



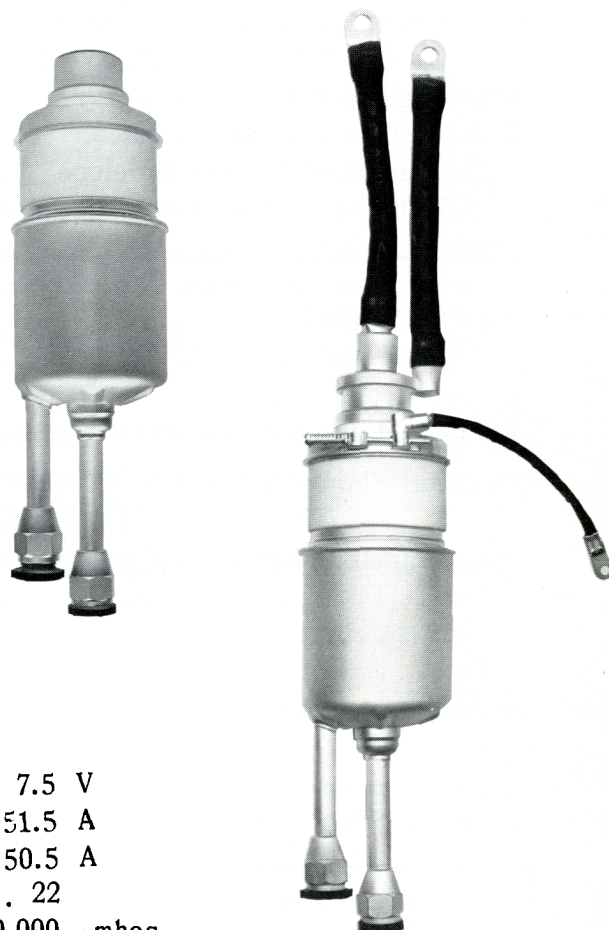
## TECHNICAL DATA

8242  
3CW5000A3  
8243  
3CW5000F3  
MEDIUM-MU  
WATER-COOLED  
POWER TRIODES

The EIMAC 8242/3CW5000A3 and 8243/3CW5000F3 are medium-mu water-cooled power triodes intended for use in amplifier, oscillator, or modulator service. Their maximum rated anode dissipation is 5000 watts. The two types are identical except for the addition of flexible leads for the grid and filament terminals of the 8243/3CW5000F3.

These tubes are water-cooled versions of the air-cooled 8161/3CX2500A3 and 8251/3CX2500F3.

The water-cooled tubes are recommended for industrial applications or installations where reserve anode dissipation is required.



### GENERAL CHARACTERISTICS<sup>1</sup>

#### ELECTRICAL

Filament: Thoriated-tungsten

Voltage . . . . . 7.5 V

Current @ 7.5 V(3CW5000A3) . . . . . 51.5 A  
(3CW5000F3) . . . . . 50.5 A

Amplification Factor (Average) . . . . . 22

Transconductance (Average) . . . . . 20,000  $\mu$ mhos

( $E_b = 3000$  Vdc;  $I_b = 830$  mA dc)

Direct Interelectrode Capacitances (Cathode grounded)<sup>2</sup>

$C_{in}$  . . . . . 35 pF

$C_{out}$  . . . . . 0.9 pF

$C_{gp}$  . . . . . 20 pF

Frequency of Maximum Ratings (CW)

3CW5000A3 F1 . . . . . 75 MHz

F2 . . . . . 110 MHz

3CW5000F3 F1 . . . . . 30 MHz

1. Characteristics and operating values are based on performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube as measured in a special shielded fixture, in accordance with Electronic Industries Association Standard RS-191.

