



instrument

cathode ray tubes



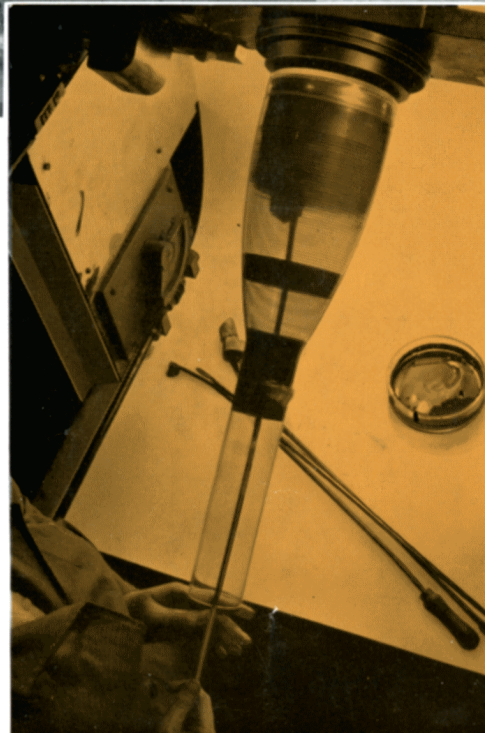
ELECTRONIC TUBES LIMITED



*With specialisation in mind . . .
the ETEL plant at High Wycombe
is laid out and organised
for one purpose—the production
of cathode ray tubes.*



Assembling electrodes for five-inch tubes.



*'Rouging' the inside of a helical p.d.a. tube
bulb on a special production run.*

Specialisation

... key to ETEL production and service

Good cathode ray instrument tubes . . . tubes to meet *your* needs . . . down-to-earth needs of performance and price . . . can be made only by a special combination of plant, skills and experience. And this in diverse fields—electronics, electron-optics, chemistry, precision engineering and glass technology to mention only a few.

You will find this specialisation at High Wycombe where the first Electronic Tubes Limited products were announced in 1946. Effort continues to be concentrated

on cathode ray tubes and E.T.L. continue to offer you *specialist* advantages in tube performance, prices and individual attention to your own particular problems and requirements.

The advantages of specialisation are reflected in the contributions E.T.L. has made in recent years to the development of the instrument tube. ETEL innovations include split beam p.d.a. tubes, tubes with shielded p.d.a. for extra high sensitivity, p.d.a. tubes with side connected deflector plates and, most recently, tubes specially designed for transistorized equipment.

Abridged details are given in this brochure for tubes ranging from one-inch diameter monitors to five-inch precision types. For further data and any other information please contact Electronic Tubes Limited, Kingsmead Works, High Wycombe, Bucks.



A precision tube is given its final test.

The ETEL preferred range

Tubes do, of course, overlap in their application suitability, but the ETEL range preferred for new equipment designs is broadly summarised below. Please refer to the relevant page numbers for more detailed information—and do not hesitate to ask for complete data sheets on types in which you are particularly interested.

Some other types are available to meet special requirements. Details of these are available on request.

| | | PAGE |
|---------------------------------------|----------------|-----------|
| WAVEFORM MONITOR TUBE | 1CP31 | 5 |
| LOW COST GENERAL PURPOSE TUBES | 3AFP31 | 6 |
| | 5DCP31 | 6 |
| MULTI-TRACE TUBES | 3AZP31 | 7 |
| | 4LP31 | 7 |
| HIGH PRECISION TUBES | 3BLP31 | 8 |
| | 4EP31 | 8 |
| | 5CLP31 | 9 |
| | 5BUP31 | 9 |
| | 5BKP31 | 9 |
| HIGH WRITING SPEED TUBES | 5BVP31 | 10 |
| | 5BVP31A | 10 |

Care and close attention are essential at the phosphor 'laying' stage.



P31 and Alternative Phosphors

The ETEL phosphor previously called P1 has now been designated type P31. This standard ETEL phosphor does, in fact, have certain advantages over the E.I.A. registered phosphor P1—it has a better light output and may be used for both visual and photographic applications.

