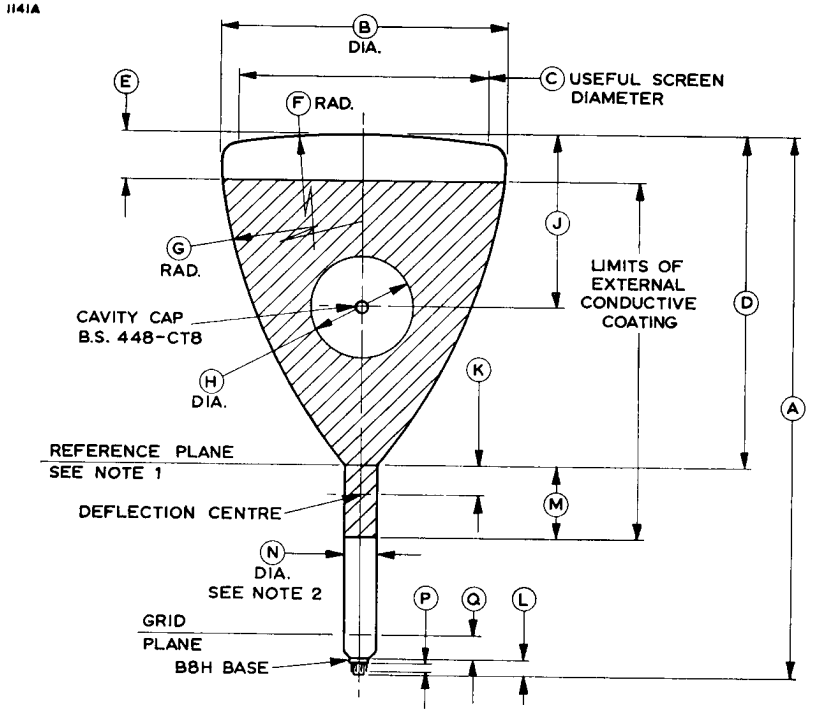


GRID CUT-OFF VOLTAGE LIMITS



ENGLISH ELECTRIC

OUTLINE



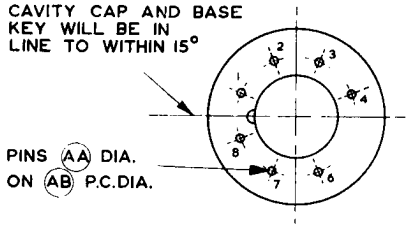
Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	22·560 Max	573·0 Max	J	$7{\cdot}244 \pm 0{\cdot}118$	$184{\cdot}0 \pm 3{\cdot}0$
B	$12{\cdot}010^{+0{\cdot}080}_{-0{\cdot}100}$	$305{\cdot}0^{+2{\cdot}0}_{-2{\cdot}5}$	K	1·240 Max	31·5 Max
C	10·430 Min	265·0 Min	L	0·630	16·0
D	$13{\cdot}900 \pm 0{\cdot}180$	$353{\cdot}0 \pm 4{\cdot}5$	M	$2{\cdot}953 \pm 0{\cdot}197$	$75{\cdot}0 \pm 5{\cdot}0$
E	1·969	50·0	N	$1{\cdot}378^{+0{\cdot}020}_{-0{\cdot}039}$	$35{\cdot}0^{+0{\cdot}5}_{-1{\cdot}0}$
F	39·370	1000	P	0·333 Max	8·46 Max
G	23·620	600·0	Q	0·984	25·0
H	$4{\cdot}331 \pm 0{\cdot}394$	$110{\cdot}0 \pm 10{\cdot}0$			

Inch dimensions have been derived from millimetres.

ENGLISH ELECTRIC

OUTLINE DETAILS

1142A



Ref.	Inches	Millimetres
AA	0·040	1·02
AB	0·600	15·24

Millimetre dimensions have been derived from inches.

Pin	Element
1	Heater
2	Internal Connection
3	Anode 1
4	Anode 3
5	No Pin
6	Grid
7	Cathode
8	Heater
Cavity Cap	Anode 2 and Anode 4

OUTLINE NOTES

1. The Reference Plane is determined by the position where 36·0mm internal diameter ring gauge rests.
2. A ring gauge 36·0mm internal diameter × 100·0mm long will pass over the neck and base to the reference plane.
3. The projected neck axis will pass within 3·5mm (0·138 inch) of the geometric centre of the tube face. The neck axis will make an angle of less than 1° 30′ with the normal to the tangential plane at the centre of the face.

Printed in England

ENGLISH ELECTRIC

ABRIDGED DATA

21-inch diagonal, rectangular display tubes for monitor and radar applications. They feature long necks, enabling two sets of scan coils to be fitted for display of alpha-numeric characters in computer read-out or radar systems. The T975D gives a flicker free display at low repetition frequencies for computer read-out.

Neck Diameter	1·437 inches (36·5mm)
Deflection Angle	90 Degrees
Deflection Method	Magnetic
Focus Method	Electrostatic
E.H.T. Voltage	15 kV

GENERAL

Electrical and General

Cathode	Indirectly Heated, Oxide Coated
Heater Voltage (*See Note* 1)	6·3 V
Heater Current	0·3±10% A
Faceplate	Tinted
Screen (*See Note* 2)	Aluminised
Inter-electrode Capacitances:	
Grid to all other electrodes, less than	8·0 pF
Cathode to all other electrodes, less than	8·0 pF

Mechanical

Overall Length	26·260 inches	(667 mm)	Max
Faceplate Diagonal	21·500 inches	(546 mm)	Max
Neck Diameter	1·496 inches	(38 mm)	Max
Net Weight	25·5 pounds	(11·6 kg)	Approx
Base			B.S.448–B12A
Final Anode Connection			Cavity Cap B.S.448–CT8
Mounting Position			*See Note* 3

ENGLISH ELECTRIC

MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

(All voltages with respect to cathode)

	Min	*Max*	
Anode 2 and Anode 4 Voltage	8·0	18	kV
Anode 3 Voltage:			
positive	—	1000	V
negative	—	500	V
Anode 1 Voltage	200	600	V
Grid Voltage, negative value (*See Note* 4)	1·0	200	V
Heater to Cathode Voltage (*See Note* 5):			
Cathode negative	—	150	V
Cathode positive	—	200	V
Peak Heater to Cathode Voltage, Cathode positive (*See Note* 6)	—	410	V
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50Hz)	—	0·5	MΩ
Heater to Cathode Resistance		*See Note* 7	

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	15	kV
Anode 3 Voltage (*See Note* 8)	−200 to +200	V
Anode 3 Current	−15 to +15	μA
Anode 1 Voltage	300	V
Grid Voltage for cut-off	−30 to −70	V

X-RAY WARNING

X-Rays are produced when types in the T975 series are operated with anode voltages above 16kV (absolute value). These rays can constitute a health hazard unless the tubes are adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect on the design of the tubes.

Printed in England

NOTES

1. The heater is suitable for series or parallel operation. In series operation the surge heater voltage must not exceed 9·5$V_{r.m.s.}$ when the supply is switched on and a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.

2. Tubes in the T975 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T975D	D*	E.V.S.007	Yellow-orange	Long
T975S	S*	—	Yellow-orange	Long
T975Y	Y*	P33	Orange	Long

*This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots. The tube can be manufactured with alternative screens, and customers' enquiries are invited.

3. The tube may be mounted in any position except with the screen down and the axis of the tube making an angle of less than 20° with the vertical.

4. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the period immediately after switching the equipment on or off when it may be allowed to rise to +1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.

5. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than 20$V_{r.m.s.}$

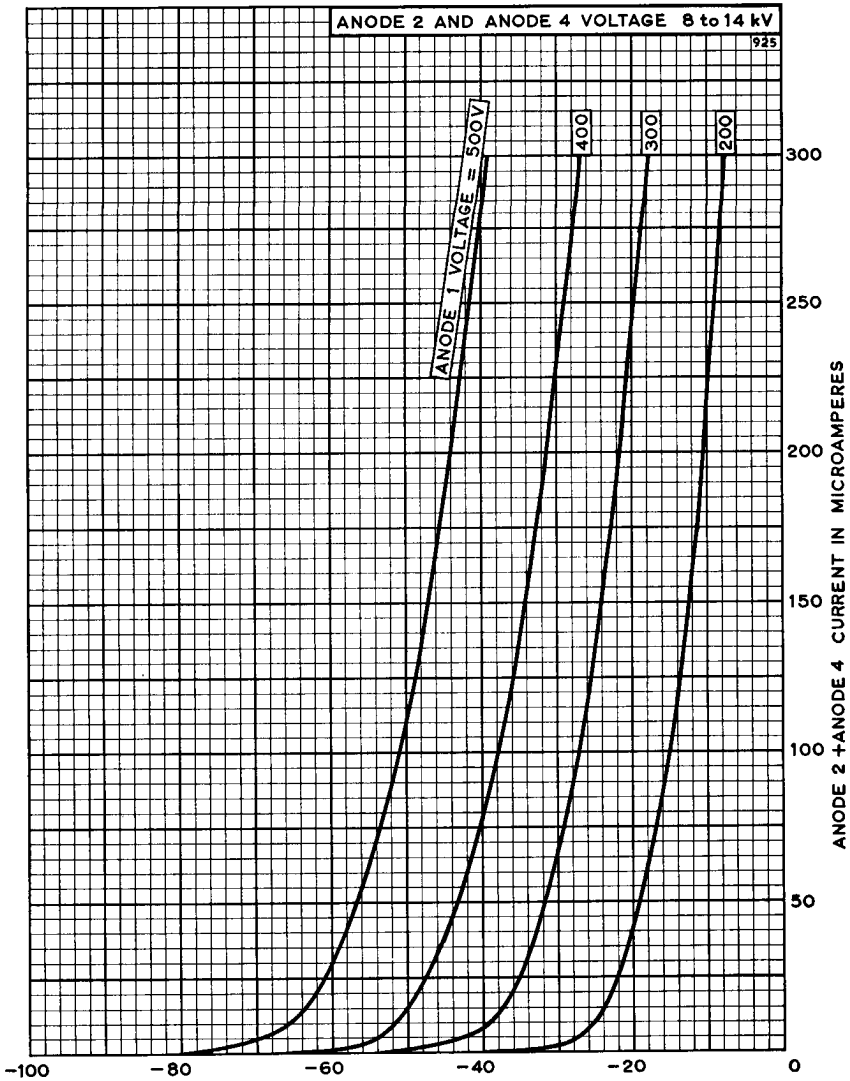
6. During a warming-up period not exceeding 45 seconds.

7. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50Hz must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.

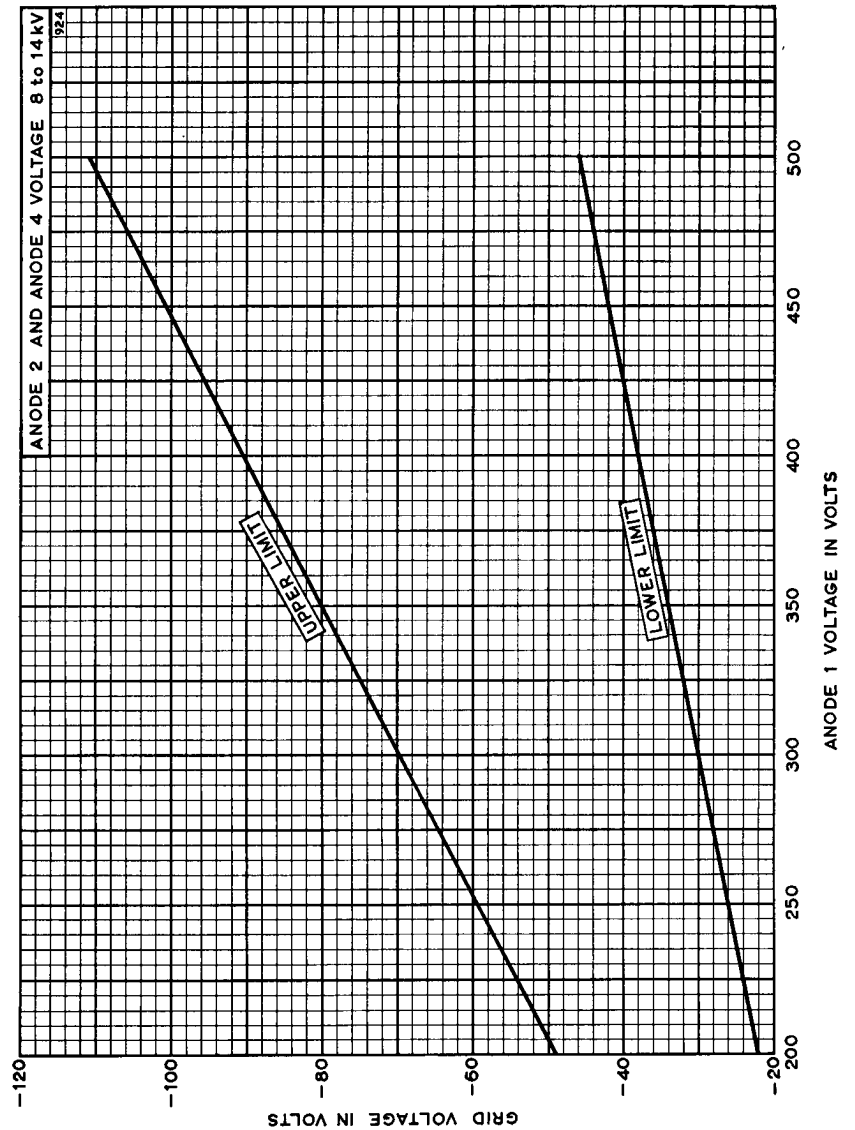
8. An acceptable focus quality will be obtained with an anode 3 voltage range of −200 to +200V. If it is required to pass through the point of focus a voltage range of at least −300 to +300V will be required.

