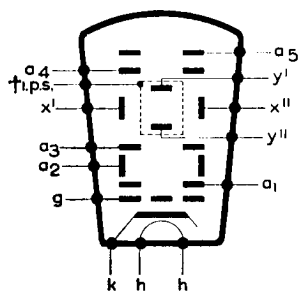
ETEL 5BKPI

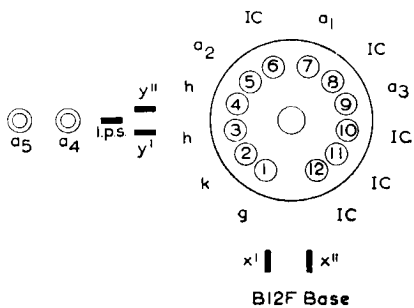
OSCILLOSCOPE TUBE

Precision oscilloscope tube with 5-in. flat screen. This tube is fitted with two stages of distributed post deflection acceleration and the deflection plates are brought out to side connections.

ETL12



†Inter-plate screen



B12F Base

GENERAL DATA

Screen type		Metal-backed P1	
Fluorescent colour of screen		green	
Persistence		medium	
Focus		electrostatic	
Deflection		electrostatic	
Post deflection acceleration		two stages distributed	
Max. faceplate diameter		133	mm
Max. overall length		452	mm
Useful screen area at $V_{a5}/V_{a3} = 5.5$, $V_{a4}/V_{a3} = 2.2$			
x direction		95	mm
y direction		60	mm
Weight (approx.)		1.25 2.75	kg lb
Mounting position		Any—see section on mounting (page 3)	

CATHODE

Indirectly-heated—suitable for parallel operation only

Heater voltage	V_h	6.3	V
Heater current	I_h	550	mA

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CAPACITANCES

The following values are nominal (except where otherwise stated) and are subject to a manufacturing tolerance of ±20%.

C_{g-all}	7.4	pF
C_{k-all}	4.1	pF
$C_{x'-all}$ (x″ earthed)	3.6	pF
$C_{x''-all}$ (x′ earthed)	3.6	pF
$C_{y'-all}$ (y″ earthed)	1.6	pF
$C_{y''-all}$ (y′ earthed)	1.7	pF
$C_{x'-x''}$	2.3	pF
$C_{y'-y''}$	1.7	pF
$C_{x'+x''-y'+y''}$ max.	0.1	pF
$C_{x'+x''-g+k}$ max.	0.1	pF
$C_{y'+y''-g+k}$ max.	0.1	pF

LIMITING VALUES (absolute ratings)

Max. first anode voltage	V_{a1} max.	1.5	kV
Max. second anode voltage	V_{a2} max.	750	V
Max. third anode voltage	V_{a3} max.	2.0	kV
Max. fourth anode voltage (P.D.A. ring)	V_{a4} max.	5.5	kV
Max. fifth anode voltage (final P.D.A.)	V_{a5} max.	12	kV
Min. fifth anode voltage (final P.D.A.)	V_{a5} min.	6.0	kV
Max. voltage differences	$V_{a1}-V_{a2}$ max.	1.5	kV
	$V_{a3}-V_{a2}$ max.	2.2	kV
	$V_{a4}-V_{a3}$ max.	3.5	kV
	$V_{a5}-V_{a4}$ max.	8.0	kV
Max. grid voltage	V_g max.	−200	V
Min. grid voltage	V_g min.	−1.0	V
Max. grid resistor	$R_{g\ k}$ max.	1.0	MΩ
Max. peak heater to cathode voltage	$v_{h-k(pk)}$ max.	250	V
Max. average first and third anode dissipation	p_{a1+a3} max.	2.0	W
Max. power input to screen	p_t max.	5.0	mW/cm²
Max. resistance from any deflector plate to a_3	R_{x-a3} max. / R_{y-a3} max.	5.0	MΩ
Max. voltage between any deflector plate and a_3	$V_{x\ a3}$ max. / V_{y-a3} max.	500	V
Max. V_{a5} to V_{a3} ratio for scan size of 60mm × 95mm (V_{a4}/V_{a3} — 2.2)	$\frac{V_{a5}}{V_{a3}}$ max.	5.5	
Min. insulation between fifth and third anodes	r_{a5-a3} min.	80	MΩ