## MECHANICAL

### Maximum Overall Dimensions:

|                                                 |                   |
|-------------------------------------------------|-------------------|
| Length (excluding leads on 3CW5000F3) . . . . . | 12.56 In; 31.9 Cm |
| Diameter . . . . .                              | 3.63 In; 9.22 Cm  |
| Net Weight (Approximate) 3CW5000A3 . . . . .    | 4.8 lb; 2.2 kg    |
| 3CW5000F3 . . . . .                             | 5.5 lb; 2.5 kg    |

Operating Position (both types) . . . . . Axis Vertical, Base Down or Up

### Maximum Operating Temperatures:

|                                                       |                            |
|-------------------------------------------------------|----------------------------|
| Ceramic/Metal Seals or Envelope . . . . .             | 250°C                      |
| 3CW5000F3 Filament Lead/Tube Base junctions . . . . . | 150°C                      |
| Cooling: Anode . . . . .                              | Water or Equivalent Liquid |
| Envelope, Seals, Base Areas . . . . .                 | Forced Air                 |
| Base: 3CW5000A3 . . . . .                             | Special Coaxial            |
| 3CW5000F3 . . . . .                                   | Special with Flying Leads  |

## RANGE VALUES FOR EQUIPMENT DESIGN

|                                                            | <u>Min.</u> | <u>Max.</u> |
|------------------------------------------------------------|-------------|-------------|
| Filament: Current @ 7.5 volts (3CW5000A3) . . . . .        | 49.0        | 54.0 A      |
| (3CW5000F3) . . . . .                                      | 48.0        | 53.0 A      |
| Interelectrode Capacitance (Grounded cathode) <sup>1</sup> |             |             |
| Cin . . . . .                                              | 29.2        | 40.2 pF     |
| Cout . . . . .                                             | 0.60        | 1.20 pF     |
| Cgp . . . . .                                              | 16.8        | 23.2 pF     |
| Amplification Factor . . . . .                             | 19          | 26          |

1. Capacitance values are for a cold tube as measured in a special shielded fixture, in accordance with Electronic Industries Association standard RS-191.

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias and plate voltage is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. This current variation causes no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

## RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR Class C Telephony or FM- Grid Driven

### ABSOLUTE MAXIMUM RATINGS:

|                                       |             |
|---------------------------------------|-------------|
| DC PLATE VOLTAGE (up to F1) . . . . . | 6000 VOLTS  |
| DC PLATE VOLTAGE (F1 to F2) . . . . . | 4000 VOLTS  |
| DC PLATE CURRENT . . . . .            | 2.5 AMPERES |
| PLATE DISSIPATION . . . . .           | 5000 WATTS  |
| GRID DISSIPATION . . . . .            | 150 WATTS   |

1. Approximate value.
2. Approximate; useful power delivered to the load will be lower because of circuit losses.

### TYPICAL OPERATION (Frequencies to 30 MHz)

|                                             |      |      |      |      |
|---------------------------------------------|------|------|------|------|
| Plate Voltage . . . . .                     | 4000 | 5000 | 6000 | Vdc  |
| Plate Current . . . . .                     | 2.5  | 2.5  | 2.1  | Adc  |
| Grid Voltage . . . . .                      | -300 | -450 | -500 | Vdc  |
| Grid Current <sup>1</sup> . . . . .         | 245  | 265  | 180  | mAdc |
| Peak rf Grid Voltage <sup>1</sup> . . . . . | 580  | 750  | 765  | v    |
| Driving Power <sup>1</sup> . . . . .        | 142  | 197  | 136  | W    |
| Grid Dissipation <sup>1</sup> . . . . .     | 68   | 78   | 46   | W    |
| Plate Power Input . . . . .                 | 10   | 12.5 | 12.5 | kW   |
| Plate Dissipation . . . . .                 | 2.5  | 2.5  | 2.5  | kW   |
| Plate Power Output <sup>2</sup> . . . . .   | 7.5  | 10   | 10   | kW   |

## PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class C Telephony - Carrier Conditions

### ABSOLUTE MAXIMUM RATINGS:

|                                       |      |         |
|---------------------------------------|------|---------|
| DC PLATE VOLTAGE (up to F1) . . . . . | 5000 | VOLTS   |
| DC PLATE VOLTAGE (F1 to F2) . . . . . | 3500 | VOLTS   |
| DC PLATE CURRENT . . . . .            | 2.0  | AMPERES |
| PLATE DISSIPATION . . . . .           | 3350 | WATTS   |
| GRID DISSIPATION . . . . .            | 150  | WATTS   |

1. Approximate value.
2. Approximate; useful power delivered to the load will be lower because of circuit losses.

### TYPICAL OPERATION (Frequencies to 30 MHz)

|                                             |      |      |      |                  |
|---------------------------------------------|------|------|------|------------------|
| Plate Voltage . . . . .                     | 4000 | 4500 | 5000 | Vdc              |
| Plate Current . . . . .                     | 1.67 | 1.55 | 1.45 | Adc              |
| Total Bias Voltage . . . . .                | -450 | -500 | -550 | Vdc              |
| Fixed Bias Voltage . . . . .                | -230 | -325 | -410 | Vdc              |
| Grid Resistor . . . . .                     | 1500 | 1500 | 1400 | $\Omega$         |
| Grid Current . . . . .                      | 150  | 120  | 100  | mA <sub>dc</sub> |
| Peak rf Grid Voltage <sup>1</sup> . . . . . | 680  | 720  | 760  | v                |
| Driving Power <sup>1</sup> . . . . .        | 102  | 86   | 76   | W                |
| Grid Dissipation <sup>1</sup> . . . . .     | 35   | 26   | 21   | W                |
| Plate Dissipation <sup>1</sup> . . . . .    | 1.67 | 1.67 | 1.67 | kW               |
| Plate Power Output <sup>2</sup> . . . . .   | 5.0  | 5.3  | 5.6  | kW               |

## AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR Class AB

### ABSOLUTE MAXIMUM RATINGS:

|                             |      |         |
|-----------------------------|------|---------|
| DC PLATE VOLTAGE . . . . .  | 6000 | VOLTS   |
| DC PLATE CURRENT . . . . .  | 2.5  | AMPERES |
| PLATE DISSIPATION . . . . . | 5000 | WATTS   |
| GRID DISSIPATION . . . . .  | 150  | WATTS   |

1. Approx. Adjust for specified zero-signal plate current.
2. Approximate.

### TYPICAL OPERATION (Two Tubes)

|                                                           |      |      |      |      |          |
|-----------------------------------------------------------|------|------|------|------|----------|
| Plate Voltage . . . . .                                   | 4000 | 5000 | 5000 | 6000 | Vdc      |
| Grid Voltage <sup>1</sup> . . . . .                       | -145 | -190 | -190 | -240 | Vdc      |
| Zero Signal Plate Current                                 | 0.6  | 0.5  | 0.5  | 0.4  | Adc      |
| Max. Signal Plate Current                                 | 2.70 | 2.26 | 3.2  | 3.0  | Adc      |
| Effective Load,<br>plate-to-plate . . . . .               | 3300 | 5000 | 3600 | 4650 | $\Omega$ |
| Peak af Grid Voltage<br>(per tube) <sup>2</sup> . . . . . | 285  | 310  | 360  | 390  | v        |
| Max. Signal Peak<br>Driving Power <sup>2</sup> . . . . .  | 134  | 118  | 230  | 225  | W        |
| Max. Signal Nom.<br>Driving Power <sup>2</sup> . . . . .  | 67   | 59   | 115  | 113  | W        |
| Max. Signal Plate<br>Output Power <sup>2</sup> . . . . .  | 7.4  | 8.0  | 11.0 | 13.0 | kW       |

## APPLICATION

### MECHANICAL

**MOUNTING** - The 3CW5000A3 and 3CW5000F3 must be mounted vertically, base down or up at the convenience of the circuit designer. The filament connections to the 3CW5000A3 should be made through spring collets. These are available from EIMAC with the following part numbers:

149575 Inner line collet;

149576 Outer line collet

Reasonable care should be taken that these collets do not impart undue strain to the terminals or the base of the tube.