ENGLISH ELECTRIC

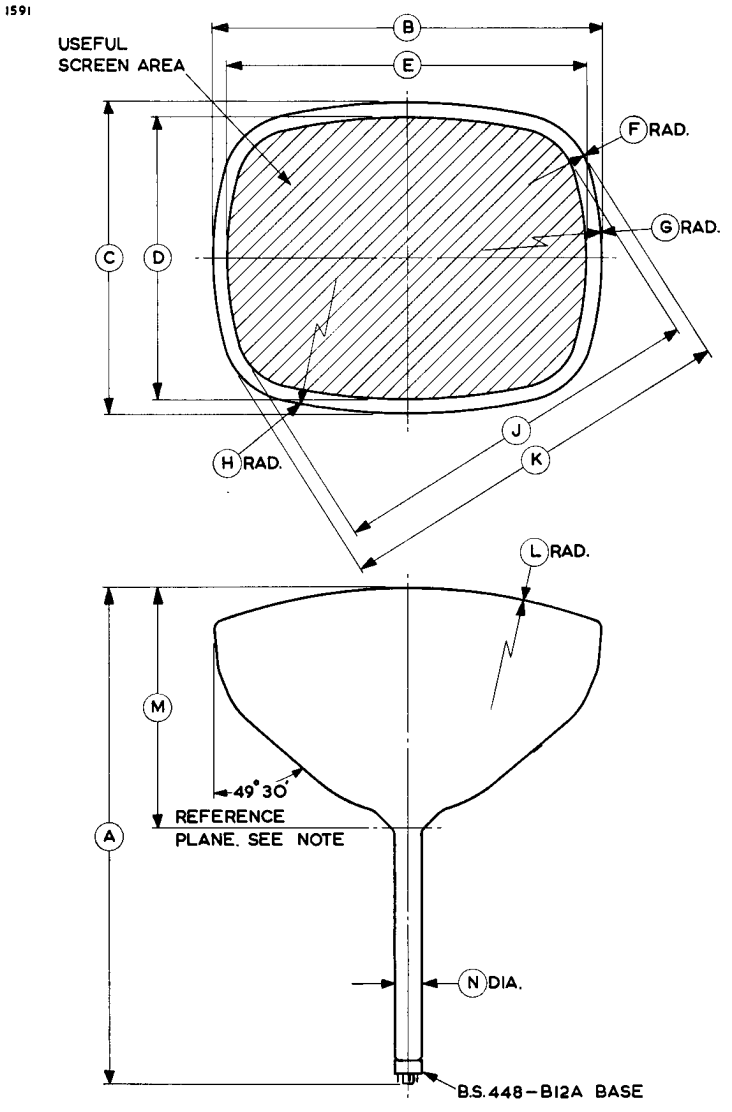
GRID VOLTAGE CHARACTERISTICS



GRID CUT-OFF VOLTAGE LIMITS



OUTLINE



Note Reference plane determined by gauge JEDEC G116 (*See page* 9)

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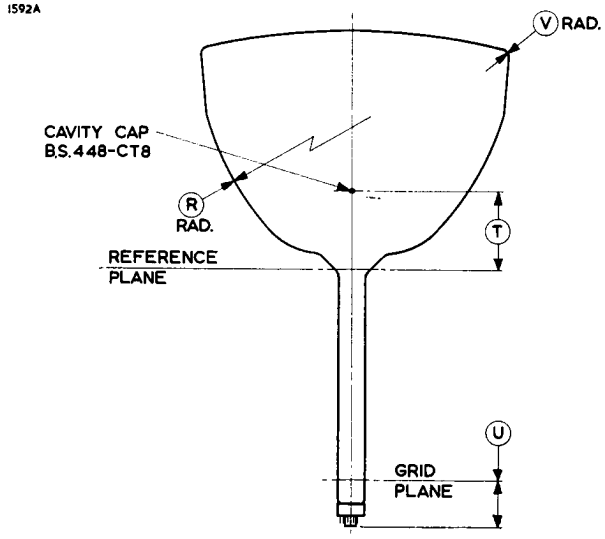
OUTLINE

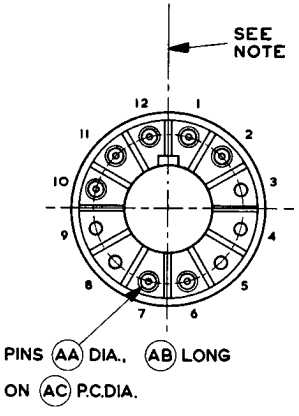


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	25·945±0·315	659·0±8·0	K	21·375±0·125	542·9±3·2
B	20·236±0·138	514·0±3·5	L	32·992	838·0
C	16·378±0·138	416·0±3·5	M	12·500±0·197	317·5±5·0
D	14·764 Min	375·0 Min	N	1·437±0·059	36·5±1·5
E	18·898 Min	480·0 Min	R	15·000	381·0
F	4·016	102·0	T	4·134±0·256	105·0±6·5
G	17·677	449·0	U	1·969 Nom	50·0 Nom
H	30·787	782·0	V	0·433	11·0
J	19·843 Min	504·0 Min			

Inch dimensions have been derived from millimetres except dimension K

OUTLINE DETAILS

1198B



Pin	Element
1	Heater
2	Grid
3	No Pin
4	No Pin
5	No Pin
6	Anode 3
7	No Connection
8	No Pin
9	No Pin
10	Anode 1
11	Cathode
12	Heater
Cavity Cap	Anode 2 & Anode 4

Ref.	Inches	Millimetres
AA	0·098 ± 0·003	2·362 ± 0·076
AB	0·410 Max	10·41 Max
AC	1·063	27·00

Millimetre dimensions have been derived from inches.

Note The anode cavity cap will be in line with the base key to within 15°

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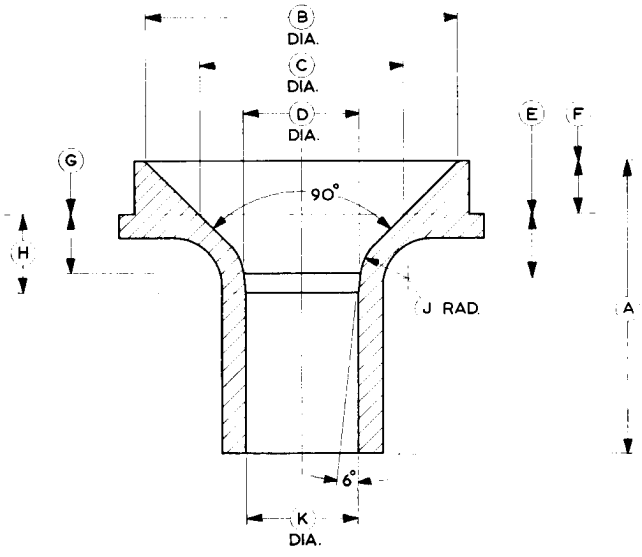
REFERENCE LINE GAUGE

1406



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	3·062	77·77	F	0·562 ± 0·001	14·275 ± 0·025
B	3·244 ± 0·001	82·398 ± 0·025	G	0·448	11·38
C	2·120 ± 0·002	53·848 ± 0·051	H	0·650	16·51
D	1·542 ± 0·003	39·167 ± 0·076	J	0·500	12·70
E	0·500 ± 0·001	12·700 ± 0·025	K	$1{\cdot}500^{+0{\cdot}003}_{-0{\cdot}000}$	$38{\cdot}10^{+0{\cdot}076}_{-0{\cdot}000}$

Millimetre dimensions have been derived from inches.

CV Equivalents:
CV6130 (T977D)
CV6172 (T977Z)

ABRIDGED DATA

12-inch diameter radar tubes for use with valve or transistor scan amplifiers; improved resolution versions of type T924Z (CV429).

The T977D will give flicker-free images at low repetition frequencies for computer read-out.

Neck Diameter	1·378 inches	(35·0 mm)
Deflection Angle	50	Degrees
Deflection Method		Magnetic
Focus Method (*See Note* 1)		Magnetic
E.H.T. Voltage	15	kV

GENERAL

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 2)	6·3	V
Heater Current	0·3±10%	A
Faceplate		Clear
Screen (*See Note* 3)		Aluminised
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	12	pF
Cathode to all other electrodes, less than	12	pF

Mechanical

Overall Length	20·472 inches	(520 mm)	Max
Overall Diameter	12·087 inches	(307 mm)	Max
Useful Screen Diameter	9·843 inches	(250 mm)	Min
Neck Diameter	1·398 inches	(35·5 mm)	Max
Net Weight	12 pounds	(5·4 kg)	Approx
Base			B.S.448–B12A
Final Anode Connection (*See Note* 4)			Cavity Cap B.S.448–CT8
Mounting Position			*See Note* 5

MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

(All voltages with respect to cathode)

	Min	*Max*	
Anode 2 Voltage	9·0	15·5	kV
Anode 1 Voltage	250	600	V
Grid Voltage, negative value (*See Note* 6)	0	250	V
Heater to Cathode Voltage (*See Note* 7):			
Cathode negative	—	150	V
Cathode positive	—	200	V
Peak Heater to Cathode Voltage, Cathode positive (*See Note* 8)	—	410	V
Cathode Current (Mean)	—	150	μA
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50Hz)	—	0·5	MΩ
Heater to Cathode Resistance		*See Note* 9	

TYPICAL OPERATING CONDITIONS

Anode 2 Voltage	15	kV
Anode 1 Voltage	300	V
Grid Voltage for cut-off	−30 to −90	V
Grid Drive for 50μA beam current	10 to 30	V
Line Width (*See Note* 10)	0·25	mm Max

OPTIMUM BEAM FOCUSING

In order to obtain maximum brightness and minimum spot size, it is necessary to carry out the following procedure.

(*a*) Stray magnetic fields should be minimised in the region of the gun structure by fitting a tubular mumetal shield over the neck.

(*b*) The beam may be centred in the defining aperture by a small magnet, located in the region of the grid and adjusted to give maximum brightness. A suitable magnet is Elac type BC11.

(*c*) The magnetic axis of the focus coil should be aligned with the electron beam. This may be done either by adjusting the position of the focus coil (*See Method* 1), or by fitting additional deflection coils to adjust the position of the beam (*See Method* 2). In each case a.c. focusing (*See Page* 3) may be used to identify the optimum alignment condition.

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Method 1

Adjustment of the focus coil position

The mounting of the focus coil should be such that the coil can be moved in any direction, i.e., vertically, horizontally and tilted about either the vertical or horizontal axis. An a.c. current is passed through the focus coil and the position of the coil is adjusted until the optimum alignment is reached. (*See A.C. Focusing* below.*)

Method 2

Electromagnetic deflection of the beam

Two sets of alignment coils are fitted on the tube neck, between the beam defining aperture and the focus coil (*see diagram, page* 8). Each set of coils is capable of deflecting the beam slightly in both X and Y directions. The currents in the alignment coils are adjusted to give correct alignment of the beam. (*See A.C. Focusing* below.*)

**A.C. Focusing*

An alternating current is passed through the focus coil such that the positive and negative excursions of the current each produce a focused spot. Provided there is no current through the main deflection coils, the picture on the tube faceplate will consist of a defocused area and two focused spots. The optimum focusing condition is obtained when the two focused spots coincide at the centre of the defocused spot.

NOTES

1. The focus coil should be positioned so that the focusing field is entirely on the screen side of the beam defining aperture. When using a focus coil having a short air gap, the centre of the air gap should be approximately 120mm from the reference plane.
2. The heater is suitable for series or parallel operation. In series operation the surge heater voltage must not exceed $9{\cdot}5V_{r.m.s.}$ when the supply is switched on and a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.
3. Tubes in the T977 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T977D	D*	E.V.S.007	Yellow-Orange	Long
T977Y	Y*	P33	Orange	Long
T977Z	Z*	P26	Orange	Very Long

*This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots. The tube can be manufactured with alternative screens, and customers' enquiries are invited.

ENGLISH ELECTRIC

4. When supplied as a CV6130 equivalent, an adaptor is fitted to convert the final anode connection to B.S.448–CT2.

5. The tube may be mounted in any position except with the screen down and the axis of the tube making an angle of less than 20° with the vertical.

6. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the period immediately after switching the equipment on or off when it may be allowed to rise to +1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.

7. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than $20V_{r.m.s.}$

8. During a warming-up period not exceeding 45 seconds.

9. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50Hz must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.

10. Measured under the following conditions:
    Pulsed line 250mm long
    Pulse length 100μs
    Pulse repetition rate 50p.p.s.
    Beam current 50μA (peak)
    Modulation pulses and deflection waveform synchronised
    Line width measured with a microscope as in K1001/5.A.5.7.2.2.

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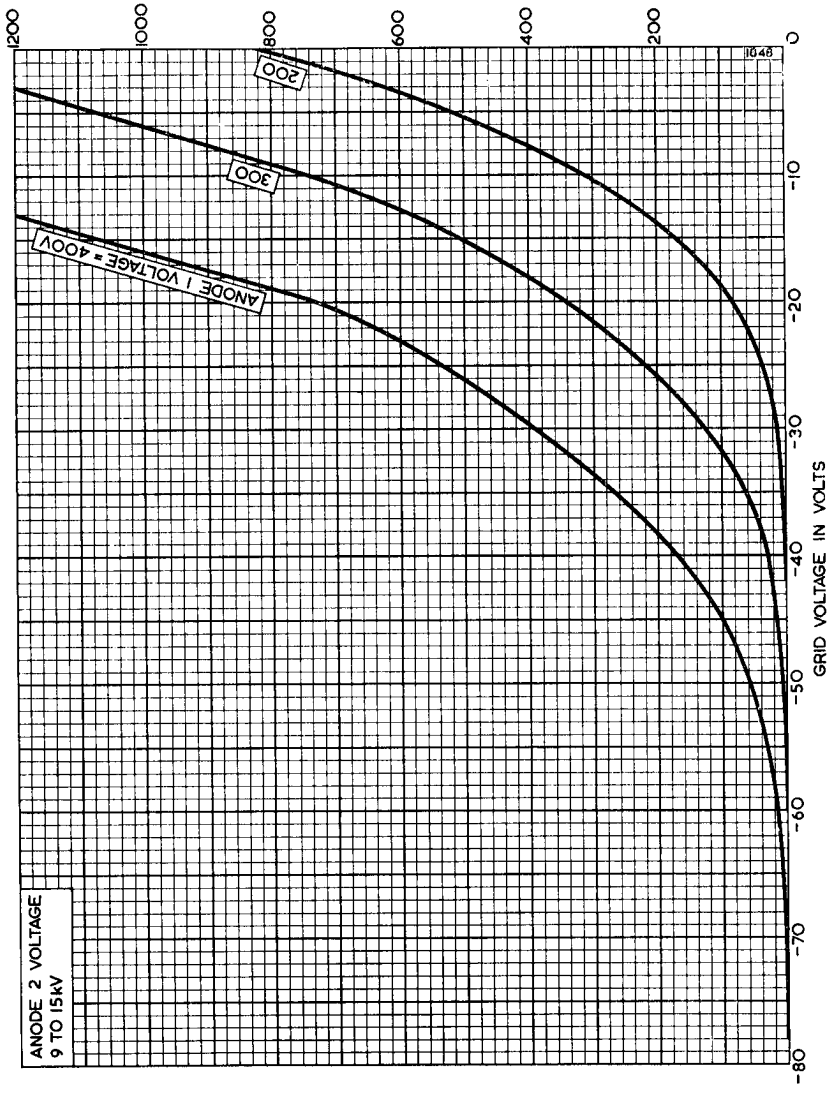
GRID VOLTAGE CHARACTERISTICS



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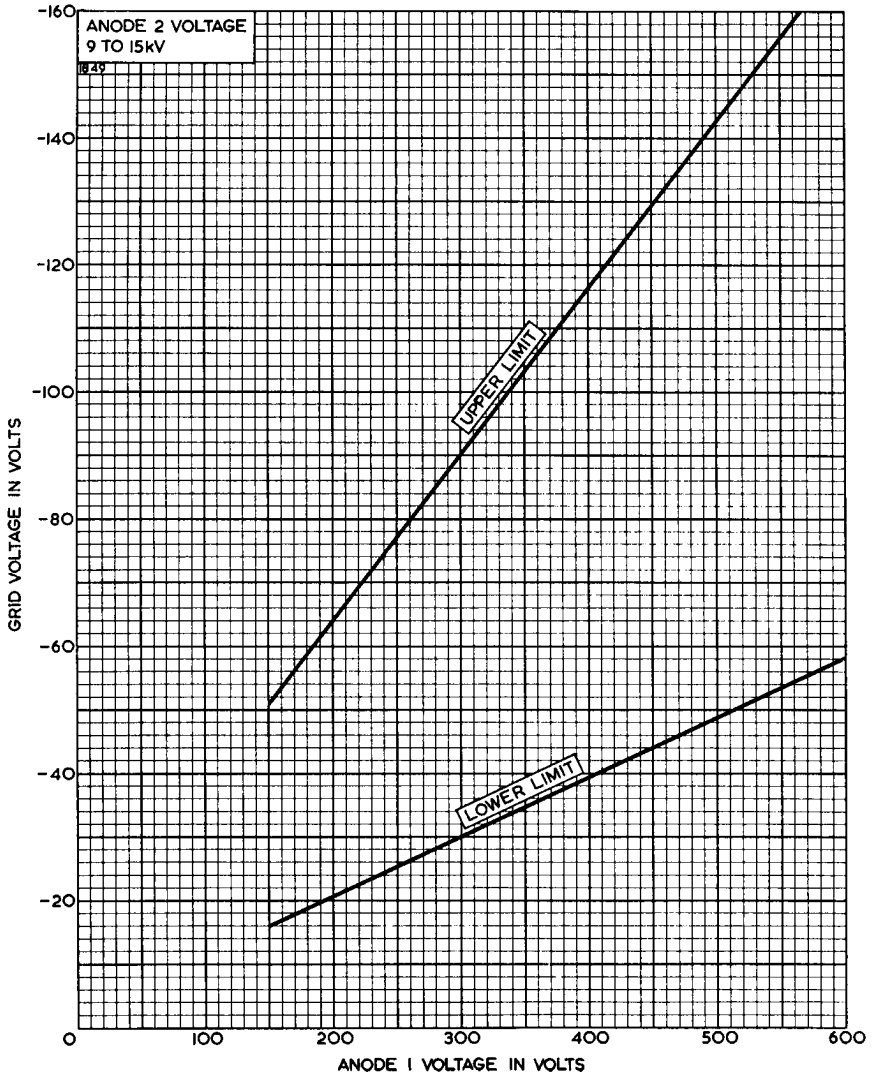
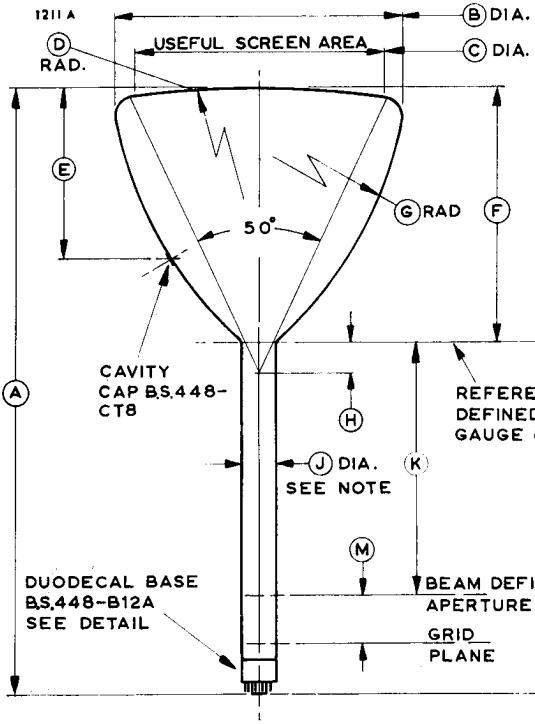
ENGLISH ELECTRIC

