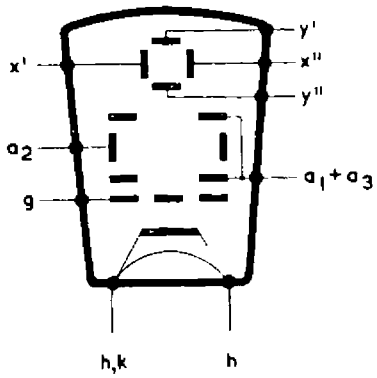
from JEDEC release #2554, Aug. 3, 1959

ETEL 3AFP1

OSCILLOSCOPE TUBE

High sensitivity oscilloscope tube with 2¾-in. diameter screen, suitable for symmetrical or asymmetrical operation.



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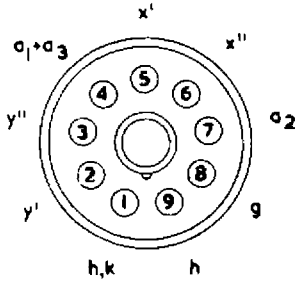

B9G Base

GENERAL DATA

Screen type		P1
Fluorescent colour of screen		green
Persistence		medium
Focus		electrostatic
Deflection		electrostatic
Minimum useful screen diameter	55	mm
Maximum overall diameter	71	mm
Maximum overall length	257	mm
Weight (approx.)	128	g
	4.5	oz
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

Note—The cathode is connected to one side of the heater, the common connection being to pin 1.

CAPACITANCES

C_{g-all}	5.6 to 7.6	pF
C_{k-all}	2.3 to 3.1	pF
$C_{x'-all\ (x''\ earthed)}$	4.3 to 7.3	pF
$C_{x''-all\ (x'\ earthed)}$	4.3 to 7.3	pF
$C_{y'-all\ (y''\ earthed)}$	2.8 to 4.2	pF
$C_{y''-all\ (y'\ earthed)}$	2.8 to 4.2	pF
$C_{x'-x''}$	1.4 to 2.6	pF
$C_{y'-y''}$	2.2 to 3.0	pF
$C_{x'+x''-y'+y''}$ max.	0.33	pF
$C_{x'+x''-g+k}$ max.	1.6	pF
$C_{y'+y''-g+k}$ max.	1.6	pF

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LIMITING VALUES (absolute ratings except where stated)

Maximum first and third anode voltage	V_{a1+a3} max.	1.5	kV
Minimum first and third anode voltage	V_{a1+a3} min.	700	V
Minimum design centre first and third anode voltage	V_{a1+a3} min.	800	V
Maximum second anode voltage	V_{a2} max.	500	V
Maximum voltage difference	$V_{a1+a3}-V_{a2}$ max.	1.2	kV
Maximum grid voltage	V_g max.	−200	V
Minimum grid voltage	V_g min.	−1.0	V
Maximum grid resistor	R_{g-k} max.	1.0	MΩ
Maximum peak total anode dissipation	$p_{a(tot)pk}$ max.	2.0	W
Maximum power input to screen	p_t max.	3.0	mW/cm²
Maximum resistance from deflector plates to first and third anodes (asymmetrical operation)	$R_{x-a1+a3}$ max. $R_{y-a1+a3}$ max.	2.0	MΩ
Maximum resistance from deflector plates to first and third anodes (symmetrical operation)	$R_{x-a1+a3}$ max. $R_{y-a1+a3}$ max.	4.0	MΩ

TYPICAL OPERATING CONDITIONS

First and third anode voltage	V_{a1+a3}	1.0	kV
Second anode voltage for focus	V_{a2}	210 to 320	V
Grid voltage for visual cut-off	V_g	−28 to −65	V
Grid drive for intensity of 0.008 candelas	V_{in}	20	V
*Focus electrode current	I_{a2}	−50	μA
x plate sensitivity	S_x	20	V/cm
y plate sensitivity	S_y	11.5	V/cm

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

If V_{a1+a3} is altered, the grid cut-off voltage, the focus voltage and the sensitivity will change in the same ratio.