Tubes are listed on the left with this standard P31 phosphor, but a number of them are available with alternative phosphors. Please check with E.T.L. against your own requirements.

| Phosphor type | Colour | | Persistence |
|---------------|--------------------------|-------------------|----------------------|
| | Fluorescent | Phosphorescent | |
| P7 | Blue-white | Yellow | Long Medium/Short |
| P11 | Blue | Blue | |
| P15 | Blue-green | Blue-green | Extremely short |
| P31 | Blue-green | Blue-green | Medium |
| Z | Infra red storage Screen | | |

Waveform Monitor Tube

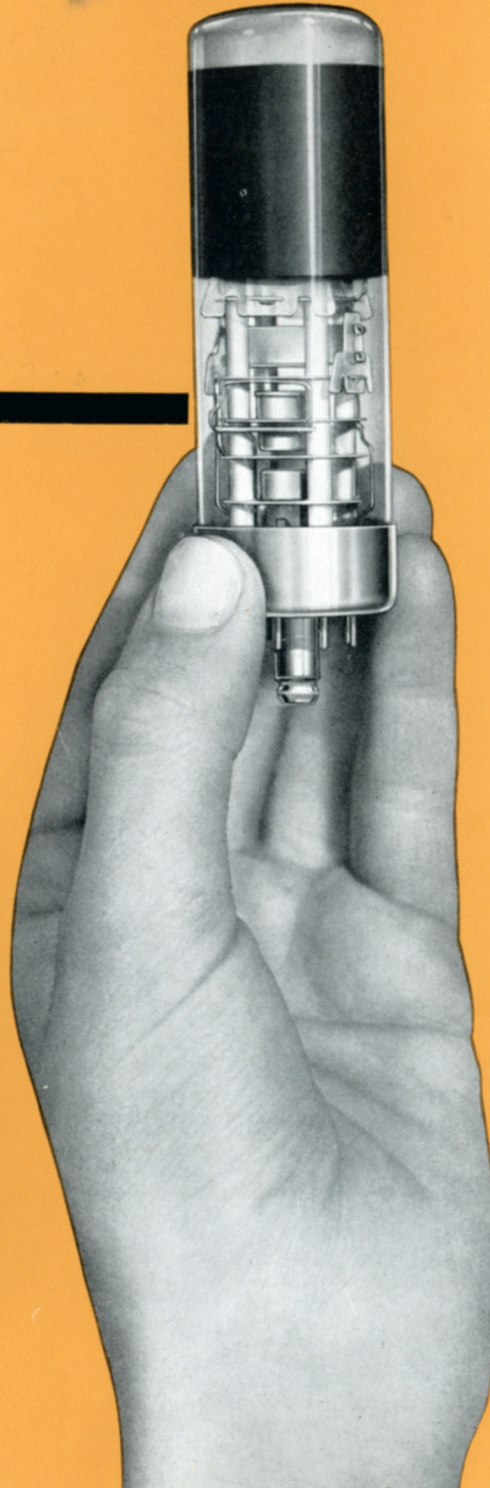
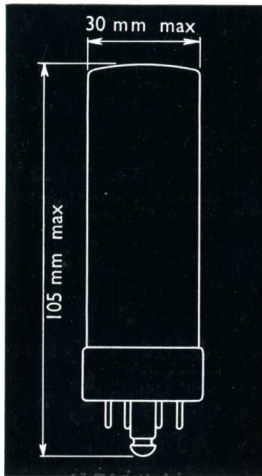
Heater 6.3V, 550 mA.

| | | | |
|---------------------|----|-----------|------|
| V_{a1+a3} | .. | 500 | V |
| S_x | .. | 53 | V/cm |
| S_y | .. | 45 | V/cm |
| V_{h-k} (pk) max. | | ± 250 | V |

Alternative phosphors

P11 available.

P15 to special order.



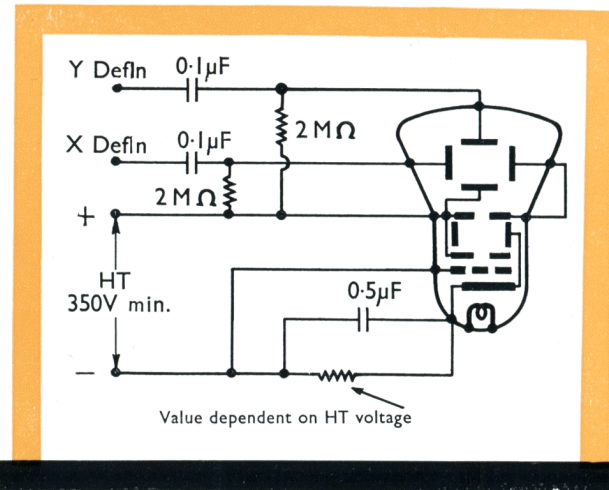
1CP31

Waveform monitoring facilities can be incorporated in both existing equipment and new designs with extreme ease and economy with the miniature one-inch diameter tube 1CP31.