**COOLING** - With an anode dissipation of 5000 watts and with an incoming water temperature of 50°C maximum, 7.7 gpm of cooling water must be supplied to the anode cooling jacket. Outlet water temperature from the cooling jacket should never exceed 70°C, and water pressure on the jacket should not exceed 60 psi. The pressure drop across the anode cooling jacket itself, with a water flow of 7.7 gpm, will be approximately 6 psi. The grid-terminal contact surface and adjacent ceramic must be cooled by forced air, with quantity, velocity, and



direction adjusted to limit the maximum seal temperature to less than 250°C.

The filament stem structure also requires forced-air cooling. A minimum of 6 cfm should be directed into the space between the inner and outer filament contacting surfaces.

Both air and water flow must be supplied before or simultaneously with the application of electrode voltages, including the filament, and may be removed simultaneously with them. Where long life and consistent performance are factors, cooling in excess of minimum requirements is normally beneficial.

## ELECTRICAL

**FILAMENT OPERATION**-The filament voltage, as measured at the filament terminals, should be 7.5 volts, with maximum allowable variations due to line fluctuations of from 7.12 to 7.87 volts.

**RADIO FREQUENCY RADIATION**-Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 30 MHz, most of the energy will pass completely through the human body with little attenuation or heating effect. Public health agencies are concerned with the hazard, however, even at these frequencies, and it is worth noting that some commercial dielectric heating units actually operate at frequencies as low as the 13 and 27 MHz bands.

Many EIMAC power tubes, such as these, are specifically designed to generate or amplify radio frequency power. There may be a relatively strong rf field in the general proximity of the power tube and its associated circuitry--the more power involved, the stronger the rf field. Proper enclosure design and efficient coupling of rf energy to the load will minimize the rf field in the vicinity of the power amplifier unit itself.