DEFLECTION

Designed for symmetrical or asymmetrical deflection on both x and y plates. The arrangement of the plates is such that viewing the tube in the horizontal position with the base spigot key vertically uppermost a positive voltage on the y′ plate deflects the spot upwards and a positive voltage on the x′ plate deflects the spot to the left. The x plates are nearest the screen.

When symmetrically operated the mean potential of the deflector plates must not differ from that of the final anode. In the asymmetrical case one plate of each pair must not differ from the final anode by more than the deflection voltage.

x plate sensitivity	S_x max.	$\frac{610}{V_{a1+a3}}$	mm/V
	S_x min.	$\frac{410}{V_{a1+a3}}$	mm/V
y plate sensitivity	S_y max.	$\frac{1050}{V_{a1+a3}}$	mm/V
	S_y min.	$\frac{685}{V_{a1+a3}}$	mm/V

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PATTERN DISTORTION

With asymmetrical deflection in both x and y directions a square raster of nominal side 40mm will lie entirely inside a 41.4mm square and entirely outside a 38.6mm square, i.e., maximum total pattern distortion with asymmetrical deflection is 3.5%.

When symmetrical deflection is used, the total pattern distortion will normally be less than 2.5%.

LINE WIDTH

The nominal value for line width under d.c. conditions and for $V_{a1,a3} = 1kV$ is 0.6mm. The pattern consists of a circle of 40mm diameter supplied from a 200kc/s source. The grid voltage corresponds to a beam current (I_1) of 1μA.

SPOT ECCENTRICITY

With the tube magnetically shielded an undeflected spot lies within 6.0mm of the physical screen centre.

ORIENTATION AND RECTANGULARITY

The y axis lies within 15° of the centre line of the base spigot key.

The angle between the x and y axes is 90°$\pm$2.0°.

MOUNTING

There is no restriction on the position of mounting.

The screen end of the tube may conveniently be supported by insertion into a mask or rubber surround. At the rear end it is permissible to use a clamp around the tube base providing that the tube is protected against excessive tightening and shock by means of a resilient pad which should be at least $\frac{1}{4}$ in. in thickness. Alternatively the socket may be used as a support if it is mounted on a pad of shock absorbent material and sprung towards the face of the tube.

This tube is not intended to be soldered directly into the wiring and a socket of approved type should be used at all times.

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 very close proximity to the tube, thicker or multiple shields may be 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.	Types ET3a, ET3b, ET3c, ET3d
Magnetic and Electrical Alloys Ltd., Burnbank, Hamilton, Lanarkshire.	Type ST37

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SUPPLY ARRANGEMENTS

The circuit shown is a typical arrangement for use in a portable equipment such as a small oscilloscope. The positive supply may be used to feed the auxiliary apparatus.

Asymmetric shift networks are shown but all deflector plates are available for the application of sweep or signal voltages if required. Although the circuit employs feed to the deflector plates through isolating capacitors, d.c. connection may be used if the circuit is modified to suit. The resistors R14 to R17 and the capacitors C11 to C14 should be removed together with the shift networks R2, R3 and R4 and C5 and C6; shift may then be applied by means of variable bias in the deflection amplifiers. It may be advantageous to replace R5 and R6 by a preset potentiometer to ensure the final anode remaining at the mean deflector plate potential.

If the tube is to be run from a conventional high voltage supply, R6 and R7 may be replaced by a single 470kΩ resistor and R5 may be omitted. Shift must then be obtained by means other than those shown.

The circuit as shown includes arrangements for modulating the brightness of the tube. If positive or 'bright-up' pulses are applied, care must be exercised to ensure that the grid is not allowed to become positive with respect to the cathode. As a safety precaution it is suggested that a resistor (R13) is inserted in the grid lead with minimum value of 2000Ω per volt of signal. If no brightness modulation is to be employed, R12, R13 and C10 may be omitted.