GRID VOLTAGE CUT-OFF LIMITS



OUTLINE



Bulb Ring Gauges

Ring Gauge Diameter (mm)	Distance from centre of Tube Face (mm)
280	93 ± 10
230	150 ± 9
180	191 ± 8
130	222 ± 7
80	249 ± 6

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	20·197 ± 0·276	513·0 ± 7·0	H	1·260 Max	32·0 Max
B	12·008 $^{+0·079}_{-0·098}$	305·0 $^{+2·0}_{-2·5}$	J	1·378 $^{+0·020}_{-0·039}$	35·0 $^{+0·5}_{-1·0}$
C	9·843 Min	250·0 Min	K	5·787	147
D	39·370 ± 3·937	1000 ± 100	L	1·417	36·0
E	7·087 ± 0·236	180·0 ± 6·0	M	1·969	50
F	10·709 ± 0·138	272·0 ± 3·5	N	9·488	241
G	16·772	426·0			

Inch dimensions have been derived from millimetres.

Note A ring gauge 36·1mm diameter by 100mm long will pass over base and neck to reference plane.

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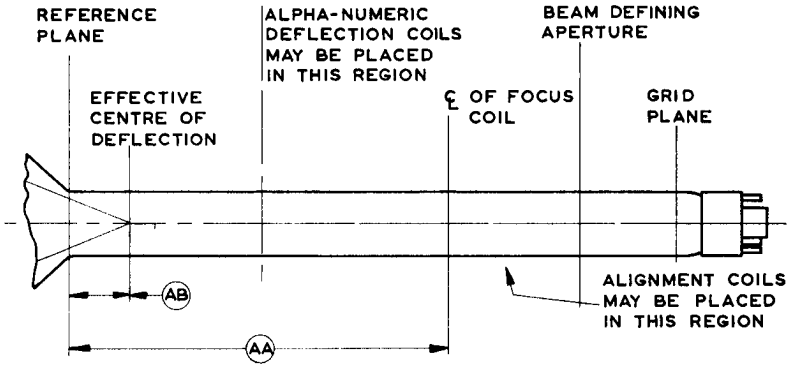
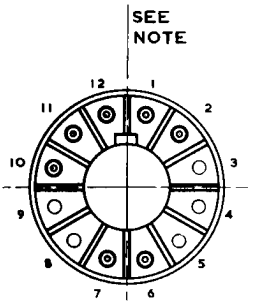
OUTLINE DETAILS

1203





Ref.	Inches	Millimetres
AA	4·724	120
AB	1·260 Max	32·0 Max

Inch dimensions have been derived from millimetres.

Note The anode cavity cap will be in line with the base key to within 15°.

Pin	Element	Pin	Element
1	Heater	8	No Pin
2	Grid	9	No Pin
3	No Pin	10	Anode 1
4	No Pin	11	Cathode
5	No Pin	12	Heater
6	No Connection	Cavity	
7	No Connection	Cap	Anode 2

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OSCILLOSCOPE TUBES

T979H T979N T979X

INTRODUCTION

The T979H, T979N and T979X are 5-inch diameter cathode ray tubes for wide band, high speed oscilloscope applications. They are identical except for their screen characteristics.

The incorporation of a post deflection accelerator mesh and an internal spiral coating, together with an improved gun design, gives the tubes the following features:

(1) Deflection sensitivities in the X and Y directions of 9V/cm and 3V/cm respectively, making them particularly suitable for use with deflection circuits employing transistors.

(2) A large useful screen area, permitting the use of either 6 × 10cm or 8 × 8cm displays.

(3) Excellent brightness, giving a visible trace at writing speeds up to 1–3nsec/cm, and with negligible distortion introduced in the post deflection accelerator (P.D.A.) system. The small amounts of barrel or pin cushion distortion, linearity distortion and astigmatism present can be eliminated by adjustment of electrode potentials.

(4) Good sensibility due to the small spot size.

(5) Variations of deflection sensitivities with variations in P.D.A. voltage are considerably reduced.

(6) Minimum deflector plate inductance and inter-plate capacitance, due to the deflector plate connections being made via short pins sealed into the side of the bulb.

GENERAL DATA

Electrical and General

Cathode	Indirectly Heated, Oxide Coated
Heater Voltage (*See Note* 1)	6·3 V
Heater Current	0·3 ± 10% A
Faceplate	Flat, Clear Glass
Screen (*See Note* 2)	Aluminised
Deflection Method	Electrostatic
Focus Method	Electrostatic
Linearity of Scan (*See Note* 3)	2 %
Raster Distortion (*See Note* 4)	±1 %
Orthogonality	90 ± 1 Degrees

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Minimum useful scan

Y1 to Y2 (*See Note* 5)	8·0	cm
X1 to X2 (*See Note* 5)	10	cm

Undeflected Spot Position (to geometric centre of faceplate)

Y Orientation	±0·6	cm
X Orientation	±1·0	cm

Helix Resistance

Anode 5 to Interplate Shield	200	MΩ Min
→	1000	MΩ Max

Inter-electrode Capacitances

(With all other electrodes not mentioned, and those marked *, earthed)

Grid to all other electrodes	6·1 pF Nom
Cathode to all other electrodes	5·7 pF Nom
X1 Electrode to all other electrodes except X2*	3·5 pF Nom
X2 Electrode to all other electrodes except X1*	3·5 pF Nom
Y1 Electrode to all other electrodes except Y2*	2·9 pF Nom
Y2 Electrode to all other electrodes except Y1*	2·9 pF Nom
X1 to X2 Electrode	3·1 pF Nom
Y1 to Y2 Electrode	1·7 pF Nom
X1+X2 Electrodes to Y1+Y2 electrodes	< 0·1 pF
X1+X2+Y1+Y2 Electrodes to cathode	< 0·1 pF
X1+X2+Y1+Y2 Electrodes to grid	< 0·1 pF

Mechanical

Overall Length	20·71 inches (526 mm)	Max
→ Overall Diameter (excluding cap)	5·37 inches (136·5 mm)	Max
Seated Height	21·260±0·236 inches (504±6 mm)	
Neck Diameter (excluding pins)	2·28 inches (58 mm)	Max
Useful Screen Area	2·36 by 3·94 or 3·15 by 3·15 inches 6·0 by 10 or 8·0 by 8·0 cm	Min Min
Net Weight	3 pounds (1·4 kg)	Approx
Base		B.S.448–B12F
Anode 5 Cavity Cap		B.S.448–CT8
Mounting Position (*See Note* 6)		Any

→ Indicates a change

MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

(All voltages are with respect to cathode except where otherwise stated)

	Min	*Max*	
Anode 5 (Screen) Voltage (*See Note* 7) ..	6·0	15*	kV
Anode 4 Voltage	1·0	3·3	kV
Anode 3 and Anode 1 Voltage	1·0	3·3	kV
Anode 2 Voltage	0	1·5	kV
Grid Bias Voltage (negative value)	0	200	V
Grid Voltage (positive peak value)	—	2·0	V
Cathode Current (intermittent mean)	—	0·3	mA
Y Plate Shield Voltage	—	3·3	kV
Interplate Shield Voltage	—	3·3	kV
Mesh Shield Voltage	—	3·3	kV
Mesh Voltage (negative with respect to mesh shield voltage)	10	20	V
Deflection Voltage on X or Y electrodes (Peak)	—	500	V
Heater to Cathode Voltage (Peak):			
Cathode positive	—	200	V
Cathode negative	—	125	V
Screen Dissipation (average)	—	5·0	mW/sq.cm
X1 or X2 to Anodes 3 and 1 Impedance ..	—	2·0	MΩ
Y1 or Y2 to Anodes 3 and 1 Impedance ..	—	1·0	MΩ
Grid to Cathode Impedance	—	1·0	MΩ
Anode 4 to Anodes 3 and 1 Impedance ..			*See Note* 8

*With respect to anode 3 and anode 1 voltage.

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TYPICAL OPERATING CONDITIONS

Anode 5 (Screen) Voltage	12	12	12	kV
Mesh Voltage (with respect to mesh shield)	−15	−15	−15	V
Anode 4 Voltage (adjusted for minimum astigmatism) (*See Note* 9) ..	1·0	1·5	3·0	kV
Anode 3 and Anode 1 Voltage	1·0	1·5	3·0	kV
Anode 2 Voltage (for focus)	165 to 335	250 to 500	500 to 1000	V
Grid Voltage (for spot cut-off	−30 to −57	−45 to −85	−90 to −170	V
Y Plate Shield Voltage (*See Note* 10)..	1·0	1·5	3·0	kV
Interplate Shield Voltage (*See Note* 11)	1·0	1·5	3·0	kV
Mesh Shield Voltage (*See Note* 12)..	1·0	1·5	3·0	kV
Mesh Current	(*See Note* 13)	(*See Note* 13)	(*See Note* 13)	
Anode 3 and Anode 1 Current	(*See Note* 14)	(*See Note* 14)	(*See Note* 14)	
Anode 2 Current	±15	±15	±15	μA
Cathode Current	(*See Note* 14)	(*See Note* 14)	(*See Note* 14)	
Deflection Factor (*See Note* 15):				
Mean Potential of X and Y plates	1·0	1·5	3·0	kV
X1 and X2 Electrodes:				
Mean	6·1	9·0	17·5	V/cm
Limits	5·3 to 6·8	8·0 to 10	15·5 to 19·5	V/cm
Y1 and Y2 Electrodes:				
Mean	2·0	3·0	6·2	V/cm
Limits	1·6 to 2·3	2·5 to 3·5	5·2 to 7·2	V/cm
Correction Potential Ranges				
Mesh (with respect to mesh shield) (*See Note* 16)	−12 to −18	−12 to −18	−12 to −18	V
Anode 4 (astigmatism) (*See Notes* 9 *and* 16)	±40	±40	±40	V
Y Plate Shield (*See Notes* 10 *and* 16)	±20	±20	±20	V
Interplate Shield (*See Notes* 11 *and* 16) ..	±60	±40	±20	V
Line Width (*See Note* 17)..	0·6	0·5	0·3	mm

ASSOCIATED COMPONENTS

The following components can be obtained from the suppliers listed; there may possibly be alternative sources:—

(1)	B.S.448-B12F socket	Catalogue No. 77/842	Carr Fastener Co. Ltd. Stapleford, Notts.
(2)	B.S.448-CT8 Cavity Cap Connector	Catalogue No. 77/699	Carr Fastener Co. Ltd. Stapleford, Notts.
(3)	Side Pin Connectors	Miniature wander socket type WS1 (colours: red, black or blue)	A.E.I. Clix, Radio & Electronics Components Division, Barton Hill, Bristol.
(4)	Magnetic Shield to suit T979 series (*See page* 11)		Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

NOTES

1. The heater is suitable for parallel operation only.

2. The T979 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent and Afterglow Colour	Persistence
T979H	H	P31	Blue-Green	Medium Short
T979N	N	P2	Yellowish-Green	Medium
T979X	X	P7	Blue with Yellowish-Green Afterglow	Long

The tube can be manufactured with alternative screens, and customers' enquiries are invited.

3. The deflection factor for a deflection of 75% of the useful scan will not differ from that for a deflection of 25% by more than 2%.

4. The edges of a 6 × 10cm raster will fall between two concentric rectangles 101 × 60·6mm and 99 × 59·4mm.

5. The tube can be used for either 6 × 10cm or 8 × 8cm displays.

6. The tube should be supported near the screen and also on the parallel neck near the base; it should not be supported by the base only. The socket should not be mounted rigidly, but should have flexible leads and be able to move freely. To avoid the need for excessive magnetic shielding the tube should be mounted as far away as possible from transformers, chokes and other sources of stray field.

7. Anode 5 may be operated at a voltage lower than the minimum specified but the light output will then be limited by the screen aluminising.

8. When high beam currents are used, anode 4 collects current and the anode 4 to anodes 3 and 1 impedance should be kept as low as possible to avoid defocusing.

9. Adjustment of the anode 4 voltage about the mean Y plate potential is used to correct astigmatism introduced in the deflection system. The range of voltage required is of the order of ± 40V.

10. The Y plate shields should be operated about the mean potential of the Y1 and Y2 electrodes. Variation of the potential about this value controls the edge effects of the Y deflection electrode field and provides a fine adjustment of the deflection linearity in the Y direction.

11. Variation of the interplate shield voltage about the mean potential of the deflection electrodes provides correction for barrel and pin cushion distortion. When the mean potentials of the X and Y deflection electrodes are equal, a range of ± 40V maximum is required (with anode 3 and anode 1 voltage of 1·5kV); the range is slightly wider when the mean potentials are not equal.

12. The mesh shield should be operated at approximately the mean X plate potential.

13. At peak beam current, the mesh current will be of the order of 5μA.

→14. Under normal operating conditions, the peak anode 3 and anode 1 current and the peak cathode current can exceed 0·5mA. Under low duty cycle conditions such as viewing transients however, the peak cathode current may reach 2·0mA and the regulation of the power supplies to the anode 3 and anode 1 circuit and the cathode circuit should be adequate for such variations.

→Indicates a change

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15. The X electrodes and Y electrodes are designed primarily for symmetrical operation. Some degradation of focus and trace geometry will result if the tube is operated under asymmetric conditions.

16. These figures apply when the mean potentials of the X and Y electrodes and anode 3 are equal. When the mean deflection electrode potentials differ from the anode 3 voltage, a slightly wider range will be required.

17. Measured under the following conditions:

Anode 4 Voltage		Optimised
Anode 2 Voltage		Optimised
Grid Drive	25	V
Raster Size	5×5	cm
Vertical Lines	200	
Frame Repetition	50	c/s
Spot Velocity	500	m/sec

The line width measured with a microscope as in K1001. Compared with the shrinking raster method, this method is more accurate but pessimistic. Thus it must be remembered that the equivalent line width measured by the shrinking raster method will be considerably less than the value stated when comparison is made with data given in these terms.

