# SPECIAL VALVES

## Velocity-Modulated Oscillator

### Code: V271C/3M

The V271C/3M is a single-transit velocity-modulated oscillator of a new type for operation in the frequency range 6 850–7 350 Mc/s.

It is intended for use as a frequency modulated transmitting valve in radio links. No forced air cooling is required for operation up to the conditions specified as maximum ratings.

**CATHODE**

| | | |
|---|---|---|
| Indirectly-heated, oxide-coated | | |
| Heater voltage | 6.3 | V |
| Nominal current | 0.25 | A |

**DIMENSIONS**

| | | | |
|---|---|---|---|
| Nominal overall length | 5¼ in., | 134 | mm |
| Nominal overall width | 4¼ in., | 108 | mm |
| Nominal overall depth | 1.9 in., | 69 | mm |
| Base | | B8G | |
| Weight of packaged assembly, including magnet but excluding tuning and output circuits | | 900 | g |
| | | 31.8 | oz |

**MOUNTING**

The valve has fitted on each side a flange plate with three OBA tapped holes into which are screwed special studs shown on the outline drawing.

The circuits have special flanges with quick release attachments which engage under the heads of the studs, as shown in Fig. 1.

Alternatively the tuning and output circuits may have plain flanges which are attached to the plates by OBA knurled screws. In this case the special studs are removed by unscrewing them.



COMPONENTS GROUP

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### MAXIMUM RATINGS

Voltages are given with respect to cathode unless otherwise stated.

| | | |
|---|---|---|
| Maximum direct anode voltage | 600 | V |
| Maximum direct resonator voltage | 600 | V |
| Maximum direct drift tube voltage, *with respect to resonator* | 200 | V |
| Maximum direct screen voltage | 400 | V |
| Maximum direct anode dissipation | 27 | W |
| Maximum direct resonator dissipation | 18 | W |
| Maximum direct drift tube dissipation | 3 | W |
| Maximum direct screen dissipation | 2 | W |
| Maximum total dissipation for all electrodes except heater | 40 | W |
| Maximum direct cathode current | 65 | mA |
| Maximum temperature of mica window seal | 130 | °C |
| Maximum temperature of any other part of valve envelope | 300 | °C |

### TYPICAL OPERATING CONDITIONS

Conditions are given for operation in Mode 15 ($3\frac{3}{4}$ cycles) and Mode 19 ($4\frac{3}{4}$ cycles). The Mode numbers are the number of quarter periods of oscillation occupied by electrons in transit through the drift space.

#### Mode 15

Frequency-modulated oscillator in the frequency range 6 850–7 350 Mc/s.

| | | |
|---|---|---|
| Direct anode voltage | 550 | V |
| Direct resonator voltage | 530 | V |
| Direct grid voltage | −50 | V |
| *Direct drift tube voltage | 395 to 505 | V |
| †Direct screen voltage, approximately | 180 | V |

*This is adjusted to give maximum power output at the operating frequency set by the tuning piston. Graphs of frequency as a function of piston position and drift tube voltage are shown in Figs. 3 and 4. The frequency-modulating voltage is applied to the drift tube only.

†This is adjusted to give a cathode current of 60 mA with a corresponding anode current of 30 to 40 mA.

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**Mode 19**

Oscillator in the frequency range 6 850–7 350 Mc/s.

| | | |
|---|---|---|
| Direct anode voltage | 370 | V |
| Direct resonator voltage | 350 | V |
| Direct grid voltage | −50 | V |
| *Direct drift tube voltage | 240 to 310 | V |
| †Direct screen voltage, approximately | 120 | V |

*This is adjusted to give maximum power output at the operating frequency. The graph of piston position versus operating frequency is the same as for Mode 15.

†This is adjusted to give a cathode current of 45 mA with a corresponding anode current of 22 to 30 mA.

**PERFORMANCE**

The valve should be used with the tuning and output circuits shown in Fig. 1. With the operating conditions as previously specified and the coupling slug adjusted to give maximum power output into a waveguide load whose V.S.W.R. is less than 1.2 the following performance should be obtained.

**Mode 15**

| | | |
|---|---|---|
| Power output, minimum | 800 | mW |
| Electronic tuning between half-power points, minimum | ±8.5 | Mc/s |
| Modulation sensitivity when loaded for maximum power | 250 to 450 | kc/s per V |
| Minimum mechanical tuning range obtained by variation of piston position | 6 850 to 7 350 | Mc/s |

**Typical Characteristic Curves**

| | |
|---|---|
| Tuning piston position versus frequency | Figure 3 |
| Power output versus frequency | Figure 5 |
| Electronic tuning versus frequency | Figure 6 |

**Mode 19**

| | | |
|---|---|---|
| Power output, minimum | 200 | mW |
| Electronic tuning between half-power points, minimum | ±6 | Mc/s |
| Modulation sensitivity when loaded for maximum power | 450 to 650 | kc/s per V |

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#### CIRCUITS

A diagram of the tuning and output circuits with a valve assembled is shown in Fig. 1. A separate diagram of the tuning circuit showing the reference plane for measurement of piston position is shown in Fig. 2.

