

IMPORTANT
The classification of the phosphor of this tube has been changed to P31, the screen characteristics remaining unaltered to ETEL tubes previously classified P1.

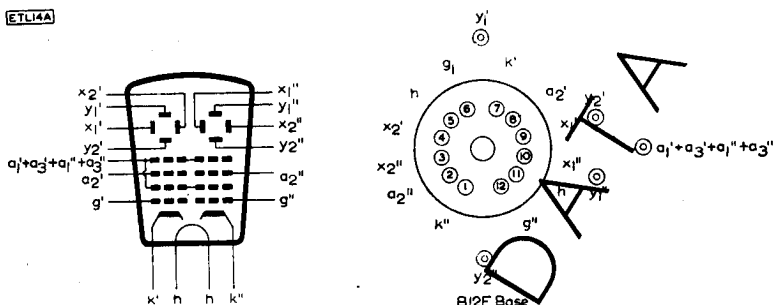
TEL 3AZP31

9-11
DHM9-11

OSCILLOSCOPE TUBE

General purpose double gun oscilloscope tube with 3½-in. flat screen. This tube has side connected y plates and separate x plates.

ETL14A



GENERAL DATA

| | |
|------------------------------|--|
| Screen type | P31 |
| Fluorescent colour of screen | green |
| Persistence | medium |
| Focus | electrostatic |
| Deflection | electrostatic |
| Maximum overall diameter | 94 mm |
| Maximum overall length | 310 mm |
| Weight (approx.) | { 18 oz 510 g |
| Mounting position | Any - see section on mounting (page 4) |

CATHODE

| | | |
|--|----------|--------|
| Indirectly heated - suitable for parallel operation only | | |
| Heater voltage | V_h | 6.3 V |
| Heater current max. | I_{h1} | 1.25 A |

CAPACITANCES

| | Gun' | | Gun'' | | pF |
|--------------------------------|------|------|-------|------|----|
| | Min. | Max. | Min. | Max. | |
| C_g -all | 5.2 | 7.4 | 5.0 | 7.2 | pF |
| C_k -all | 3.0 | 4.6 | 3.0 | 4.6 | pF |
| C_{x1} -all (x_2 earthed) | 4.5 | 6.5 | 4.5 | 6.5 | pF |
| C_{x2} -all (y_1 earthed) | 4.6 | 7.2 | 4.6 | 7.2 | pF |
| C_{y1} -all (y_2 earthed) | 2.0 | 4.0 | 2.8 | 4.4 | pF |
| C_{y2} -all (y_1 earthed) | 2.8 | 4.4 | 2.0 | 4.0 | pF |
| C_{x1-x2} | — | 1.7 | — | 1.7 | pF |
| C_{y1-y2} | 1.5 | 2.5 | 1.5 | 2.5 | pF |
| $C_{x1+x2-y1+y2}$ | — | 0.2 | — | 0.2 | pF |
| $C_{x1'+x2'-x1''+x2''}$ max. | | | | 1.6 | pF |
| $C_{y1'+y2'-y1''+y2''}$ max. | | | | 0.6 | pF |



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LIMITING VALUES (absolute ratings) each gun

| | | | |
|---|--------------------|-----|--------------------|
| Maximum first and third anode voltage | V_{a1+a3} max. | 1.8 | kV |
| Minimum first and third anode voltage | V_{a1+a3} min. | 1.0 | kV |
| Maximum second anode voltage | V_{a2} max. | 600 | V |
| Maximum negative grid voltage | $-V_g$ max. | 200 | V |
| Minimum negative grid voltage | $-V_g$ min. | 1.0 | V |
| Maximum grid resistor | R_{g-k} max. | 1.0 | M Ω |
| Maximum peak heater to cathode voltage | $V_{h-k(pk)}$ max. | 250 | V |
| Maximum resistance from any deflector plate to $a_1 + a_3$ | $R_{x-a1+a3}$ max. | 2.0 | M Ω |
| | $R_{y-a1+a3}$ max. | | |
| Maximum voltage between any deflector plate and $a_1 + a_3$ | $V_{x-a1+a3}$ max. | 300 | V |
| | $V_{y-a1+a3}$ max. | | |
| Maximum total anode dissipation | $P_{a(tot)}$ max. | 2.0 | W |
| Maximum power input to screen (gun' + gun") | P_t max. | 3.0 | mW/cm ² |