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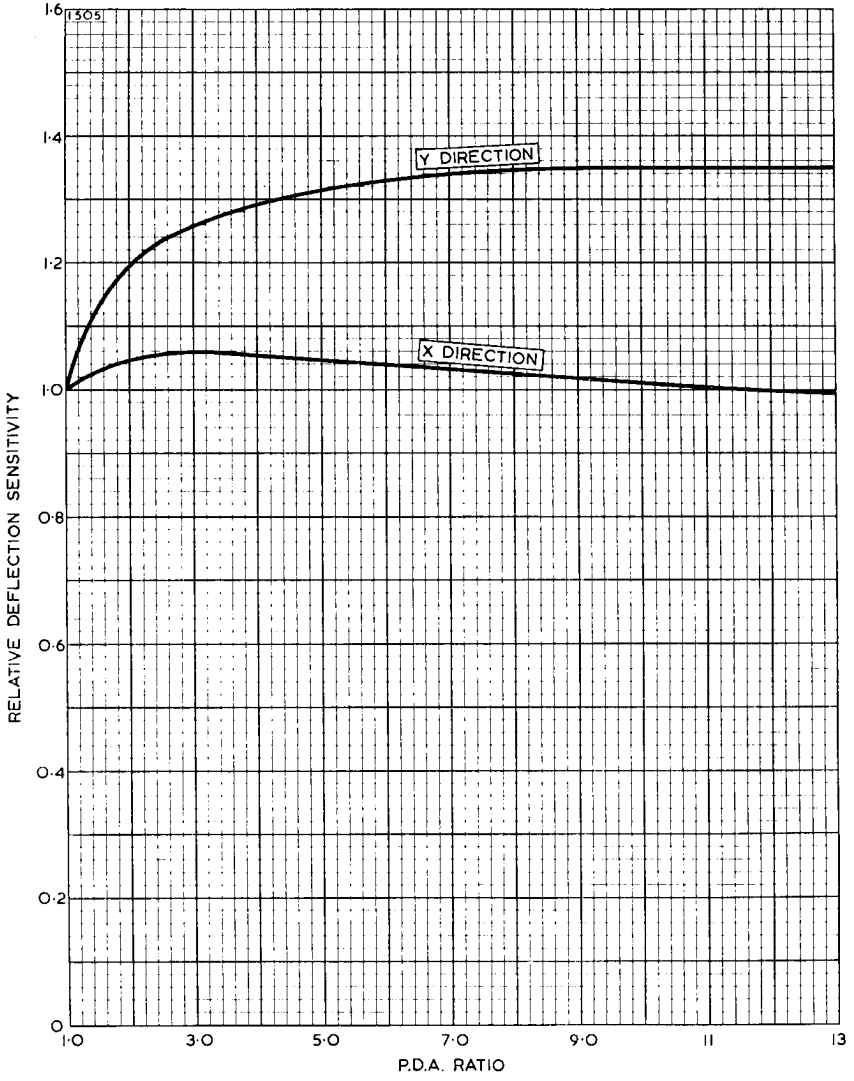
P.D.A. RATIO CHARACTERISTIC



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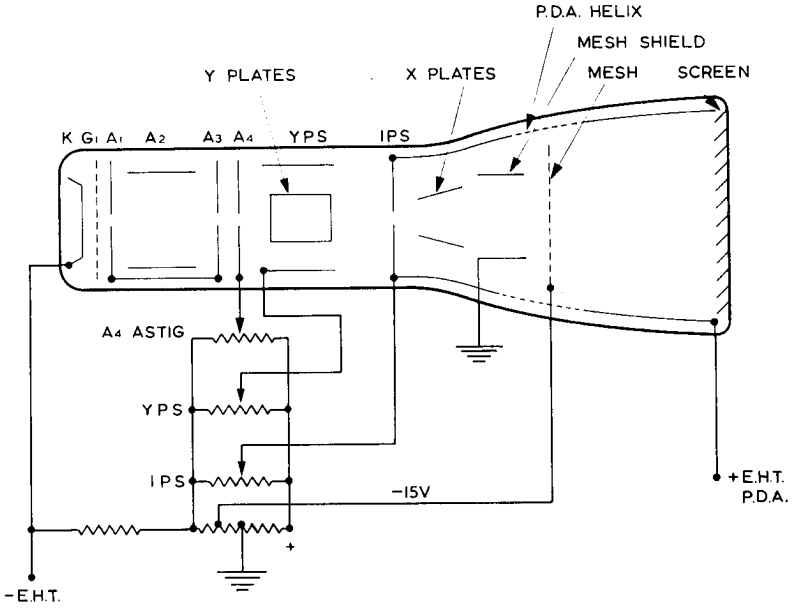
SCHEMATIC DIAGRAM

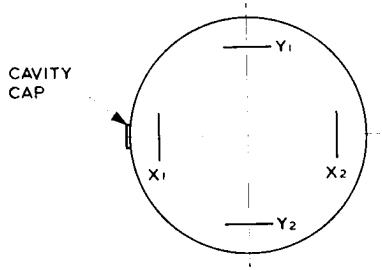
1483



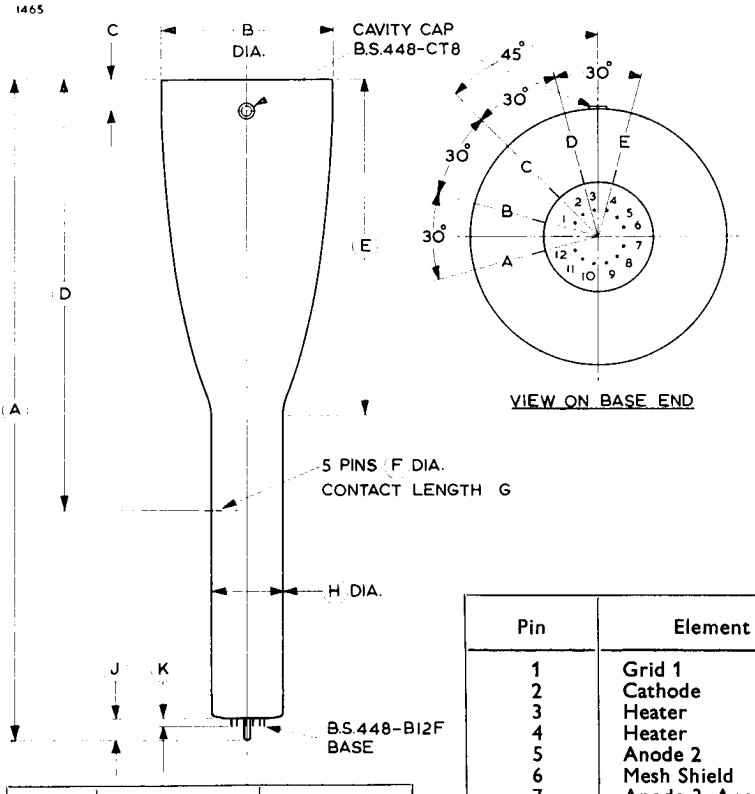
ORIENTATION OF DEFLECTION PLATES

(view on screen end of tube)

1482



OUTLINE



Ref.	Inches	Millimetres
A	20·71 Max	526·0 Max
→ B	5·374 Max	136·5 Max
→ C	1·575 ± 0·118	40·0 ± 3·0
D	13·425 ± 0·197	341·0 ± 5·0
E	10·512 ± 0·394	267 ± 10·0
F	0·039	1·00
G	0·236 ± 0·039	6·0 ± 1·0
H	2·283 Max	58·0 Max
J	0·709 Max	18·0 Max
K	0·248 Max	6·3 Max

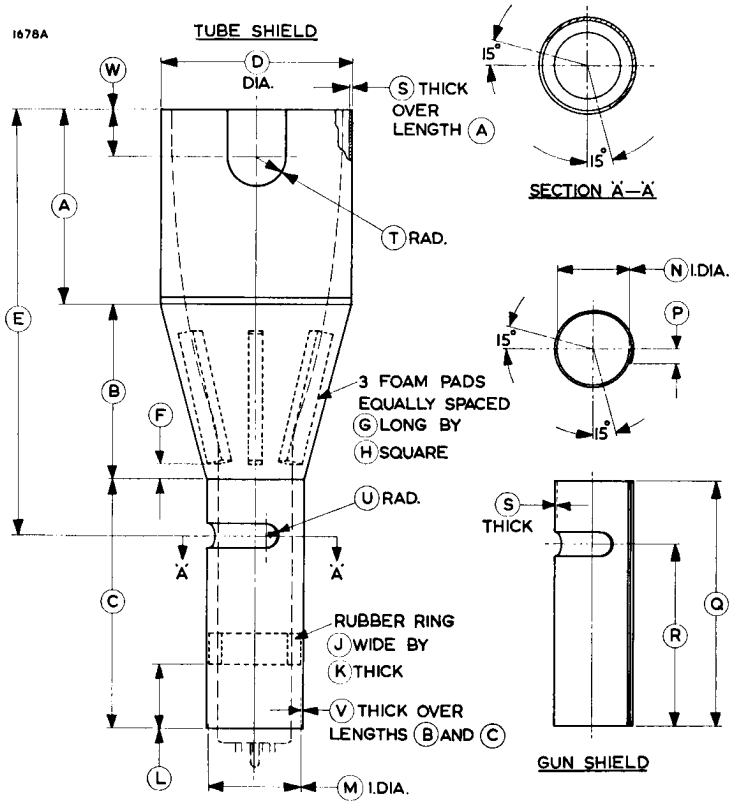
Inch dimensions have been derived from millimetres.

→Indicates a change

Pin	Element
1	Grid 1
2	Cathode
3	Heater
4	Heater
5	Anode 2
6	Mesh Shield
7	Anode 3, Anode 1
8	Anode 4
9	Mesh
10	Y Plate Shield
11	No Connection
12	No Connection
A	X2 Electrode
B	X1 Electrode
C	Interplate Shield
D	Y1 Electrode
E	Y2 Electrode
Cavity Cap	Anode 5 (Screen)

The overall bulb diameter 'B' does not include the cavity cap.

OUTLINE FOR MUMETAL SHIELDS



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	6·125	155·6	L	2·000	50·80
B	5·437	138·1	M	3·094	78·59
C	7·875	200·0	N	2·125	53·98
D	$5{\cdot}437^{+0{\cdot}031}_{-0{\cdot}000}$	$138{\cdot}1^{+0{\cdot}79}_{-0{\cdot}00}$	P	0·500 Approx	12·70 Approx
E	13·437	341·3	Q	7·750	196·9
F	0·500	12·70	R	5·750	146·1
G	4·000	101·6	S	0·015	0·38
H	0·500	12·70	T	1·000	25·40
J	1·000	25·40	U	0·375	9·53
K	0·437	11·10	V	0·036	0·91
			W	1·562	39·67

Millimetre dimensions have been derived from inches.

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OSCILLOSCOPE TUBES

T980H T980N T980X

INTRODUCTION

The T980H, T980N and T980X are 5-inch diameter cathode ray tubes for wide band, high speed oscilloscope applications. They are identical except for their screen characteristics and similar to the T979 series but are fitted with anode modulator electrodes.

The incorporation of a post deflection accelerator mesh and an internal spiral coating, together with an improved gun design, gives the tubes the following features:

(1) Deflection sensitivities in the X and Y directions of 9V/cm and 3V/cm respectively, making them particularly suitable for use with deflection circuits employing transistors.

(2) A large useful screen area, permitting the use of either 6 × 10cm or 8 × 8cm displays.

(3) Excellent brightness, giving a visible trace at writing speeds up to 1–3nsec/cm, and with negligible distortion introduced in the post deflection accelerator (P.D.A.) system. The small amounts of barrel or pin cushion distortion, linearity distortion and astigmatism present can be eliminated by adjustment of electrode potentials.

(4) Anode modulation plates give zero spot movement under normal operating conditions, but if only beam blanking is required, and spot movement can be tolerated, then modulation can be accomplished at a lower voltage.

(5) Good sensibility due to the small spot size.

(6) Variations of deflection sensitivities with variations in P.D.A. voltage are considerably reduced.

(7) Minimum deflector plate inductance and inter-plate capacitance, due to the deflector plate connections being made via short pins sealed into the side of the bulb.

GENERAL DATA

Electrical and General

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 1)	6·3	V
Heater Current	0·3 ± 10%	A
Faceplate	Flat, Clear Glass	
Screen (*See Note* 2)	Aluminised	
Deflection Method	Electrostatic	
Focus Method	Electrostatic	
Anode Modulation (*See Note* 3)	Electrostatic	
Linearity of Scan (*See Note* 4)	2	%
Raster Distortion (*See Note* 5)	±1	%
Orthogonality	90 + 1	Degrees

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Minimum useful scan

Y1 to Y2 (*See Note* 6)	8·0	cm
X1 to X2 (*See Note* 6)	10	cm

Undeflected Spot Position (to geometric centre of faceplate)

Y Orientation	±0·6	cm
X Orientation	±1·0	cm

Helix Resistance

Anode 5 to Interplate Shield	200	MΩ Min
→	1000	MΩ Max

Inter-Electrode Capacitances

(With all other electrodes not mentioned, and those marked*, earthed)

Grid to all other electrodes	6·1 pF Nom
Cathode to all other electrodes	5·7 pF Nom
Anode Modulator to all other electrodes	6·5 pF Nom
Anode Modulation Corrector to all other electrodes	8·8 pF Nom
Anode Modulator + Corrector to all other electrodes	11·4 pF Nom
Anode Modulator to anode modulation corrector	1·2 pF Nom
X1 Electrode to all other electrodes except X2*	3·5 pF Nom
X2 Electrode to all other electrodes except X1*	3·5 pF Nom
Y1 Electrode to all other electrodes except Y2*	2·9 pF Nom
Y2 Electrode to all other electrodes except Y1*	2·9 pF Nom
X1 to X2 Electrode	3·1 pF Nom
Y1 to Y2 Electrode	1·7 pF Nom
X1+X2 Electrodes to Y1+Y2 electrodes	<0·1 pF
X1+X2+Y1+Y2 Electrodes to cathode	<0·1 pF
X1+X2+Y1+Y2 Electrodes to grid	<0·1 pF

Mechanical

Overall Length	20·71 inches (526 mm)	Max
→ Overall Diameter (excluding cap)	5·37 inches (136·5 mm)	Max
Seated Height	21·260±0·236 inches (504±6 mm)	
Neck Diameter (excluding pins)	2·28 inches (58 mm)	Max
Useful Screen Area	2·36 by 3·94 or 3·15 by 3·15 inches	Min
	6·0 by 10 or 8·0 by 8·0cm	Min
Net Weight	3 pounds (1·4 kg)	Approx
Base		B.S.448–B12F
Anode 5 Cavity Cap		B.S.448–CT8
Mounting Position (*See Note* 7)		Any

→ Indicates a change

MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

(All voltages are with respect to cathode except where otherwise stated)

	Min	*Max*	
Anode 5 Voltage (*See Note* 8)	6·0	15*	kV
Anode 4 Voltage	1·0	3·3	kV
Anode 3 and Anode 1 Voltage	1·0	3·3	kV
Anode 2 Voltage	0	1·5	kV
Anode Modulator Voltage	−300*	+300*	V
Anode Modulation Corrector Voltage	−300*	+300*	V
Anode Modulator to Anodes 3 and 1 Impedance	—	25	kΩ
Anode Modulation Corrector to Anodes 3 and 1 Impedance	—	25	kΩ
Grid Bias Voltage (negative value)	0	200	V
Grid Voltage (positive peak value)	—	2·0	V
Cathode Current (Intermittent Mean)	—	0·3	mA
Y Plate Shield Voltage	—	3·3	kV
Interplate Shield Voltage	—	3·3	kV
Mesh Shield Voltage	—	3·3	kV
Mesh Voltage (negative with respect to mesh shield voltage)	10	20	V
Deflection Voltage on X or Y electrodes (Peak)	—	500	V
Heater to Cathode Voltage (Peak):			
Cathode positive	—	200	V
Cathode negative	—	125	V
Screen Dissipation (average)	—	5·0	mW/sq.cm
X1 or X2 to Anodes 3 and 1 Impedance	—	2·0	MΩ
Y1 or Y2 to Anodes 3 and 1 Impedance	—	1·0	MΩ
Grid to Cathode Impedance	—	1·0	MΩ
Anode 4 to Anodes 3 and 1 Impedance			(*See Note* 9)

*With respect to anode 3 and anode 1 voltage.