The valve is designed to operate into Waveguide No. 14, correct loading being obtained by adjustment of the coupling slug. Some adjustment may be necessary to obtain maximum power when tuning over the available frequency range.

The tuning circuit is of 1 in. $\times$ $\frac{1}{2}$ in. internal section waveguide incorporating a non-contact tuning piston moved directly by a micrometer.

#### MODULATION

Frequency modulation is obtained by variation of the drift tube voltage with respect to resonator.

The direct drift tube current does not exceed 5 mA; the input capacitance is 20 to 30 pF and the slope resistance is of the order of 25 kilohm.

#### THERMAL DRIFT AND STABILITY

The initial thermal drift from cold to the final operating frequency is between 9 Mc/s and 13 Mc/s and is completed in less than 5 minutes.

The variation of frequency with ambient temperature is between 50 and 100 kc/s per °C over the range covered by movement of the tuning piston.

#### MAGNET

The magnet is adjusted and locked in position during the testing of the valve and *should not be re-adjusted* during the life of the valve.

# Code: V271C/3M

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Type 495–LVA–352

OUTPUT CIRCUIT.
GUIDE SIZE 14.

Type 495–LVA–351

TUNING CIRCUIT.

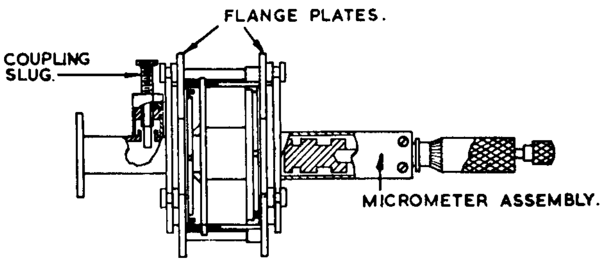


FIG. 1

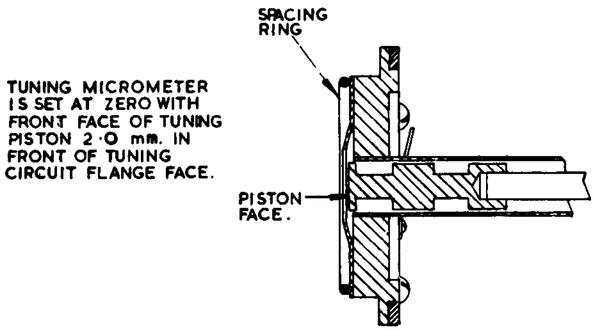


FIG. 2

STC

# Code: V271C/3M

CONTINUED

Fig. 3.—Typical Mechanical Tuning Characteristic.

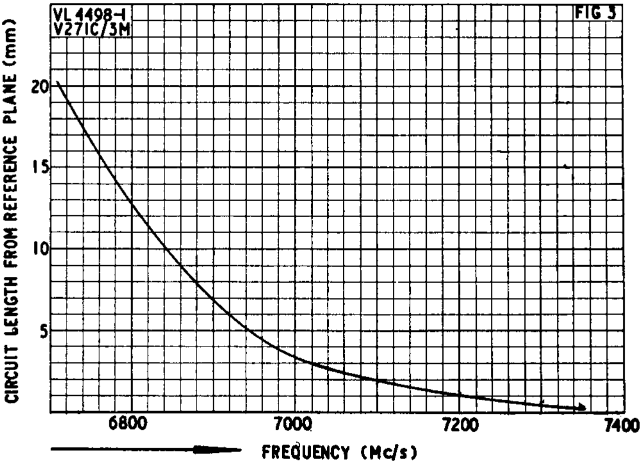


Fig. 4.—Typical Optimum Drift Tube Voltage Characteristic.