Circuit Values

C1, C2	8 μF	350Vd.c.
C3, C4	0.5 μF	1000Vd.c.
C5, C6, C8, C11, C12, C13, C14	0.1 μF	350Vd.c.
C7	2.0 μF	350Vd.c.
C9	0.5 μF	250Vd.c.
C10	0.1 μF	1000Vd.c.
R1	2.2kΩ	1W
R4	150 kΩ	½W
R5	22 kΩ	½W
R6	47 kΩ	1W
R7, R9, R12	220 kΩ	¼W
R10	150 Ω	¼W
R13		See text
R14, R15, R16, R17	1 MΩ	¼W
RV2, RV3, RV8 potentiometers,	470 kΩ	½W
RV11 potentiometer,	100 kΩ	½W
V1	Full wave rectifier, type EZ80	
MR1, MR2	Rectifiers, 300V 1mA	
T1	Transformer, 300–0–300V, 2×6.3V	

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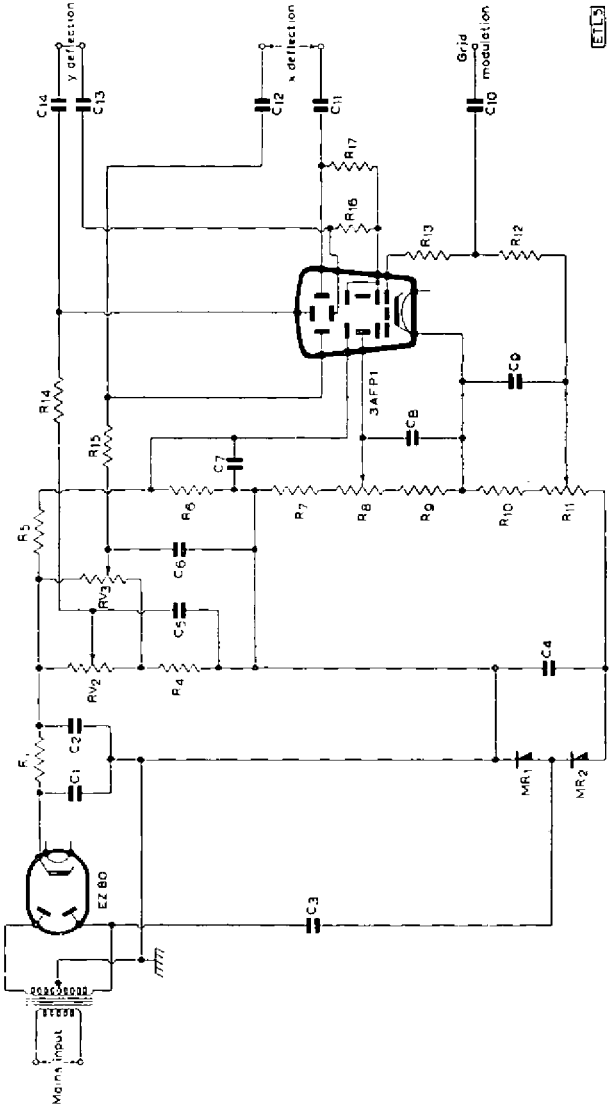

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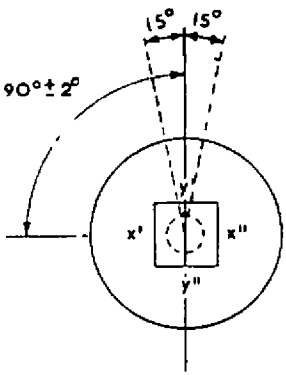
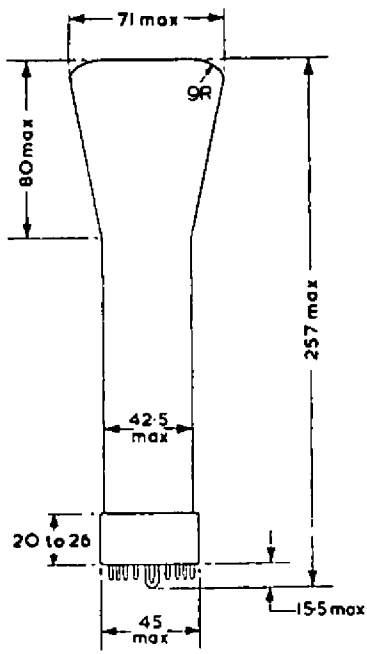


Orientation of axes of deflection as viewed from screen end.



All dimensions in mm

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