TYPICAL OPERATION (each gun)

| | | | |
|---------------------------------|---------------|------------|---------|
| First and third anode voltage | V_{a1+a3} | 1.5 | kV |
| Second anode voltage | V_{a2} | 330 to 470 | V |
| Grid voltage for visual cut-off | V_g | -42 to -95 | V |
| *Maximum second anode current | I_{c2} max. | -125 | μ A |
| x plate sensitivity | S_x | 23 | V/cm |
| y plate sensitivity | S_y | 16 | V/cm |

*With second anode voltage set for focus and $V_g = -1.0V$.
 S_x , S_y and V_g for visual cut-off are proportional to V_{a1+a3} .

DEFLECTION

Designed for symmetrical operation only on both x and y plates. Each gun may be operated asymmetrically, but focus quality will deteriorate and trapezium distortion will be introduced. The data given for raster distortion and line width will therefore not apply. In applications where it is necessary to obtain the highest possible focus performance, it may be desirable to adjust the mean potential of the deflector plates with respect to $a_1 + a_3$.

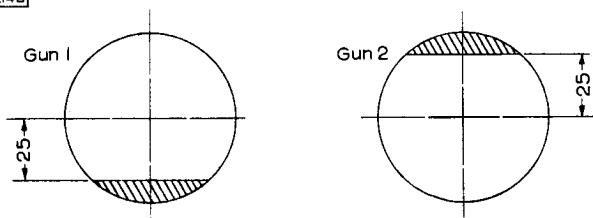
| | | | |
|---------------------|------------|--------------------------|------|
| x plate sensitivity | S_x min. | $\frac{550}{V_{a1+a3}}$ | mm/V |
| | S_x max. | $\frac{725}{V_{a1+a3}}$ | mm/V |
| y plate sensitivity | S_y min. | $\frac{820}{V_{a1+a3}}$ | mm/V |
| | S_y max. | $\frac{1100}{V_{a1+a3}}$ | mm/V |

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| | | | |
|--|---------------|-----------|----|
| Minimum useful scan from the centre of the tube face | $(x_1 - x_2)$ | ± 45 | mm |
| Minimum useful scan from the centre of the tube face | $(y_1 - y_2)$ | See Fig 1 | |

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All dimensions in mm

The unshaded portions are the useful areas for y scan

Fig. 1

RASTER DISTORTION

Centred at the screen centre, a nominally square pattern from either gun separately may be inserted into the frame bounded by the squares 48.75mm and 51.25mm., i.e., maximum total pattern distortion is $\pm 2.5\%$.

RASTER ALIGNMENT

When two nominally square rasters, whose edges coincide at their centres, are superimposed at the screen centre, and when the rasters are simultaneously adjusted in size, the edges will fall within the frame bounded by the squares 48mm and 52mm., i.e., maximum total raster misalignment is $\pm 4\%$.

LINE WIDTH

A value for line width under d.c. conditions is given below:

| | | |
|-------------------------|--------------------|---------|
| V_{a1+a3} | 1.5 | kV |
| V_{a2} | Adjusted for focus | |
| I_f | 1.0 | μA |
| Pattern-circle diameter | 50 | mm |
| Maximum line width | 0.8 | mm |

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SPOT POSITION

With the tube magnetically shielded, the undeflected spot of each gun will fall within the appropriate 12mm circle shown on the diagram.