TYPICAL OPERATING CONDITIONS

Anode 5 (Screen) Voltage ..	12	12	12	kV
Mesh Voltage (with respect to mesh shield)	−15	−15	−15	V
Anode 4 Voltage (adjusted for minimum astigmatism) (*See Note* 10)	1·0	1·5	3·0	kV
Anode 3 and Anode 1 Voltage ..	1·0	1·5	3·0	kV
Anode 2 Voltage (for focus) ..	165 to 335	250 to 500	500 to 1000	V
Grid Voltage (for spot cut-off) ..	−30 to −57	−45 to −85	−90 to −170	V
Y Plate Shield Voltage (*See Note* 11)	1·0	1·5	3·0	kV
Interplate Shield Voltage (*See Note* 12)	1·0	1·5	3·0	kV
Mesh Shield Voltage (*See Note* 13)	1·0	1·5	3·0	kV
Anode Modulation; minimum spot movement; (30V grid drive) (*See Note* 3*a*):				
Anode Modulator Voltage*† ..	0	0	0	V
Anode Modulator Voltage*§ ..	−16	−24·2	−48·4	V
Anode Modulation Corrector Voltage*†	0	0	0	V
Anode Modulation Corrector Voltage*§	−18·3	−27·5	−55	V
Anode Modulator + Anode Modulation Corrector Current	(*See Note* 14)	(*See Note* 14)	(*See Note* 14)	
Anode Modulation for maximum sensitivity (30V grid drive) (*See Note* 3*b*):				
Anode Modulator Voltage*†	0	0	0	V
Anode Modulator Voltage*§	−8·6	−13	−26	V
Anode Modulator Current ..	(*See Note* 14)	(*See Note* 14)	(*See Note* 14)	
Mesh Current	(*See Note* 15)	(*See Note* 15)	(*See Note* 15)	
Anode 3 and Anode 1 Current ..	(*See Note* 16)	(*See Note* 16)	(*See Note* 16)	
Anode 2 Current	±15	±15	±15	μA
Cathode Current	(*See Note* 16)	(*See Note* 16)	(*See Note* 16)	
Deflection Factor (*See Note* 17):				
Mean Potential of X and Y plates	1·0	1·5	3·0	kV
X1 and X2 Electrodes:				
Mean	6·1	9·0	17·5	V/cm
Limits	5·3 to 6·8	8·0 to 10	15·5 to 19·5	V/cm
Y1 and Y2 Electrodes:				
Mean	2·0	3·0	6·2	V/cm
Limits	1·6 to 2·3	2·5 to 3·5	5·2 to 7·2	V/cm

†Zero modulation, i.e. full beam current. §For extinction of stationary spot.
*With respect to anode 3 and anode 1 voltage.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

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Correction Potential Ranges

Mesh (with respect to mesh shield) (*See Note* 18) ..	−12 to −18	−12 to −18	−12 to −18	V
Anode 4 (astigmatism) (*See Notes* 10 *and* 18)	±40	±40	±40	V
Y Plate Shield (*See Notes* 11 *and* 18)	±20	±20	±20	V
Interplate Shield (*See Notes* 12 *and* 18)	±60	±40	±20	V
Line Width (*See Note* 19) ..	0·6	0·5	0·3	mm

ASSOCIATED COMPONENTS

The following components can be obtained from the suppliers listed; there may possibly be alternative sources:

(1) B.S.448–B12F socket	Catalogue No. 77/842	Carr Fastener Co. Ltd., Stapleford, Notts.
(2) B.S.448–CT8 Cavity Cap Connector	Catalogue No. 77/699	Carr Fastener Co. Ltd., Stapleford, Notts.
(3) Side Pin Connectors	Miniature wander socket type WS1 (colours red, black or blue).	A.E.I. Clix, Radio and Electronics Components Division, Barton Hill, Bristol.
(4) Magnetic Shield to suit T980 series (*See page* 12)		Magnetic Shields Ltd., Headcorn Road, Staplehurst, Tonbridge, Kent.

NOTES

1. The heater is suitable for parallel operation only.
2. The T980 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent and Afterglow Colour	Persistence
T980H	H	P31	Blue-Green	Medium-Short
T980N	N	P2	Yellowish-Green	Medium
T980X	X	P7	Blue with Yellowish-Green Afterglow	Long

The tube can be manufactured with alternative screens, and customers' enquiries are invited.

3. (*a*) **Minimum Spot Movement Operation** (Patent applied for). In applications where spot movement caused by anode modulation is undesirable, the modulation electrodes can be operated as follows. The anode modulation corrector requires up to 20% more modulation voltage than the anode modulator to achieve minimum spot movement. The modulating signal is therefore connected directly to the anode modulation corrector and a proportion of the signal (adjusted for minimum spot movement) is fed to the anode modulator. The maximum signal required to cut off the beam in this case is 22V per kV of anode 1 voltage. By this method, zero spot movement can be obtained for a given value of grid drive, and at other values of grid drive the spot movement will be very small (less than one spot diameter). If a slightly greater spot movement can be tolerated, the anode modulator and anode modulation corrector may be connected together.
   (*b*) **Maximum Sensitivity Operation** In applications where spot movement is acceptable, the modulating signal is applied to the anode modulator and the anode modulation corrector is connected to Anode 1. The maximum signal required to cut off the beam in this case is 15V per kV of anode 1 voltage and the spot movement is approximately 7mm.
   N.B. The anode modulation electrodes cannot be used with positive signals to obtain beam brightening.
4. The deflection factor for a deflection of 75% of the useful scan will not differ from that for a deflection of 25% by more than 2%.
5. The edges of a 6 × 10cm raster will fall between two concentric rectangles 101 × 60·6mm and 99 × 59·4mm.
6. The tube can be used for either 6 × 10cm or 8 × 8cm displays.
7. The tube should be supported near the screen and also on the parallel neck near the base; it should not be supported by the base only. The socket should not be mounted rigidly, but should have flexible leads and be able to move freely. To avoid the need for excessive magnetic shielding the tube should be mounted as far away as possible from transformers, chokes and other sources of stray field.
8. Anode 5 may be operated at a voltage lower than the minimum specified but the light output will then be limited by the screen aluminising.
9. When high beam currents are used, anode 4 collects current and the anode 4 to anodes 3 and 1 impedance should be kept as low as possible to avoid defocusing.
10. Adjustment of the anode 4 voltage about the mean Y plate potential is used to correct astigmatism introduced in the deflection system. The range of voltage required is of the order of ±40V.
11. The Y plate shields should be operated about the mean potential of the Y1 and Y2 electrodes. Variation of the potential about this value controls the edge effects of the Y deflection electrode field and provides a fine adjustment of the deflection linearity in the Y direction.

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12. Variation of the interplate shield voltage about the mean potential of the deflector electrodes provides correction for barrel and pin cushion distortion. When the mean potentials of the X and Y deflection electrodes are equal, a range of ±40V maximum is required (with anode 3 and anode 1 voltage of 1·5kV); the range is slightly wider when the mean potentials are not equal.

13. The mesh shield should be operated at approximately the mean X plate potential.

14. The total current will be approximately 50% of the anode 3 and anode 1 current and will be of the opposite direction.

15. At peak beam current, the mesh current will be of the order of 5μA.

16. When anode modulation is used as the sole means of modulating the beam, ← the cathode current must never exceed 0·3mA. Where cathode modulation or grid modulation is used in addition to anode modulation, or cathode and grid modulation are used without anode modulation, the peak anode 1 and 3 current, and the peak cathode current can exceed 0·5mA, and under low duty cycle conditions, such as viewing transients, may reach 2·0mA. Under these conditions the regulation of the power supplies to the anode 1 and anode 3 circuit and cathode circuit should be adequate for such variation.

17. The X electrodes and Y electrodes are designed primarily for symmetrical operation. Some degradation of focus and trace geometry will result if the tube is operated under asymmetric conditions.

18. These figures apply when the mean potentials of the X and Y electrodes and anode 3 are equal. When the mean deflection electrode potentials differ from the anode 3 voltage, a slightly wider range will be required.

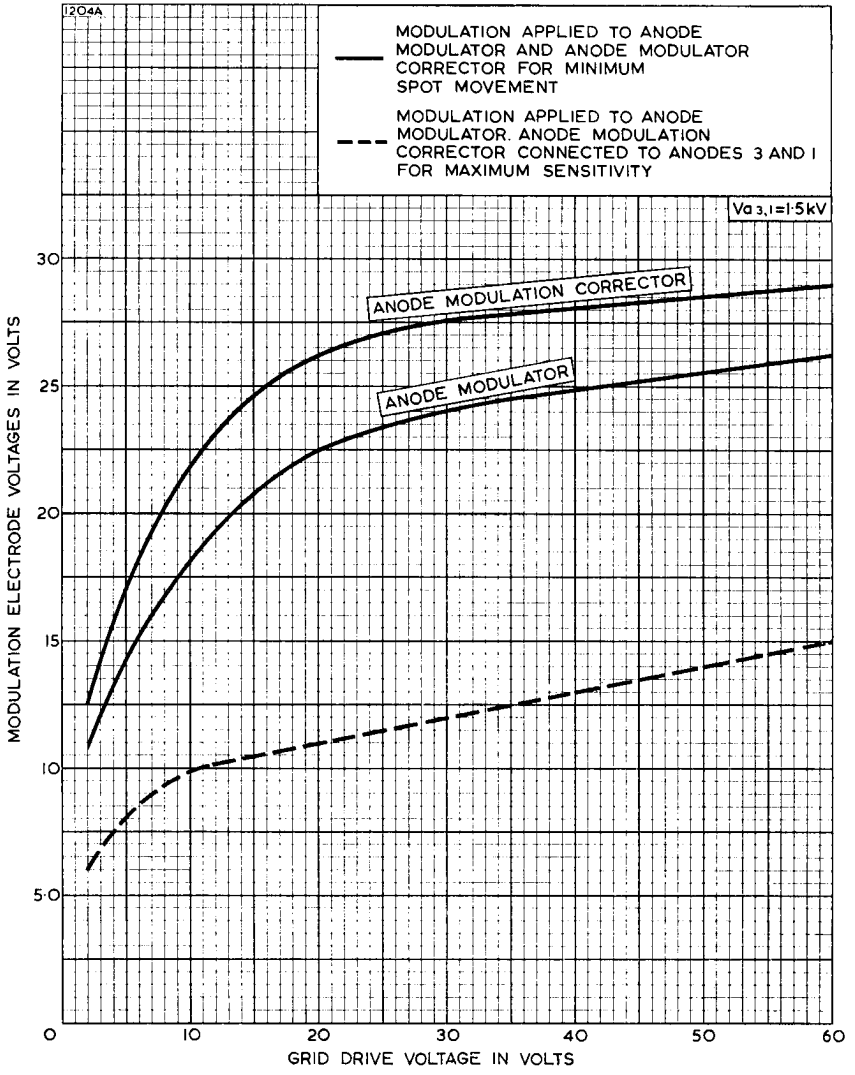
19. Measured under the following conditions:

Anode 4 Voltage	Optimised	
Anode 2 Voltage	Optimised	
Grid Drive	25	V
Raster Size	5×5	cm
Vertical Lines	200	
Frame Repetition	50	c/s
Spot Velocity	500	m/sec

The line width measured with a microscope as in K1001. Compared with the shrinking raster method, this method is more accurate but pessimistic. Thus it must be remembered that the equivalent line width measured by the shrinking raster method will be considerably less than the value stated when comparison is made with data given in these terms.

← Indicates a change

MODULATION VOLTAGE CHARACTERISTICS



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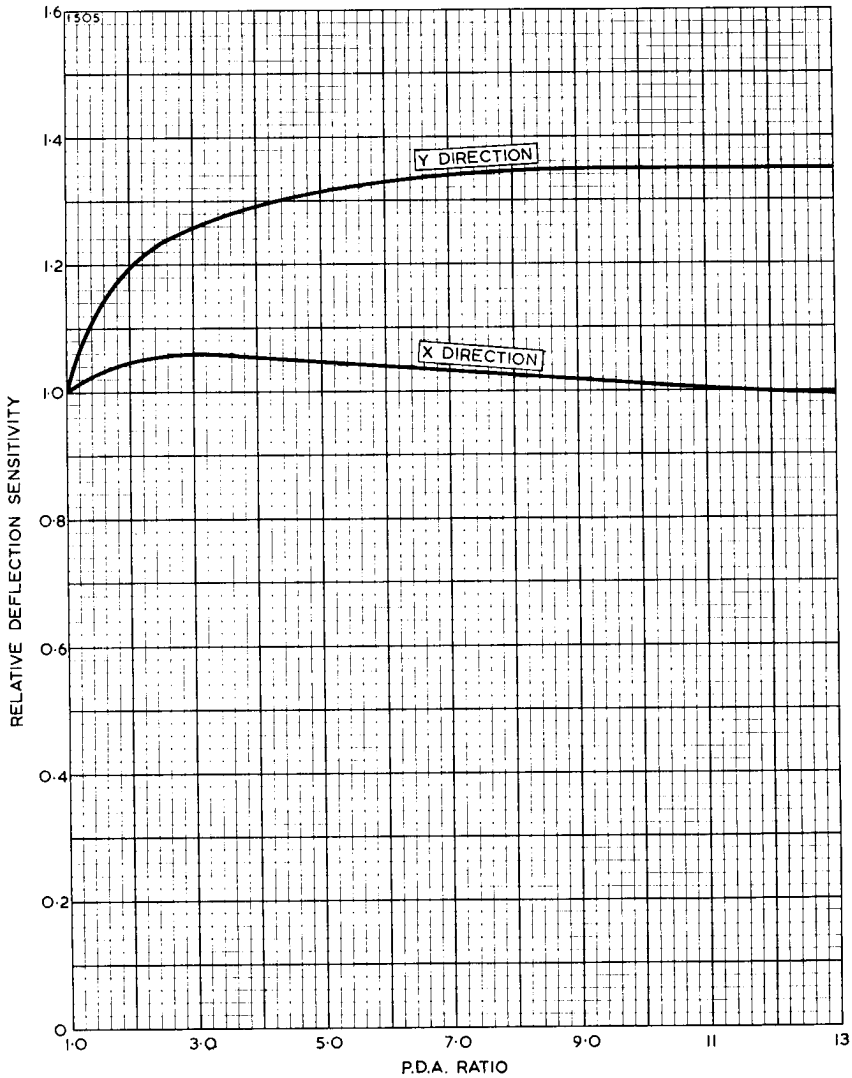
P.D.A. RATIO CHARACTERISTIC