The tube itself is inexpensive and the associated circuitry required is very simple. The operating voltage is so low that in most equipment suitable connection to an existing H.T. supply is all that is required. Beam focusing is fully automatic and auto-bias is quite adequate.

Space problems rarely occur when the 1CP31 is used—the maximum overall dimensions are less than 1.2×6 inches.

The simplest method of incorporating the 1CP31 as a monitor in existing equipment.



Low Cost General Purpose Tubes

3AFP31 2 $\frac{3}{4}$ -inch Tube

The 3AFP31 is a 2 $\frac{3}{4}$ -inch diameter instrument tube with a sensitivity that is unusually high for an inexpensive tube. A signal of only 60 volts on the y-plates will give full screen deflection thus materially simplifying the design of deflection amplifiers and making possible comparatively low cost equipment which will operate into the megacycle region.

The comparative simplicity of associated circuitry, combined with the low cost of the tube itself, recommend the 3AFP31 for a wide variety of applications.

Deflection: symmetrical or asymmetrical Heater 6.3V, 550 mA.

Typical Operation

| | | | | | | | | | |
|-------------------|----|----|----|--------------|-------|----|----|----|-----------|
| V_{a1+a3} | .. | .. | .. | 1.0 kV | S_x | .. | .. | .. | 20 V/cm |
| V_g for cut-off | | | | -28 to -65 V | S_y | .. | .. | .. | 11.5 V/cm |

Alternative phosphor P7 available.

5DCP31 5-inch Flat-faced Tube

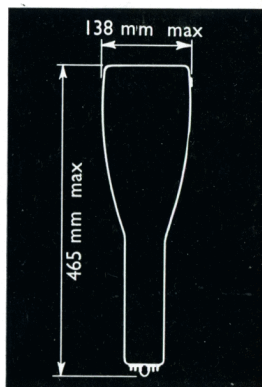
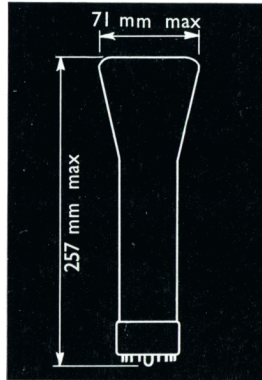
The 5DCP31 is an inexpensive tube with a 5-inch flat-faced screen which provides a good quality presentation for a wide range of instrumentation and general purpose oscillography applications.

Heater 6.3 V, 550 mA.

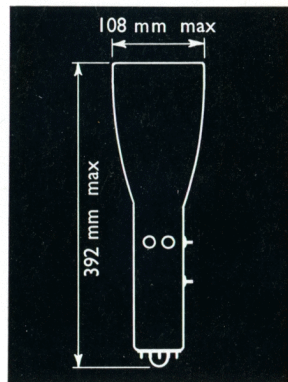
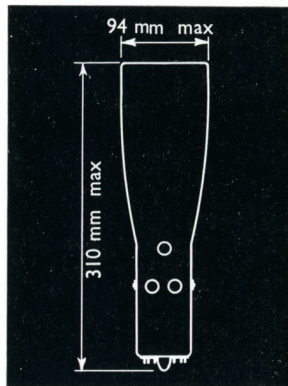
Typical Operation

| | | | | | | | | | |
|----------|----|----|----|--------|-------------------|----|----|----|---------------|
| V_{a1} | .. | .. | .. | 1.5 kV | V_g for cut-off | | | | -35 to -100 V |
| V_{a2} | .. | .. | .. | 380 V | S_x | .. | .. | .. | 22 V/cm |
| V_{a3} | .. | .. | .. | 1.5 kV | S_y | .. | .. | .. | 14 V/cm |
| V_{a4} | .. | .. | .. | 3.0 kV | | | | | |

Alternative Phosphors P7 and P11 available.



Multi-Trace Tubes



3AZP31 Double Gun Tube

The 3AZP31 has been introduced for applications where a double presentation with entirely separate deflection systems is required, but where space is at a premium. With a diameter of $3\frac{1}{2}$ inches and a length of only $12\frac{1}{4}$ inches, the 3AZP31 makes possible the design of truly portable apparatus without sacrificing performance.