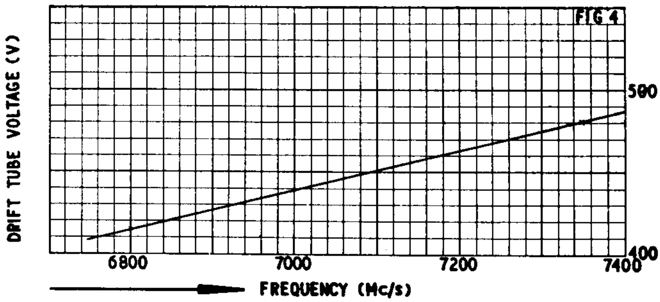

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**Fig. 5.—Typical Power Output Characteristic.**

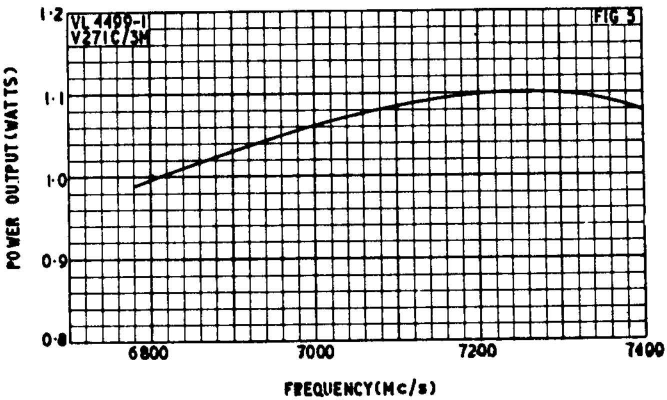
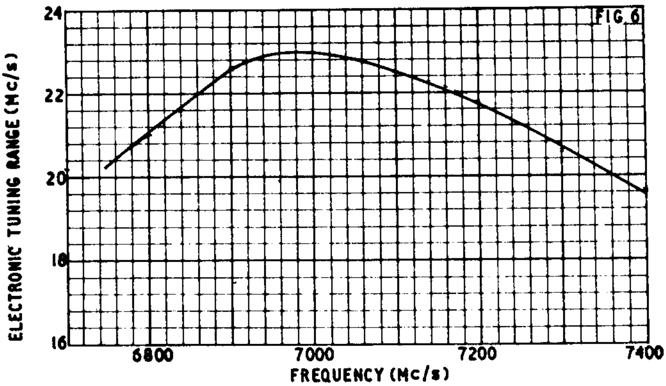



**Fig. 6.—Typical Variation of Electronic Tuning Range with Operating Frequency.**



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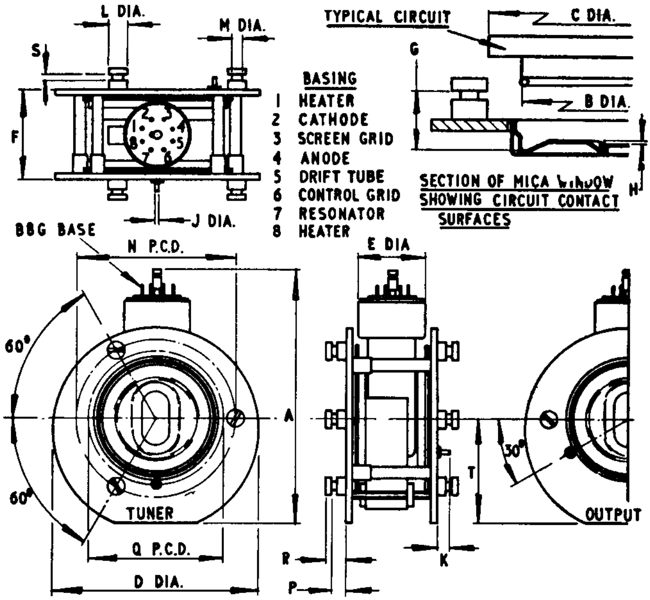


| DIM. | MILLIMETRES | INCHES | DIM. | MILLIMETRES | INCHES |
|---|---|---|---|---|---|
| A | 138,1 MAX. | $5\frac{7}{16}$ MAX. | K | 6,4±0,4 | $\frac{1}{4}\pm\frac{1}{64}$ |
| B | 57,63 MAX. | 2.269 MAX. | L | $9{,}53^{+0{,}00}_{-0{,}25}$ | $0.375^{+0.000}_{-0.010}$ |
| C | 74,40 MAX. | 2.929 MAX. | M | 4,75±0,13 | 0.187±0.005 |
| D | 108,0±1,6 | $4\frac{1}{4}\pm\frac{1}{16}$ | N | 84,33 NOM. | 3.320 NOM. |
| E | 38,1 MAX. | $1\frac{1}{2}$ MAX. | P | 7,54±0,18 | 0.297±0.007 |
| F | 51,6 MAX. | $2\frac{1}{32}$ MAX. | Q | 71,42 NOM. | 2.812 NOM. |
| G | 16,69±0,51 | 0.657±0.020 | R | 10,72±0,79 | 0.422±0.031 |
| H | 1,78 MIN. | 0.070 MIN. | S | 2,36±0,18 | 0.093±0.007 |
| J | 3,18±0,25 | 0.125±0.010 | T | 55,6±0,8 | $2\frac{3}{16}\pm\frac{1}{32}$ |

NOTE.—Basic figures are inches.