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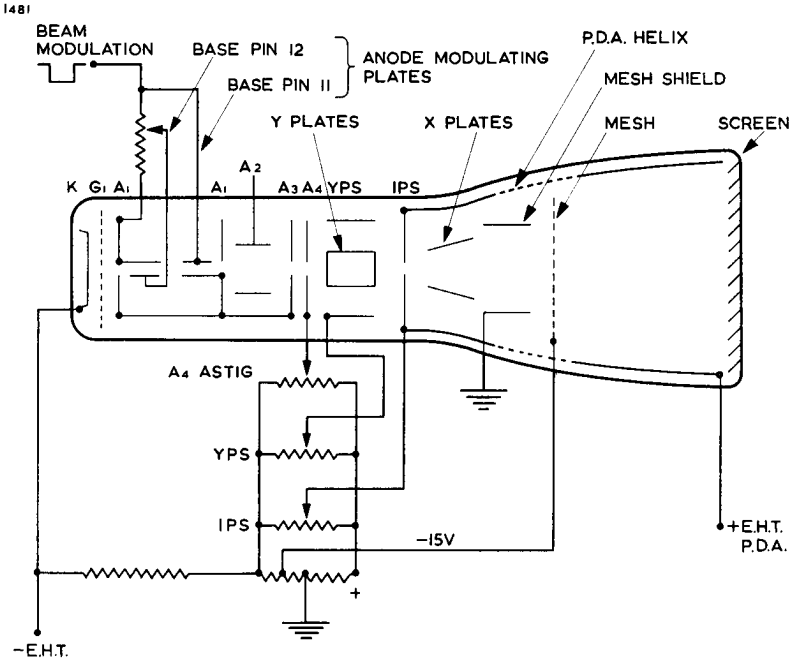
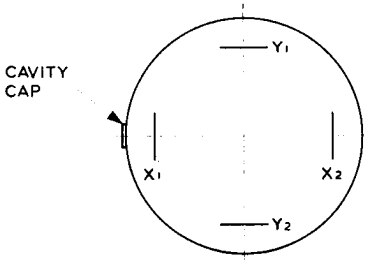
SCHEMATIC DIAGRAM

1481

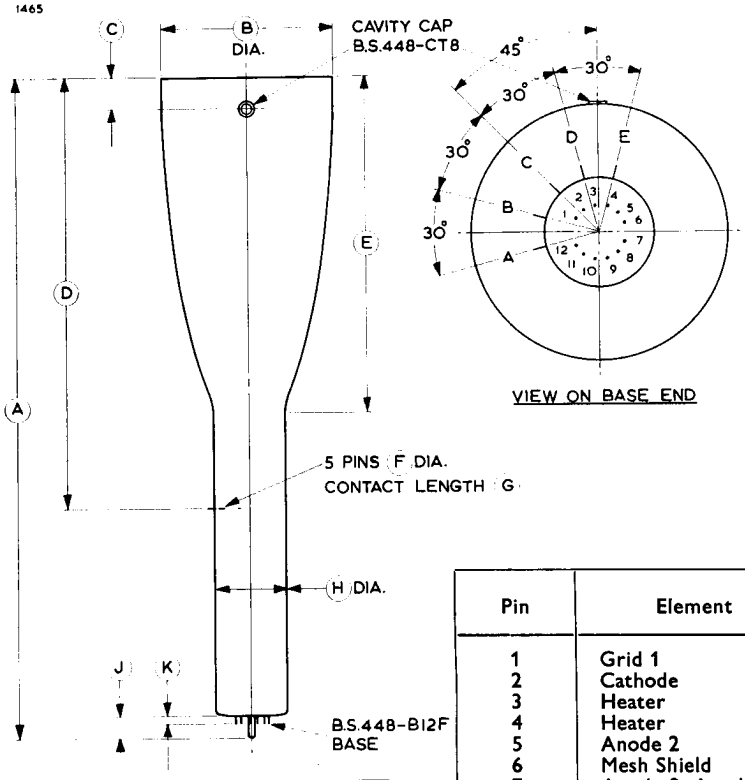


ORIENTATION OF DEFLECTION PLATES
(view on screen end of tube)

1482



OUTLINE



Ref.	Inches	Millimetres
A	20·71 Max	526·0 Max
→ B	5·374 Max	136·5 Max
→ C	1·575 ± 0·118	40·0 ± 3·0
D	13·425 ± 0·197	341·0 ± 5·0
E	10·512 ± 0·394	267·0 ± 10·0
F	0·039	1·00
G	0·236 ± 0·039	6·0 ± 1·0
H	2·283 Max	58·0 Max
J	0·709 Max	18·0 Max
K	0·248 Max	6·3 Max

Inch dimensions have been derived from millimetres.

→ Indicates a change

Pin	Element
1	Grid 1
2	Cathode
3	Heater
4	Heater
5	Anode 2
6	Mesh Shield
7	Anode 3, Anode 1
8	Anode 4
9	Mesh
10	Y Plate Shield
11	Anode Modulation Corrector
12	Anode Modulator
A	X2 Electrode
B	X1 Electrode
C	Interplate Shield
D	Y1 Electrode
E	Y2 Electrode
Cavity Cap	Anode 5 (Screen)

The overall bulb diameter 'B' does not include the cavity cap.

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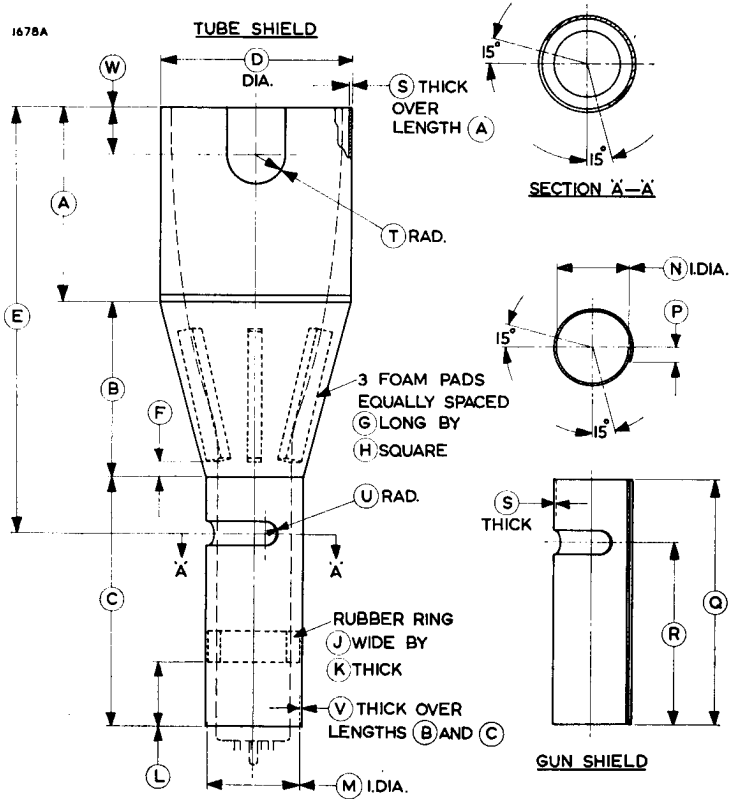
OUTLINE FOR MUMETAL SHIELDS



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	6·125	155·6	L	2·000	50·80
B	5·437	138·1	M	3·094	78·59
C	7·875	2·000	N	2·125	53·98
D	$5{\cdot}437^{+0{\cdot}031}_{-0{\cdot}000}$	$138{\cdot}1^{+0{\cdot}79}_{-0{\cdot}00}$	P	0·500 Approx	12·70 Approx
E	13·437	341·3	Q	7·750	196·9
F	0·500	12·70	R	5·750	146·1
G	4·000	101·6	S	0·015	0·38
H	0·500	12·70	T	1·000	25·40
J	1·000	25·40	U	0·375	9·53
K	0·437	11·10	V	0·036	0·91
			W	1·562	39·67

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC

ABRIDGED DATA

12-inch diameter, high resolution radar tubes.

Neck Diameter	1·378 inches	(35 mm)
Deflection Angle	50	Degrees
Deflection Method		Magnetic
Focus Method		Electrostatic
E.H.T. Voltage	15	kV

GENERAL

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 1)	6·3	V
Heater Current	0·3	A
Faceplate		Clear
Screen (*See Note* 2)		Aluminised
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	12·0	pF
Cathode to all other electrodes, less than	12·0	pF

Mechanical

Overall Length	19·449 inches	(494 mm)	Max
Overall Diameter	12·087 inches	(307 mm)	Max
Useful Screen Diameter	10·433 inches	(265 mm)	Min
Neck Diameter	1·398 inches	(35·5 mm)	Max
Net Weight	12 pounds	(5·5 kg)	Approx
Base			B.S.448–B12A
Final Anode Connection			B.S.448–CT8 Cavity Cap
Mounting Position			*See Note* 3

MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

(All voltages with respect to cathode except where otherwise stated)

	Min	*Max*	
Anode 2 and Anode 4 Voltage	8·0	18	kV
Anode 3 Voltage:			
Positive value	—	700	V
Negative value	—	500	V
Anode 1 Voltage	200	500	V
Grid Voltage, negative value (*See Note* 4)	1·0	200	V
Heater to Cathode Voltage (*See Note* 5)	—	150	V
Cathode Current (Mean)	—	150	μA
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50Hz)	—	0·5	MΩ

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	15	kV
Anode 3 Voltage (*See Note* 6)	0 to +400	V
Anode 3 Current	−15 to +15	μA
Anode 1 Voltage	300	V
Grid Voltage for cut-off	−30 to −70	V
Grid Drive for 50μA beam current	10 to 30	V
Spot Size at 50μA beam current	0·45	mm

BEAM CENTRING

In order to obtain maximum brightness and the best focused spot size, stray magnetic fields must be minimised over the length of the gun structure. This may be achieved by using a tubular mumetal shield over the neck.

Where optimum performance is required, a small magnet should be used for centring the beam in the defining aperture. (Elac type BC11 is suitable.) The magnet should be located in the region of the grid and its position and strength adjusted to give maximum brightness.

X-RAY WARNING

X-Rays are produced when types in the T982 series are operated with anode voltages above 16kV (absolute value). These rays can constitute a health hazard unless the tubes are adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect on the design of the tubes.

NOTES

1. The heater is suitable for series or parallel operation. In series operation the surge heater voltage must not exceed 9·5V r.m.s. when the supply is switched on and a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.
2. Tubes in the T982 series have screens with the following characteristics.

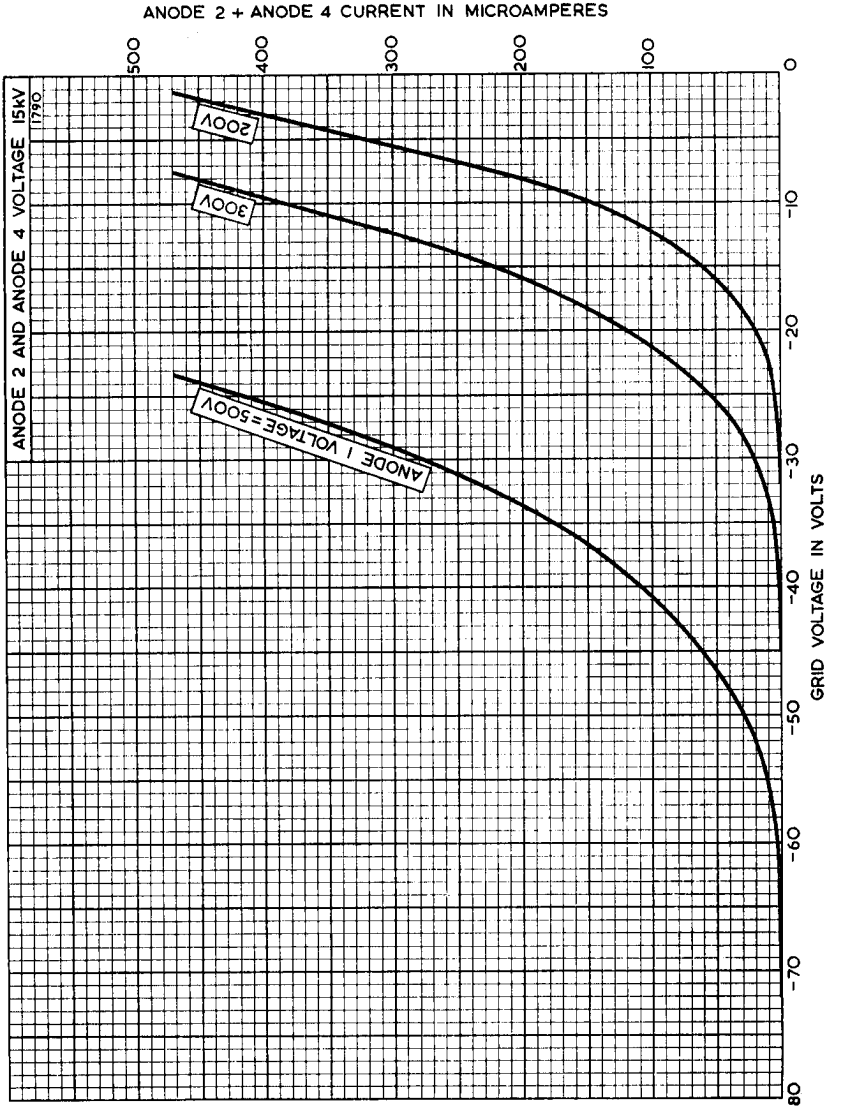
Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T982D	D*	E.V.S.007	Yellow-orange	Long
T982Y	Y*	P33	Orange	Long
T982Z	Z*	P26	Orange	Very Long

*This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots. The tube can be manufactured with alternative screens, and customers' enquiries are invited.

3. The tube may be mounted in any position except with the screen down and the axis of the tube making an angle of less than 20° with the vertical.
4. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the period immediately after switching the equipment on or off when it may be allowed to rise to +1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.
5. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than 20V r.m.s.
6. An acceptable focus quality will be obtained with an anode 3 voltage range of 0 to +400V. If it is required to pass through the point of focus a voltage range of at least −100 to +500V will be required.