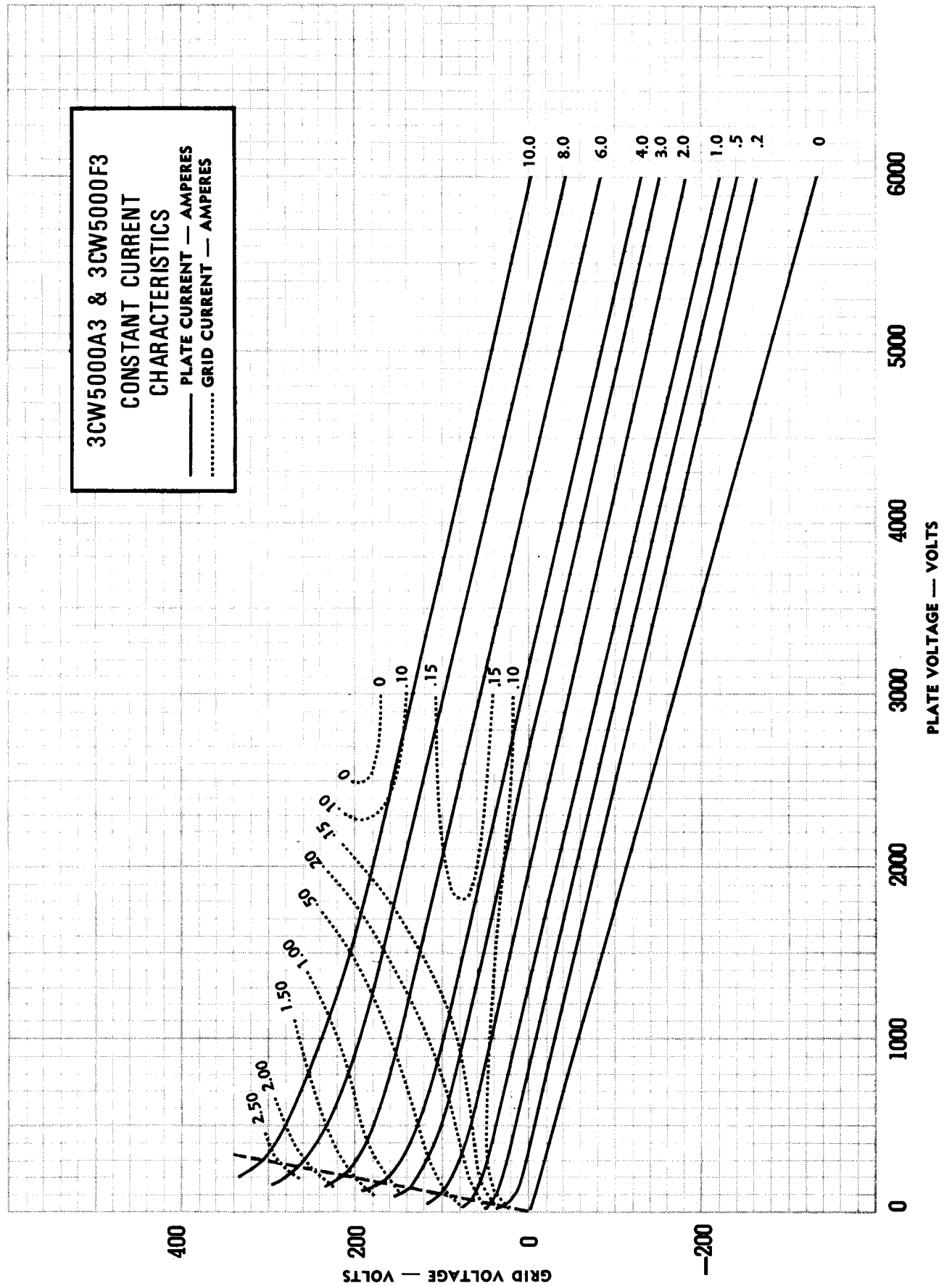
**HIGH VOLTAGE**-Normal operating voltages used with these tubes are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all equipment so that no one can come in contact with high