The sensitivity of each gun is 16 V/cm in the y direction at an accelerating potential of 1.5 kV. This, together with a flat face and side y-plate connections, suits the 3AZP31 for wideband applications. In order that simultaneous phenomena may be easily compared it is possible to overlap the two traces at least 5 cm.

Heater 6.3V, 1.25 A max.

Typical Operation

| | | | |
|---------------------|-----------|---------------------|---------|
| V_{a1+a3} | 1.5 kV | S_x (each gun) .. | 23 V/cm |
| Trace overlap .. | 5 cm min. | S_y (each gun) .. | 16 V/cm |

Capacitances

| | | | |
|---------------------------|--------|----------------------------|---------|
| c_{y1-y2} (each gun) .. | 2.0 pF | $c_{y1'+y2'-y1''+y2''}$.. | <0.6 pF |
|---------------------------|--------|----------------------------|---------|

Alternative phosphors P7 available. P11 to special order.

4LP31 Split Beam Tube with P.D.A.

The four-inch instrument tube 4LP31 is the most economical high performance tube for dual trace oscillography.

Two traces are provided in the simplest and most economical manner—by means of a single gun with a beam dividing electrode. Sensitivity of 27 V/cm at 3 kV is attained by employing post deflection acceleration.

The 4LP31 is recommended for high quality general purpose applications. It has a flat face and side connections to the deflector plates.

Heater 6.3V, 550 mA.

Typical Operation

| | | | |
|------------------|--------|----------------------|--------------|
| V_{a1} | 1.5 kV | V_g for cut-off .. | -40 to -95 V |
| V_{a3} | 1.5 kV | S_x | 27 V/cm |
| V_{a4} | 3.0 kV | $S_{y'}$ | 27 V/cm |
| | | $S_{y''}$ | 27 V/cm |

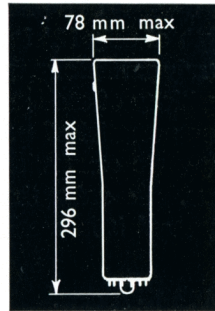
Capacitances

| | |
|-------------------------------|---------------|
| $c_{y'-a11}$ (y'' earthed) | 2.5 to 3.8 pF |
| $c_{y''-a11}$ (y' earthed) | 2.5 to 3.8 pF |
| $c_{y'-y''}$ | <0.1 pF |

Alternative phosphors P7 and P11 available.

Precision Tubes

3BLP31 Transistor Driven Tube



A new field of transistor applications has been opened up by the introduction of the 3BLP31—a 3-inch diameter cathode ray tube specifically designed for use in transistorized equipment. The deflection sensitivities of this tube are such that both x and y amplifiers may be designed around currently available high frequency transistors.

The 3BLP31 has a flat face and its electrical characteristics are closely controlled. Heater consumption, an important consideration with battery operated equipment, is only one watt.

The high sensitivity of the 3BLP31 is made possible by a distributed p.d.a. system, and a post deflection shield which allows high p.d.a. ratios to be used with minimum pattern distortion. Line width and brightness have not been sacrificed so that the presentation is equivalent to that of a tube in mains operated equipment.

By using a higher voltage than that suggested for transistor operation, the presentation of the 3BLP31 is made even better, and portable wideband precision instruments are well within the range of its applications.

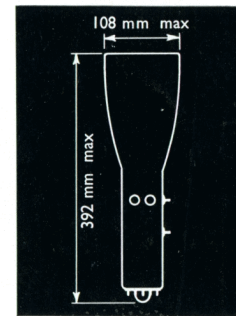
Heater 6.3V, 150 mA.

Typical Operation

| | Transistor | | Mains | |
|----------------------------|------------|-----|-------|--|
| V _{a3} | 300 | 800 | V | |
| V _{a4} | 1.5 | 4.0 | kV | |
| S _x | 5.0 | 13 | V/cm | |
| S _y | 3.0 | 8.0 | V/cm | |
| V _g for cut-off | -30 | -50 | V | |

Alternative phosphor P7 available to special order.

4EP31 4-inch Wide Application Tube



The 4EP31 is a high quality instrument tube which can be used in a wide variety of applications. For example, where maximum deflection sensitivity is needed, an overall acceleration of 2 kV will result in a sensitivity of 1mm/volt.

On the other hand, at 10 kV, photographic recording of single transients at writing speeds up to 1000 km/sec is possible. In addition to the small spot size and high brightness, a blue component in the screen material makes this tube especially suitable for such applications.