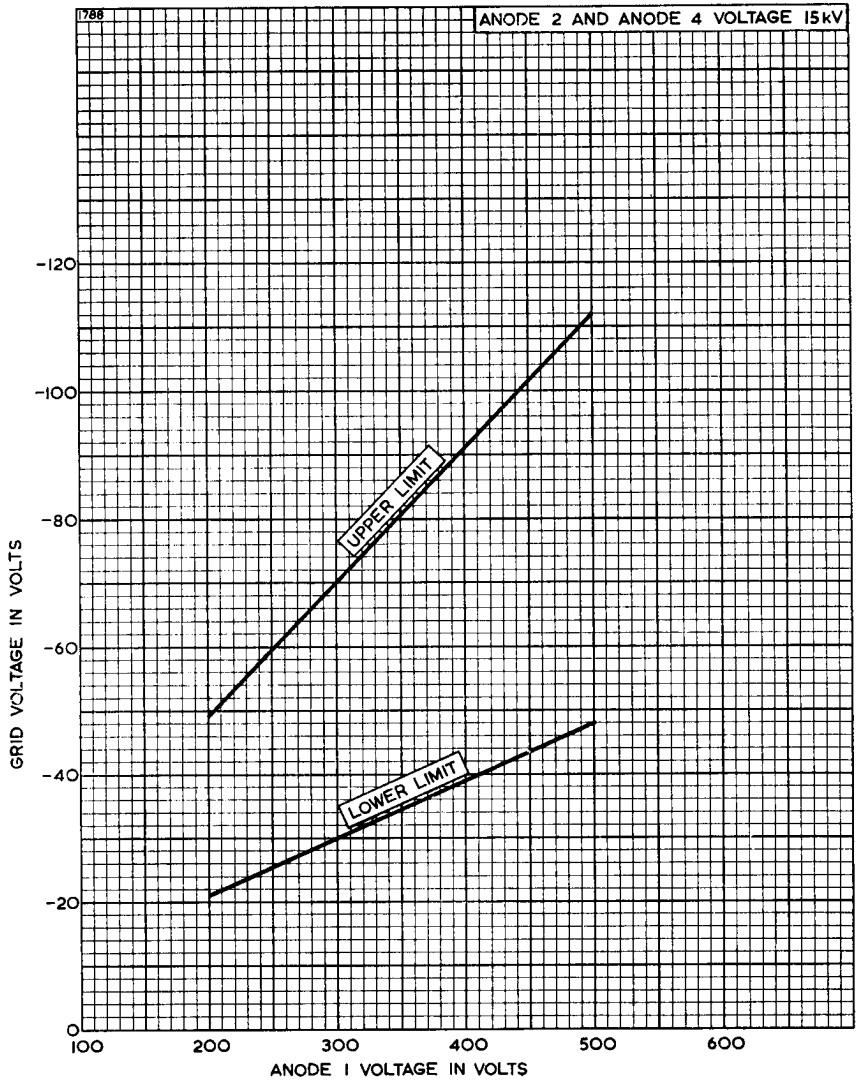
ENGLISH ELECTRIC

GRID VOLTAGE CHARACTERISTICS



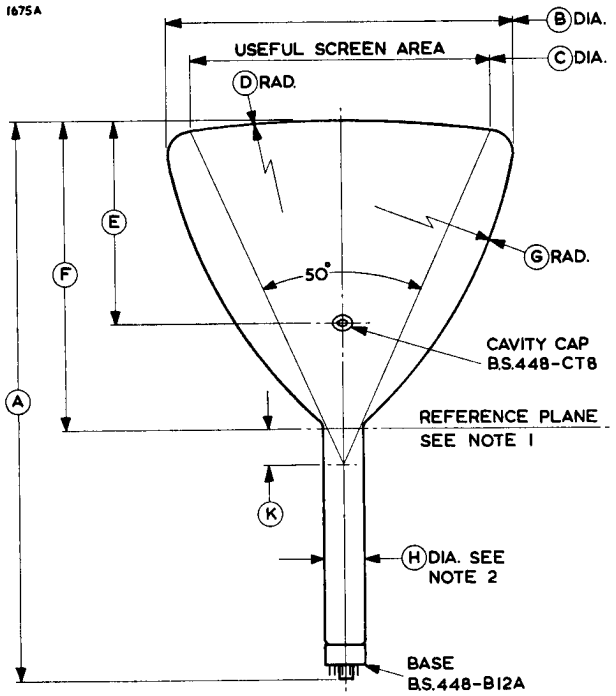
ENGLISH ELECTRIC

GRID VOLTAGE CUT-OFF LIMITS



ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	$19{\cdot}134^{+0{\cdot}315}_{-0{\cdot}276}$	$486{\cdot}0^{+8{\cdot}0}_{-7{\cdot}0}$	E	$7{\cdot}087 \pm 0{\cdot}020$	$180{\cdot}0 \pm 5{\cdot}0$
B	$12{\cdot}008^{+0{\cdot}079}_{-0{\cdot}098}$	$305{\cdot}0^{+2{\cdot}0}_{-2{\cdot}5}$	F	$10{\cdot}709 \pm 0{\cdot}138$	$272{\cdot}0 \pm 3{\cdot}5$
C	10·433	265·0	G	16·772	426·0
D	39·370	1000·0	H	$1{\cdot}368 \pm 0{\cdot}030$	$34{\cdot}75 \pm 0{\cdot}75$
			K	1·260	32·0

Inch dimensions have been derived from millimetres.

NOTES

1. Reference plane determined by 36·0mm diameter ring gauge.
2. A ring gauge 36·0mm diameter by 100mm long will pass over base and neck to reference plane.

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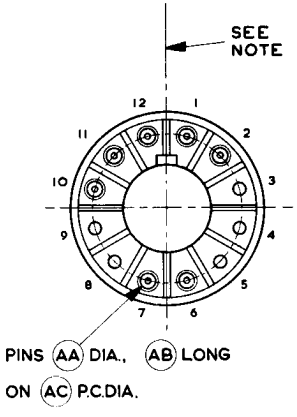
OUTLINE DETAILS

1198B



Pin	Element
1	Heater
2	Grid
3	No Pin
4	No Pin
5	No Pin
6	Anode 3
7	Internal Connection
8	No Pin
9	No Pin
10	Anode 1
11	Cathode
12	Heater
Cavity Cap	Anode 2 & Anode 4

Ref.	Inches	Millimetres
AA	0·093 ± 0·003	2·362 ± 0·076
AB	0·410 Max	10·41 Max
AC	1·063	27·00

Millimetre dimensions have been derived from inches.

Note: The anode cavity cap will be in line with the base key to within 15°.

RADAR TUBE

T983Z

ABRIDGED DATA

16-inch diameter, high resolution radar tube.

Neck Diameter	1·378 inches (35mm)
Deflection Angle	50 Degrees
Deflection Method	Magnetic
Focus Method	Electrostatic
E.H.T. Voltage	15 kV

GENERAL

Electrical and General

Cathode	Indirectly Heated, Oxide Coated
Heater Voltage (*See Note* 1)	6·3 V
Heater Current	0·3 A
Faceplate	Clear
Screen (*See Note* 2)	Aluminised
Fluorescent Colour	Orange
Persistence	Very Long
Inter-electrode Capacitances:	
Grid to all other electrodes, less than	12 pF
Cathode to all other electrodes, less than	12 pF

Mechanical

Overall Length	24·016 inches	(610 mm)	Max
Overall Diameter	16·142 inches	(410 mm)	Max
Useful Screen Diameter	14·685 inches	(373 mm)	Min
Neck Diameter	1·398 inches	(35·5 mm)	Max
Net Weight	24 pounds	(11 kg)	Approx
Base	B.S.448–B12A		
Final Anode Connection	Cavity Cap B.S.448—CT8		
Mounting Position	*See Note* 3		

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MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

(All voltages with respect to cathode except where otherwise stated)

	Min	*Max*	
Anode 2 and Anode 4 Voltage	8·0	18	kV
Anode 3 Voltage:			
positive	—	700	V
negative	—	500	V
Anode 1 Voltage	200	500	V
Grid Voltage, negative value (*See Note* 4)	1·0	200	V
Heater to Cathode Voltage (*See Note* 5)	—	150	V
Cathode Current (Mean)	—	150	μA
Grid to Cathode Resistance	—	1·5	MΩ
Grid to Cathode Impedance (at 50Hz)	—	0·5	MΩ

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	15	kV
Anode 3 Voltage (*See Note* 6)	0 to +400	V
Anode 3 Current	−15 to +15	μA
Anode 1 Voltage	300	V
Grid Voltage for cut-off	−30 to −70	V
Spot Size at 50μA beam current	0·55	mm

BEAM CENTRING

In order to obtain maximum brightness and the best focused spot size, stray magnetic fields must be minimised over the length of the gun structure. This may be achieved by using a tubular mumetal shield over the neck.

Where optimum performance is required, a small magnet should be used for centring the beam in the defining aperture. (Elac type BC11 is suitable.) The magnet should be located in the region of the grid and its position and strength adjusted to give maximum brightness.

X-RAY WARNING

X-Rays are produced when the T983Z is operated with anode voltages above 16kV (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect on the design of the tube.

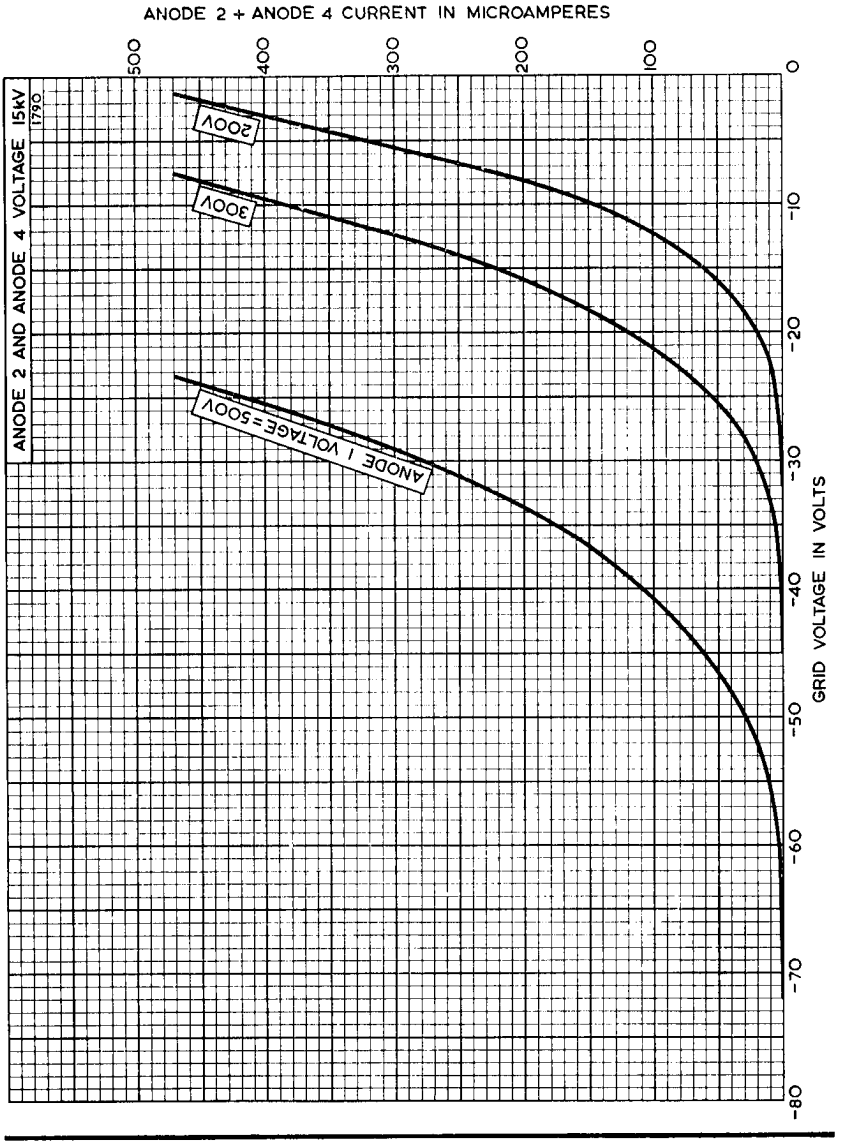
NOTES

1. The heater is suitable for series or parallel operation. In series operation the surge heater voltage must not exceed $9{\cdot}5V_{r.m.s.}$ when the supply is switched on and a current limiting device may be necessary in the circuit to ensure that this voltage is not exceeded.
2. The T983Z is supplied with an EEV Z screen which has very long persistence and satisfies the requirements of E.V.S.009 screen specification. This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots.

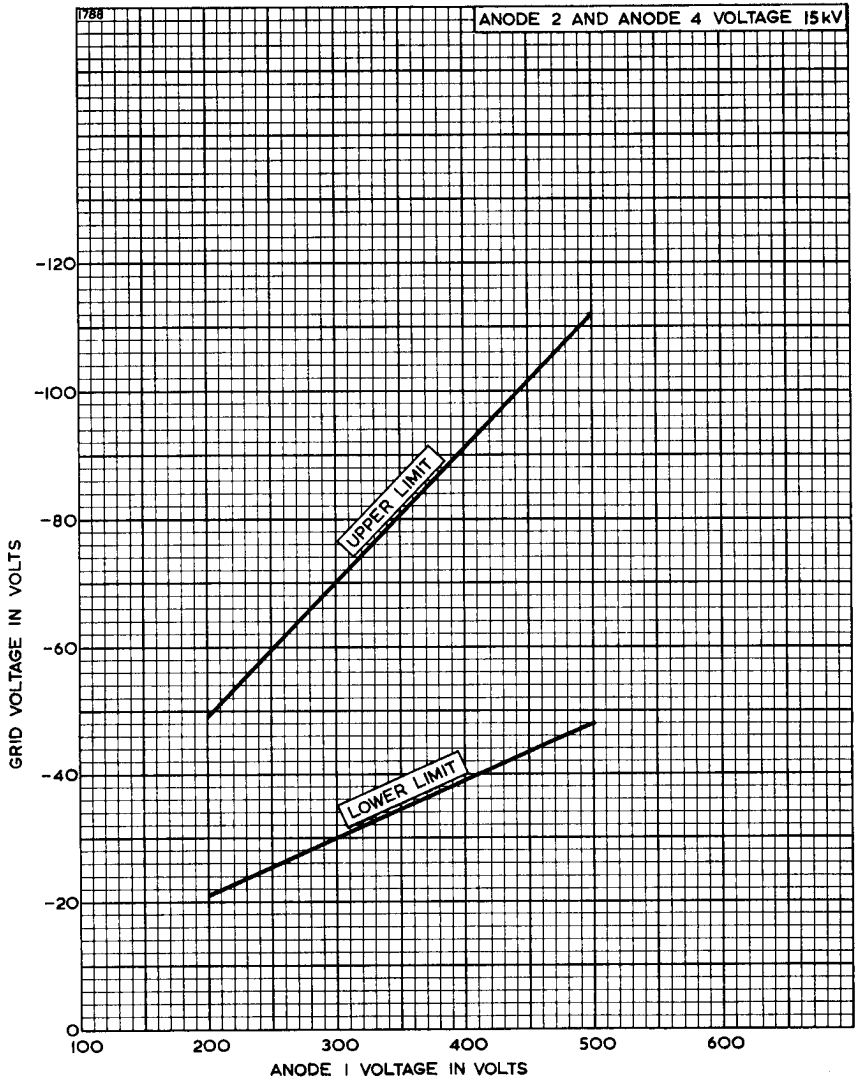
   The tube can be manufactured with alternative screens, and customers' enquiries are invited.
3. The tube may be mounted in any position except with the screen down and the axis of the tube making an angle of less than 20° with the vertical.
4. The d.c. value of grid bias must not be allowed to become positive with respect to the cathode except during the period immediately after switching the equipment on or off when it may be allowed to rise to +1V. The maximum positive grid excursion may reach 2V and at this voltage the grid current may be expected to be approximately 2mA.
5. To avoid excessive hum, the a.c. component of the heater to cathode voltage should be as low as possible, preferably less than $20V_{r.m.s.}$
6. An acceptable focus quality will be obtained with an anode 3 voltage range of 0 to +400V. If it is required to pass through the point of focus a voltage range of at least −100 to +500V will be required.

ENGLISH ELECTRIC

GRID VOLTAGE CHARACTERISTICS



GRID VOLTAGE CUT-OFF LIMITS



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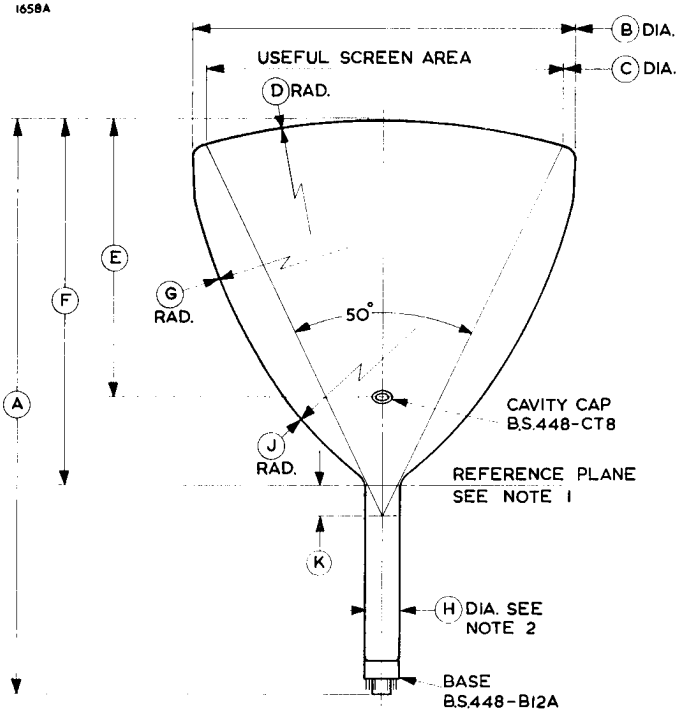
ENGLISH ELECTRIC

OUTLINE



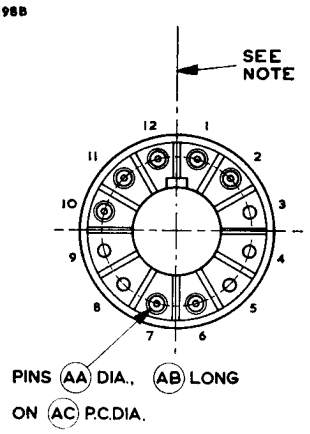
Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	23·622 ± 0·394	600·0 ± 10·0	G	23·504	597·0
B	15·984 ± 0·157	406·0 ± 4·0	H	$1{\cdot}378^{+0{\cdot}020}_{-0{\cdot}039}$	$35{\cdot}00^{+0{\cdot}5}_{-1{\cdot}0}$
C	14·685 Min	373·0 Min	J	16·732	425·0
D	27·559	700·0	K	1·260	32·0
E	11·417 ± 0·394	290·0 ± 10·0			
F	14·961 ± 0·197	380·0 ± 5·0			

Inch dimensions have been derived from millimetres.