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ETEL 5BKP1

OSCILLOSCOPE TUBE

TYPICAL OPERATING CONDITIONS

First anode voltage	V_{a1}	1.4	kV
Second anode voltage for focus	V_{a2}	440 to 560	V
†Third anode voltage	V_{a3}	1.8	kV
Fourth anode voltage	V_{a4}	4.0	kV
Fifth anode voltage	V_{a5}	10	kV
Grid voltage for visual cut-off	V_g	−45 to −90	V
Grid drive for intensity of 0.45 candelas	V_{in}	20	V
*Focus electrode current	I_{a2}	−25	μA
Fifth anode current	I_{a5}	25	μA
x plate sensitivity	S_x	26.5	V/cm
y plate sensitivity	S_y	12.5	V/cm

†Inter-plate screen (i.p.s.) connected to a_3.

*With V_{a2} set for focus and $V_{g1} = -1.0V$.

If V_{a1}, V_{a3}, V_{a4} and V_{a5} are altered but remain in the same ratio then the focus and cut-off voltages and the deflection sensitivities will change in the same ratio.

DEFLECTION

In the x direction the tube is designed for symmetrical operation only.

In the y direction, symmetrical or asymmetrical operation may be used, but vertical deflection defocusing and linearity may be a little worse in the asymmetric case than for symmetrical deflection.

The arrangement of the plates is such that viewing the screen with the x plate connector pins vertically uppermost a positive voltage on the x′ plate deflects the spot to the left and a positive voltage on the y′ plate deflects the spot upwards. The x plates are those nearest the screen.

The following data for deflection sensitivities apply when $V_{a5} = 10kV$, $V_{a5}/V_{a3} = 5.5$ and $V_{a4}/V_{a3} = 2.2$. Provided that the P.D.A. ratios remain constant, the sensitivities vary inversely with the total acceleration voltage (V_{a5}).

x plate sensitivity	S_x max.	0.43	mm/V
	S_x min.	0.33	mm/V
y plate sensitivity	S_y max.	0.89	mm/V
	S_y min.	0.7	mm/V

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PATTERN DISTORTION

Compared with a normal post deflector accelerator, the use of a distributed system enables much greater P.D.A. ratios to be used, with a consequent gain in sensitivity, before serious pattern distortion occurs.

With $V_{a5}/V_{a3} = 5.5$, $V_{a4}/V_{a3} = 2.2$ and the mean potential of the x and y plates being equal to the potentials of a_3, the inter-plate screen (i.p.s.) and the external conductive coating, the following figures apply:

(1) A nominally rectangular raster may be inserted into the frame bounded by the rectangles 76.5mm × 45.9mm and 73.5mm × 44.1mm i.e. max. total pattern distortion is 2%.

(2) With the spot undeflected in the y direction the difference in deflection sensitivity at 25% useful x scan and at 75% useful x scan is less than 2%. With the spot undeflected in the x direction the difference in deflection sensitivity at 25% useful y scan and at 75% useful y scan is less than 2% i.e. max. non-linearity of deflection is 2%.

ORIENTATION AND RECTANGULARITY

The y axis lies within 10° of the line which divides pins 6 and 7, and pins 1 and 12 symmetrically on the base.

The angle between x and y axes is 90° ± 1.5°.

MOUNTING

There is no restriction on the position of mounting.

In mounting the tube the main support should be at the end nearer the screen and so arranged that no stresses are produced in the glass. Adequate precautions should be taken to protect the tube from the effects of shock on sudden acceleration. In particular a resilient pad should be provided between the flat face of the tube and any surrounding metal parts.

This tube is not intended to be soldered directly into the wiring. The tube socket and side pin connections should not be rigidly mounted but should have flexible leads and be allowed to move freely.

POWER SUPPLIES

At average high brightness the first and third anode portion of the tube requires currents up to 0.5mA. If the tube is used for displaying low-occupance pulses the peak pulse current may reach as much as 2mA if large 'bright-up' pulses are used. The power supply for this section of the tube should therefore be adequately regulated.

The positive supply for the P.D.A. system will need to provide less than 100μA tube current so that a high frequency generator is quite suitable for this purpose.