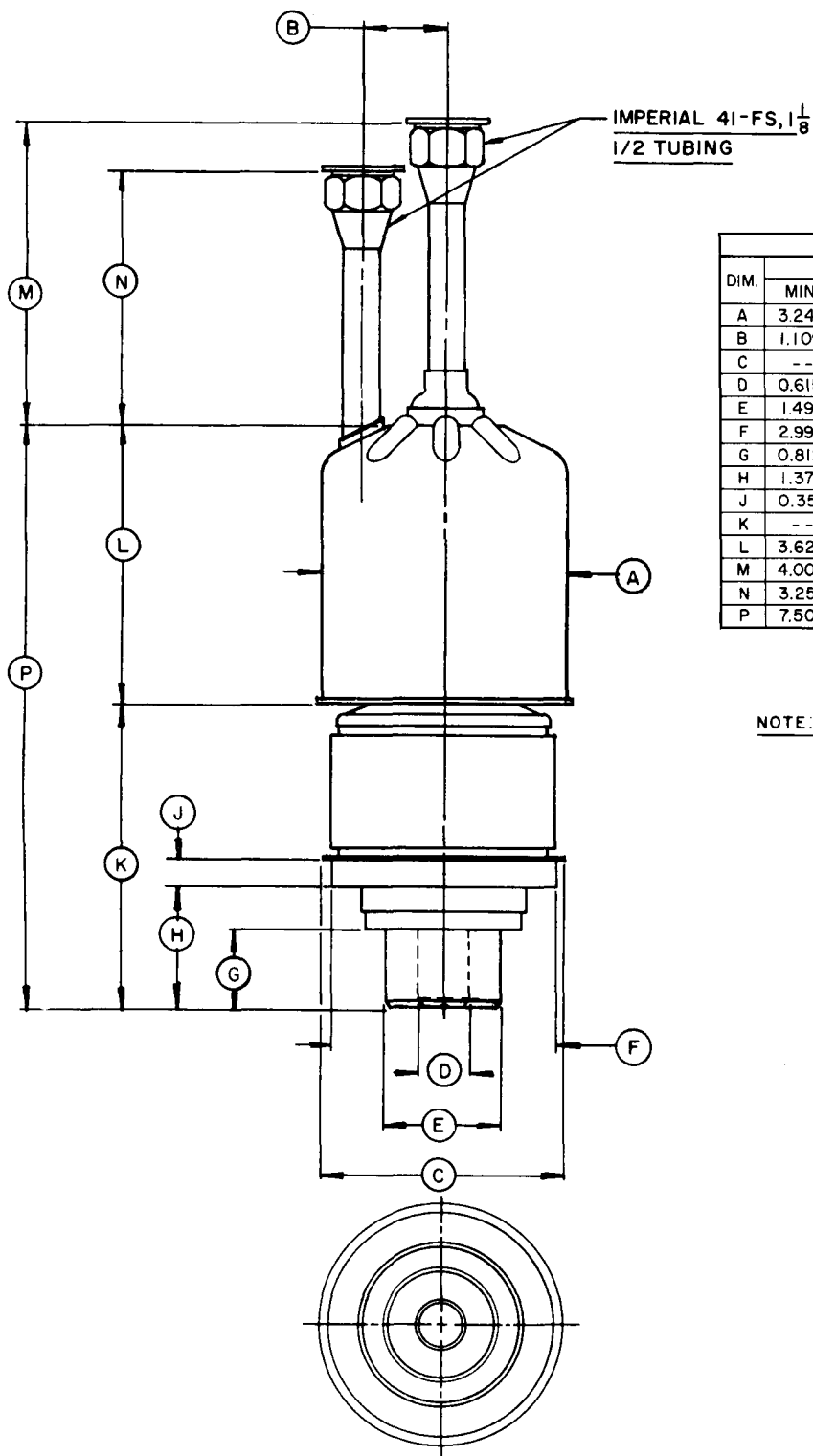
voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open primary circuits of the power supply and to discharge high-voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

**INTERELECTRODE CAPACITANCE** - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to "ground". The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