NOTES

1. Reference plane determined by 36·0mm diameter ring gauge.
2. A ring gauge 36·0mm diameter by 100mm long will pass over base and neck to reference plane.

OUTLINE DETAILS



Pin	Element
1	Heater
2	Grid
3	No Pin
4	No Pin
5	No Pin
6	Anode 3
7	Internal Connection
8	No Pin
9	No Pin
10	Anode 1
11	Cathode
12	Heater
Cavity Cap	Anode 2 & Anode 4

Ref.	Inches	Millimetres
AA	0·098 ± 0·003	2·362 ± 0·076
AB	0·410 Max	10·41 Max
AC	1·063	27·00

Millimetre dimensions have been derived from inches.

Note: The anode cavity cap will be in line with the base key to within 15°.

ENGLISH ELECTRIC

ABRIDGED DATA

12-inch diameter high brightness Radar Tubes intended primarily for marine radar P.P.I. displays. The narrow scan angle permits the use of valve or transistor scan amplifiers. They are electrically and mechanically interchangeable with T974Y and T974Z, but give a display more than twice as bright when operated under the same conditions.

Neck Diameter	1·378 inches	(35mm)
Deflection Angle	40	Degrees
Deflection Method		Magnetic
Focus Method		Electrostatic
E.H.T. Voltage	16	kV

GENERAL

Electrical and General

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage (*See Note* 1)	6·3	V
Heater Current	0·3±10%	A
Screen (*See Note* 2)		Aluminised
Inter-electrode Capacitances:		
Grid to all other electrodes, less than	8·0	pF
Cathode to all other electrodes, less than	8·0	pF
Anode 2 and Anode 4 to external conductive coating (*See Note* 3)	1500	pF

Mechanical

Overall Length	22·560 inches	(573 mm)	Max
Overall Diameter	12·090 inches	(307 mm)	Max
Useful Screen Diameter	10·430 inches	(265 mm)	Min
Neck Diameter	1·400 inches	(35·5 mm)	Max
Net Weight	13½ pounds	(6·2 kg)	Approx
Base (*See Note* 4)			B8H
Anode 2 and Anode 4 Connection			B.S.448–CT8 Cavity Cap
Mounting Position (*See Note* 4)			Any

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MAXIMUM AND MINIMUM RATINGS

(Absolute Values. *See Note* 5)

	Min	*Max*	
Anode 2 and Anode 4 Voltage (*See Note* 6) ..	8·0	18	kV
Anode 3 Voltage:			
Positive value	—	1·0	kV
Negative value	—	0·5	kV
Anode 1 Voltage	0·2	0·8	kV
Grid Voltage (negative value)	1·0	200	V
Grid to Cathode Impedance (at 50Hz) ..	—	0·5	MΩ
Grid to Cathode Resistance	—	1·5	MΩ
Heater to Cathode Voltage:			
Heater positive with respect to cathode			
D.C.	—	150	V
Peak	—	250	V
Heater negative with respect to cathode			
D.C.	—	150	V
Peak	—	300	V
Heater to Cathode Resistance		*See Note* 7	

TYPICAL OPERATING CONDITIONS

Anode 2 and Anode 4 Voltage	12 to 16	kV
Anode 3 Voltage	−100 to +300	V
Anode 3 Current (positive or negative)	15	μA
Anode 1 Voltage	600	V
Anode 1 Current (positive or negative)	15	μA
Grid Voltage for visual cut-off	−40 to −85	V
Cathode Voltage for visual cut-off (*See Note* 8) ..	43 to 82	V

NOTES

1. The heater is suitable for either series or parallel operation. In series operation, the surge heater voltage when switching on must not exceed $9{\cdot}5V_{r.m.s.}$ and a current limiting device may be required in the circuit to reduce the surge voltage below this value.

2. Tubes in the T986 series have screens with the following characteristics.

Type	EEV Screen	Equivalent	Fluorescent Colour	Persistence
T986D	D*	E.V.S.007	Yellow-orange	Long
T986Y	Y*	P33	Orange	Long
T986Z	Z*	P26	Orange	Very Long

*This is a fluoride screen which is sensitive to burn and should not be operated with slow moving spots. The tube can be manufactured with alternative screens, and customers' enquiries are invited.

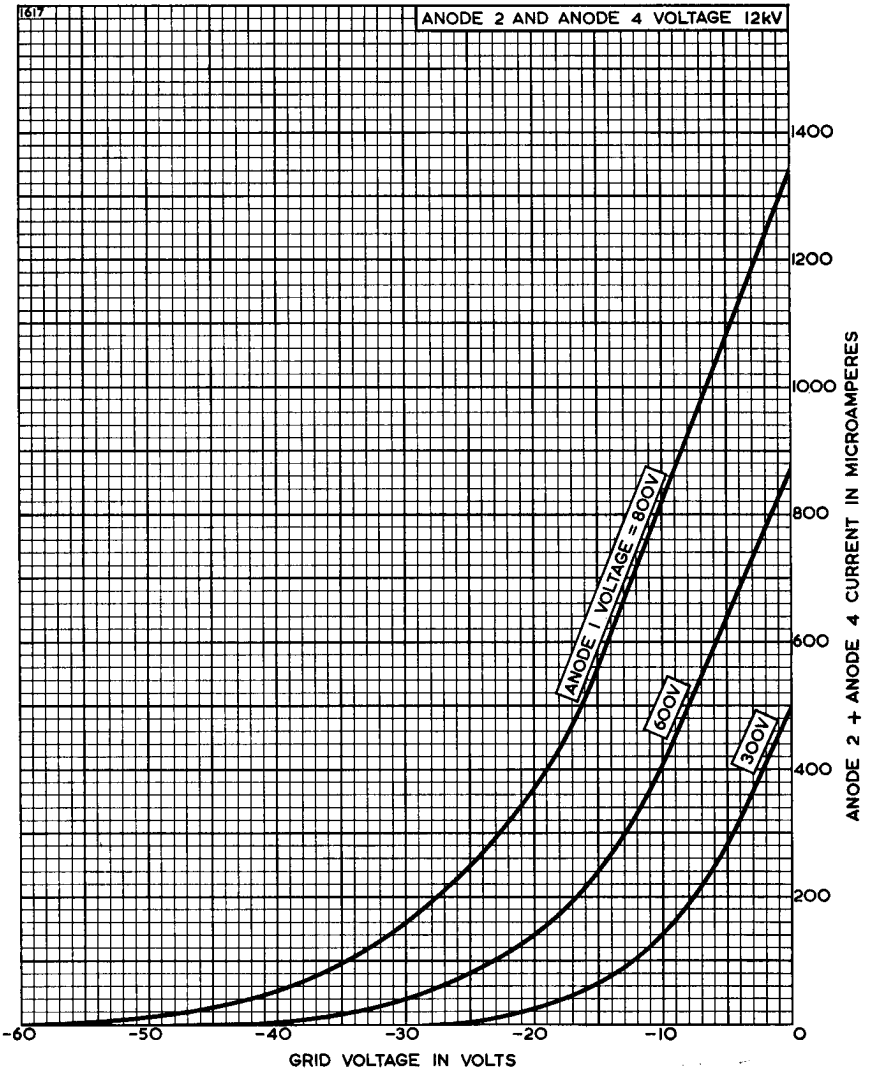
3. The capacitance of anode 2 and anode 4 to the external conductive coating may be used to provide smoothing for the e.h.t. supply.
4. The tube should not be supported by the base alone and under no circumstances should the socket be used for support purposes.
5. All voltages are with respect to cathode except where otherwise specified.
6. The associated equipment should be adequately protected against damage caused by possible high voltage flashovers inside the tube.
7. When the heater is in a series chain or earthed, the impedance between the cathode and earth at 50Hz must not exceed 100kΩ. When the heater is supplied from a separate transformer, the heater to cathode resistance must not exceed 1MΩ.
8. For cathode modulation, all voltages are with respect to the grid.

X-RAY WARNING

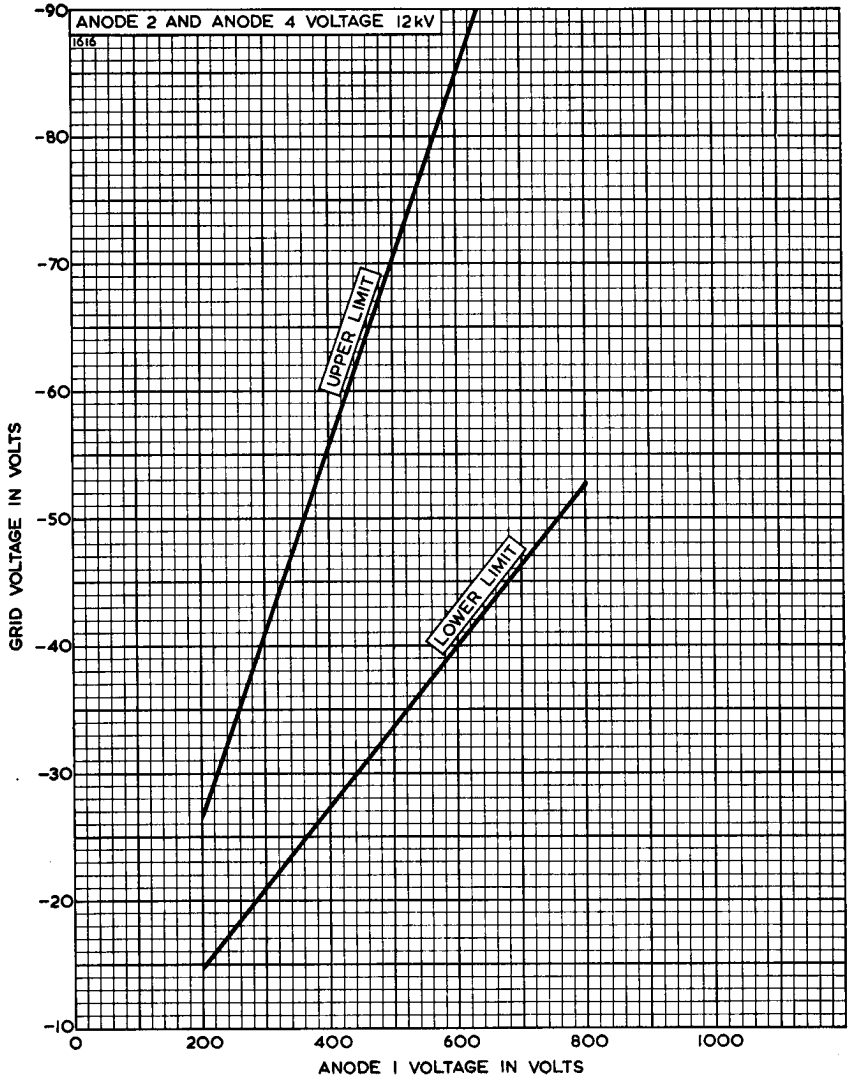
X-rays are produced when the T986 is operated above 16kV (absolute value). These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect upon the design of the tube.

ENGLISH ELECTRIC

GRID VOLTAGE CHARACTERISTICS



GRID VOLTAGE CUT-OFF LIMITS



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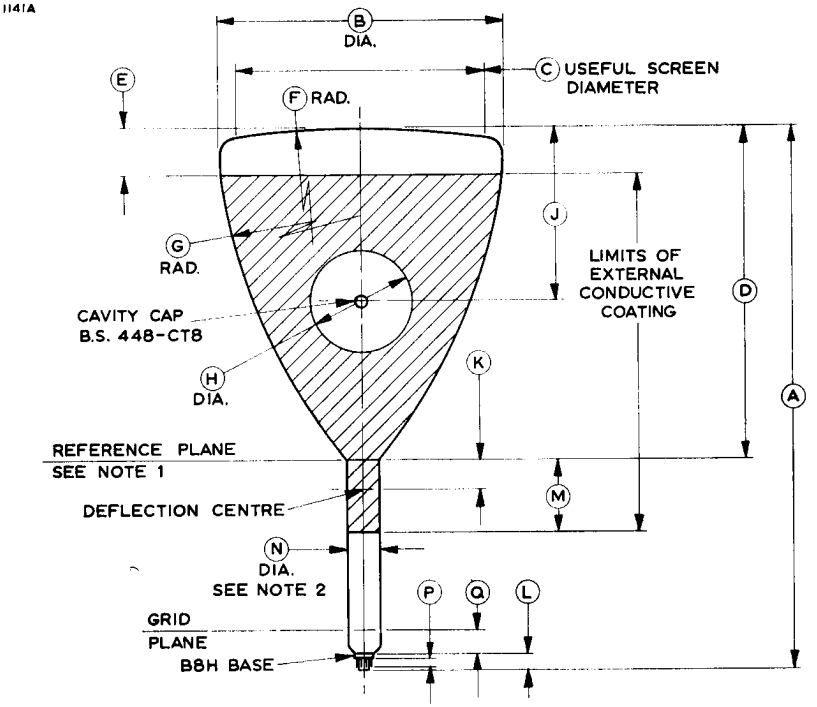
ENGLISH ELECTRIC

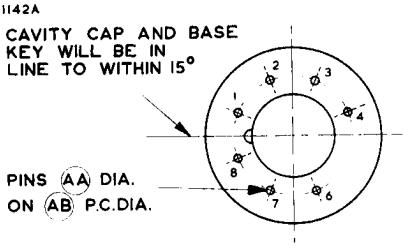
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	22·560 Max	573·0 Max	J	7·244 ± 0·118	184·0 ± 3·0
B	12·010 $^{+0·080}_{-0·100}$	305·0 $^{+2·0}_{-2·5}$	K	1·240 Max	31·5 Max
C	10·430 Min	265·0 Min	L	0·630	16·0
D	13·900 ± 0·180	353·0 ± 4·5	M	2·953 ± 0·197	75·0 ± 5·0
E	1·969	50·0	N	1·378 $^{+0·020}_{-0·039}$	35·0 $^{+0·5}_{-1·0}$
F	39·370	1000	P	0·333 Max	8·46 Max
G	23·620	600·0	Q	0·984	25·0
H	4·331 ± 0·394	110·0 ± 10·0			

Inch dimensions have been derived from millimetres.

OUTLINE DETAILS



Pin	Element
1	Heater
2	Internal Connection
3	Anode 1
4	Anode 3
5	No Pin
6	Grid
7	Cathode
8	Heater
Cavity Cap	Anode 2 & Anode 4

Ref.	Inches	Millimetres
AA	0·040	1·02
AB	0·600	15·24

Millimetre dimensions have been derived from inches.

OUTLINE NOTES

1. The Reference Plane is determined by the position where 36·0mm internal diameter ring gauge rests.
2. A ring gauge 36·0mm internal diameter × 100·0mm long will pass over the neck and base to the reference plane.
3. The projected neck axis will pass within 3·5mm (0·138 inch) of the geometric centre of the tube face. The neck axis will make an angle of less than 1° 30′ with the normal to the tangential plane at the centre of the faceplate.

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