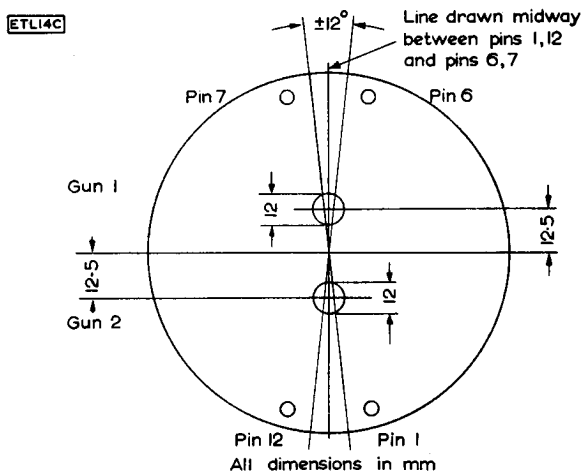


Fig. 2

ORIENTATION AND RECTANGULARITY

The y axis lies within $\pm 12^\circ$ of the line drawn midway between pins 6 and 7 and pins 1 and 12 on the base.

The angle between x and y axes on each gun is $90^\circ \pm 1.5^\circ$.

The distance between the two electrical y axes at the geometric screen centre is 3.5mm max. The maximum angle between the two electrical y axes is 2.5° . The maximum angle between the two electrical x axes is 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 effects of shock or 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 connectors should not be rigidly mounted but should have flexible leads, and be allowed to move freely.

In most cases it will be necessary to provide a closely fitting magnetic shield surrounding the tube. The tube may then be mounted conveniently by means of resilient rings inside the shield, the shield being rigidly supported by the external apparatus.

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CONNECTORS

Sockets

The B12F socket can be supplied by the Carr Fastener Co. Ltd., of Stapleford, Notts, type no. VO/842.

The tube manufacturers can supply sample quantities of this socket.

Cap connectors

Any commercially available CT7 is suitable.

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 multiple shields are required to avoid saturation and trace modulation.

Mu-metal shields suitable for use with this tube are made by:

Telegraph Construction and Maintenance Co. Ltd.,
Crawley, Sussex.

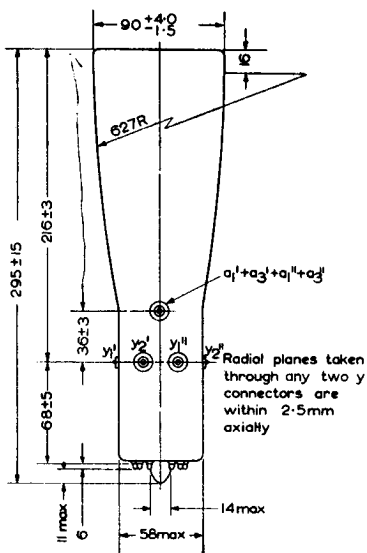
Magnetic and Electrical Alloys Ltd.,
Burnbank, Hamilton, Lanarkshire.

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

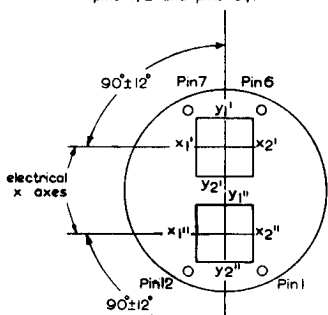
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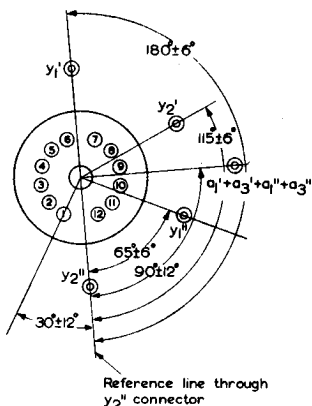


Line drawn midway between pins 1,2 and pins 6,7



Orientation of axes of deflection as viewed from screen end

Notes: Maximum angle between the two x axes = 1.5°
 Maximum angle between the two y axes = 2.5°
 Maximum distance between y axes at screen centre = 3.5mm



All connectors are CT7
 All dimensions in mm