The intermediate P.D.A. ring (a_4), despite drawing very little current (of the order of 10μA) can cause pronounced hum effects if the supply to it is inadequately smoothed.

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EXTERNAL CONDUCTIVE COATING

An external conductive coating covers the distributed P.D.A. system. This should be held at earth potential or at some steady potential within 100V of the inter-plate screen.

The capacitance between the external coating and the internal system is approximately 300pF. Rapidly varying potentials applied to the external coating may vary the potential distribution on the internal coating with consequent momentary distortion of the trace.

Contact to the coating should be made by means of a smooth metal spring.

AUXILIARY COMPONENTS

Face Surround

The Standard Insulator Co. of Camberley, Surrey, manufacture a rubber face surround for this tube which fits inside the mumetal screens recommended below and which provides adequate shock insulation for the front of the tube.

Sockets

The B12F socket can be supplied by the Carr Fastener Co. Ltd. of Stapleford Notts, type V0/842.

The tube manufacturers can supply sample quantities of this socket.

Cavity Cap Connectors

Any commercially available CT8 connector is suitable.
Typical examples are the Carr Fastener 71/529, 71/699 and 71/527. In view of the proximity of the a_5 socket to the front of the tube and consequently to the metal panel, it is recommended that a high insulation type connector be used for this purpose.

Side Pin Connectors

There are no connectors specifically intended for use with the side pins for this tube. A standard miniature diode anode clip has been found adequate in many instances and in other applications miniature crystal microphone connectors have been used.

SHIELDING

In view of the high sensitivity of the tube it is advisable to mount it as far as possible from transformers and chokes. If transformers or chokes are in close proximity to the tube, thicker or thinner multiple shields are required to avoid saturation and trace modulation.

Mumetal shields suitable for use with this tube are made by

Telegraph Construction and Maintenance Co. Ltd., Crawley, Sussex.	Type ET4
Magnetic and Electrical Alloys Ltd., Burnbank, Hamilton, Lanarkshire.	Type ST38

In some cases modifications to these designs can also be supplied.

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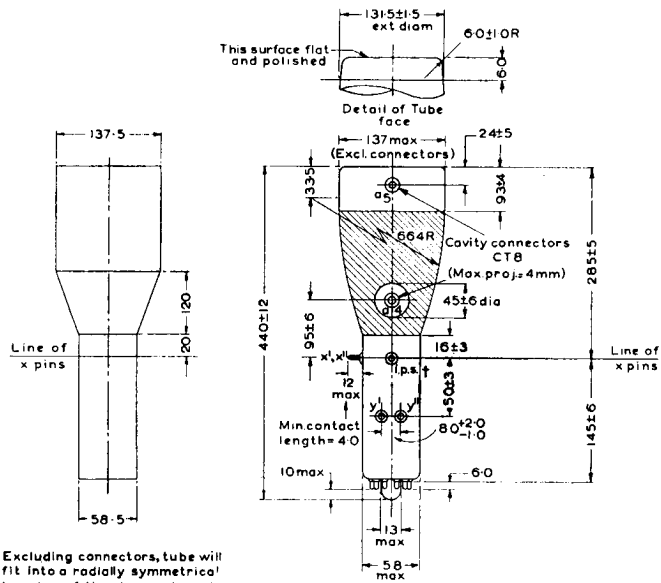
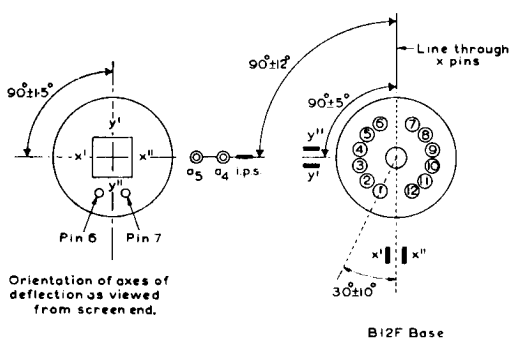


Excluding connectors, tube will fit into a radially symmetrical housing of the above internal dimensions.



Orientation of axes of deflection as viewed from screen end.

B12F Base

†The axial distance between the radial planes of the x pins and the i.p.s. pin ≥ 2·0mm

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All dimensions in mm

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