Connection to the deflector plates is made by side pins in order to reduce capacities and to simplify amplifier design. Design problems are further eased by the high figure of 300 Mc/s for the resonant frequency of the deflector plate system.

Heater 6.3V, 550 mA.

Typical Operation

| | | |
|----------------------------|------------|------|
| V _{a1} | 2.0 | kV |
| V _{a3} | 2.0 | kV |
| V _{a4} | 4.0 | kV |
| V _g for cut-off | -28 to -60 | V |
| S _x | 36.2 | V/cm |
| S _y | 23 | V/cm |

Capacitances

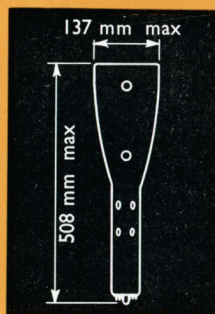
| | | |
|------------------------------------|-----|----|
| c _{y' to y''} | 1.6 | pF |
| c _{y'} —all (y'' earthed) | 3.0 | pF |
| c _{y''} —all (y' earthed) | 3.0 | pF |

Alternative Phosphors

P7 and P11 available.
P15 to special order.



5CLP31 5-inch Extra High Sensitivity Tube



The five-inch instrument tube 5CLP31 has a deflection sensitivity of 1.85 V/cm with a useful y scan of 6 cm.

A special system of shielding the post deflection field from the deflection plates in this tube allows p.d.a. ratios as high as 15 : 1 to be used without pattern distortion. Sensitivity is substantially independent of p.d.a. ratios from 10 to 15.

The extraordinarily high deflection sensitivity achieved with the high p.d.a. ratios of the 5CLP31 profoundly affects oscillograph design. Bandwidths can be increased, amplifiers simplified and power supply requirements reduced.

The 5CLP31 is a versatile tube. By simply altering the potential of one electrode, it may be converted from a very sensitive tube to a higher writing speed tube—pulses may be first examined and then a single shot photograph taken.

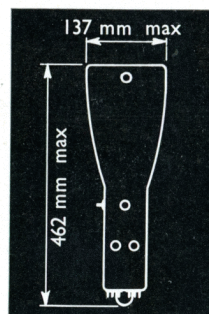
Heater 6.3V, 550 mA.

Typical Operation

| Condition | a | b | c | d | |
|---------------------------------------|-------------------------|------|------|------|--------|
| V _{a5} | 10 | 15 | 15 | 15 | kV |
| V _{a4} | 10 | 15 | 15 | 15 | 3.0 kV |
| V _{a3} | 1.0 | 1.0 | 1.5 | 1.0 | kV |
| V _{a2} (approx) for focus .. | 250 | 250 | 375 | 250 | V |
| V _{a1} | 1.0 | 1.0 | 1.5 | 1.0 | kV |
| V _g (max) for cut-off .. | -60 | -60 | -90 | -60 | V |
| S _y | 1.85 | 1.85 | 2.7 | 2.7 | V/cm |
| S _x | 7.5 | 7.5 | 11.2 | 11.2 | V/cm |
| Useful screen area | y 6 | 6 | 6 | 4 | cm |
| | x10 | 10 | 10 | 6.6 | cm |
| Capacitances | cy' to y" | .. | .. | .. | 2.0 pF |
| | cy' to all (y" earthed) | .. | .. | .. | 4.3 pF |
| | cy"-all (y' earthed) | .. | .. | .. | 4.0 pF |

Alternative phosphors P7 and P11 are available.

5BUP31 5-inch Wide Application Tube



The 5BUP31 is being produced in quantity by E.T.L. to make it an economic proposition for designers to incorporate a quality 5-inch tube in a wider range of applications. This tube is similar to the 4EP31, but is made available for those applications requiring a slightly larger screen.

Heater 6.3V, 550 mA.

Typical Operation

| | | | | | |
|-------------------------------|----|----|----|----|--------------|
| V _{a1} | .. | .. | .. | .. | 2.0 kV |
| V _{a2} | .. | .. | .. | .. | 510 V |
| V _{a3} | .. | .. | .. | .. | 2.0 kV |
| V _{a4} | .. | .. | .. | .. | 4.0 kV |
| V _g for cut-off .. | .. | .. | .. | .. | -28 to -62 V |
| S _x | .. | .. | .. | .. | 29 V/cm |
| S _y | .. | .. | .. | .. | 17.5 V/cm |

Capacitances

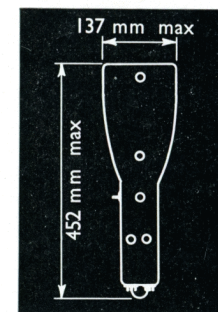
| | | | | | |
|----------------------|----|----|----|----|--------|
| cy' to y" | .. | .. | .. | .. | 1.7 pF |
| cy'-all (y" earthed) | .. | .. | .. | .. | 2.7 pF |
| cy"-all (y' earthed) | .. | .. | .. | .. | 2.7 pF |

Alternative phosphors

P7 available.

P11 to special order.

5BKP31 High Quality General Purpose Tube



This five-inch tube is ideally suited for use in the higher grade general purpose instrument. It has the high sensitivity and narrow line width expected in such equipment, and a metal backed screen and two-stage distributed p.d.a. system to ensure a brilliant display.

With a p.d.a. ratio of 5.5 : 1 the maximum pattern distortion of this tube is 2% and the maximum deviation from deflection linearity is 2%.

Heater 6.3V, 550 mA.

Typical Operation

| | | | | | |
|-------------------------------|----|----|----|----|--------------|
| V _{a1} | .. | .. | .. | .. | 1.4 kV |
| V _{a3} | .. | .. | .. | .. | 1.8 kV |
| V _{a4} | .. | .. | .. | .. | 4.0 kV |
| V _{a5} | .. | .. | .. | .. | 10 kV |
| V _g for cut-off .. | .. | .. | .. | .. | -45 to -90 V |
| S _x | .. | .. | .. | .. | 26.5 V/cm |
| S _y | .. | .. | .. | .. | 12.5 V/cm |

Capacitances

| | | | | | |
|----------------------|----|----|----|----|--------|
| cy' to y" | .. | .. | .. | .. | 1.7 pF |
| cy'-all (y" earthed) | .. | .. | .. | .. | 1.6 pF |
| cy"-all (y' earthed) | .. | .. | .. | .. | 1.7 pF |

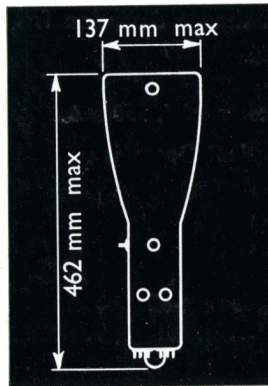
Alternative phosphors

P7 and P11 are available.

High Writing Speed Tubes

5BVP31

5BVP31A



At maximum ratings the 5BVP31 will record single transients at writing speeds up to 10,000 kilometres/sec, and with the 5BVP31A it is possible in some instances to record at writing speeds as high as 20,000 kilometres/sec.

Both tubes are fitted with conventional deflector plates, but they are brought out to closely spaced side pins for simplicity of input connection.

Operationally, the difference between these two tubes is solely that a maximum voltage of only 1.7 kV can be applied to the first anode of the 5BVP31A, compared with 5.0 kV in the case of the 5BVP31.

Heater 6.3V, 550 mA.

Typical Operation

| | 5BVP31 | 5BVP31A |
|----------------------------|---------------|--------------|
| V_{a1} | 4.0 kV | 1.5 kV |
| V_{a2} (for focus) | 1.0 kV | 0.9 kV |
| V_{a3} | 4.0 kV | 4.0 kV |
| V_{a4} | 8.0 kV | 8.0 kV |
| V_g | -56 to -120 V | -40 to -95 V |
| S_x | 60 V/cm | 60 V/cm |
| S_y | 36 V/cm | 36 V/cm |

Capacitances

| | |
|---------------------------------------|--------|
| $C_{x' - x''}$ | 1.5 pF |
| $C_{y' - y''}$ | 1.6 pF |
| $C_{x'}$ - all (x'' earthed) | 3.6 pF |
| $C_{x''}$ - all (x' earthed) | 3.6 pF |
| $C_{y'}$ - all (y'' earthed) | 3.0 pF |
| $C_{y''}$ - all (y' earthed) | 3.0 pF |

Alternative Phosphors P11 and P15 to special order.

DATA SHEETS

Data sheets giving comprehensive information on any tubes in which you are particularly interested are freely available. Please do not hesitate to ask for these and any other information which you may require.

ELECTRONIC TUBES LIMITED

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