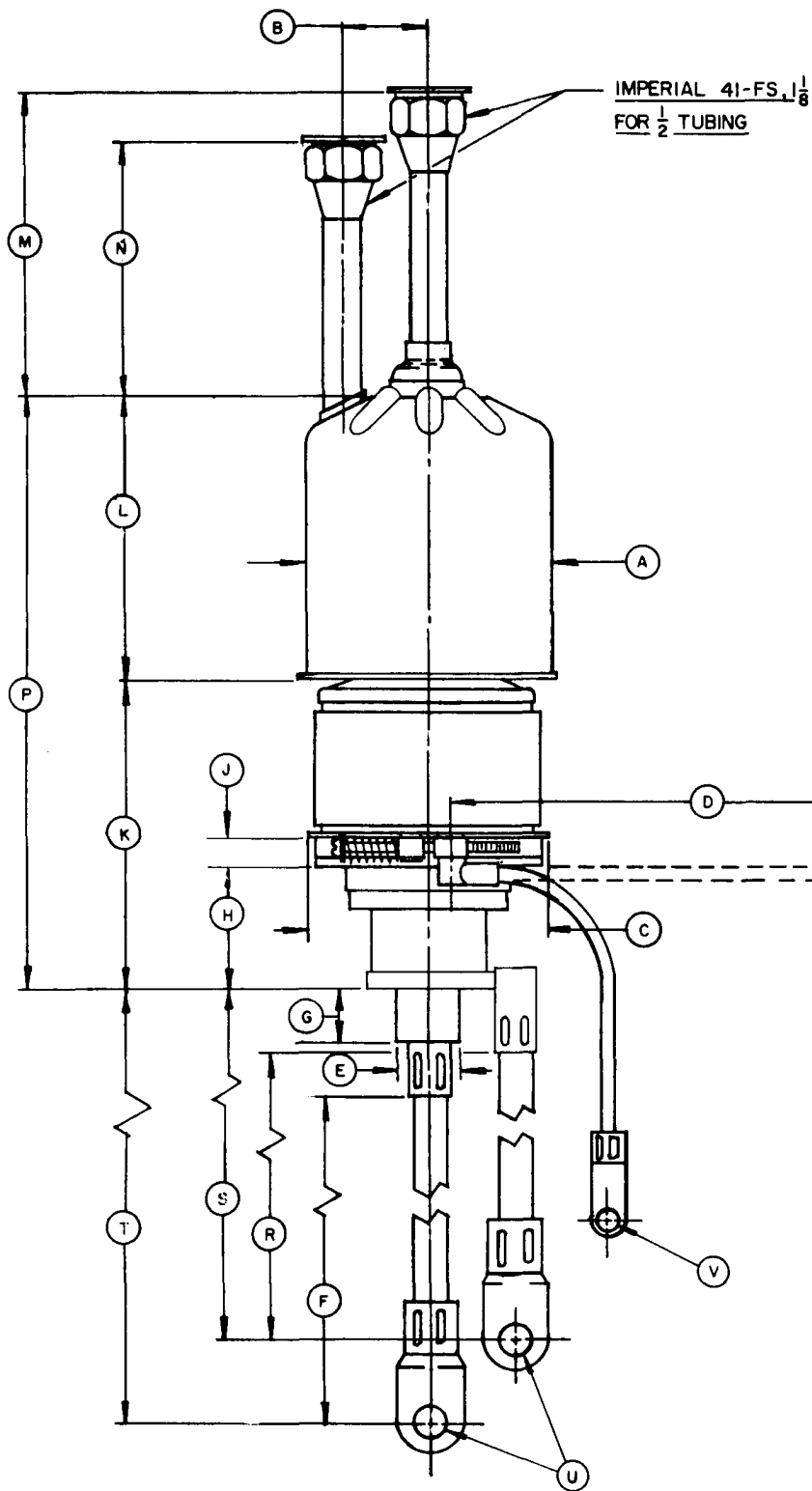
**SPECIAL APPLICATION** - If it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070, for information and recommendations.





| DIMENSIONAL DATA |        |       |       |             |        |       |
|------------------|--------|-------|-------|-------------|--------|-------|
| DIM.             | INCHES |       |       | MILLIMETERS |        |       |
|                  | MIN.   | MAX.  | REF.  | MIN.        | MAX.   | REF.  |
| A                | 3.245  | 3.255 | --    | 82.42       | 82.68  | --    |
| B                | 1.109  | 1.141 | --    | 28.17       | 28.98  | --    |
| C                | --     | 3.625 | --    | --          | 92.08  | --    |
| D                | 0.615  | 0.635 | --    | 15.62       | 16.13  | --    |
| E                | 1.490  | 1.510 | --    | 37.85       | 38.35  | --    |
| F                | 2.990  | 3.010 | --    | 75.95       | 76.45  | --    |
| G                | 0.812  | 0.938 | --    | 20.62       | 23.83  | --    |
| H                | 1.375  | 1.625 | --    | 34.93       | 41.28  | --    |
| J                | 0.359  | 0.422 | --    | 9.12        | 10.72  | --    |
| K                | --     | --    | 3.599 | --          | --     | 91.41 |
| L                | 3.625  | 3.875 | --    | 92.08       | 98.43  | --    |
| M                | 4.000  | 4.500 | --    | 101.60      | 114.30 | --    |
| N                | 3.250  | 3.750 | --    | 82.55       | 95.25  | --    |
| P                | 7.500  | 8.125 | --    | 190.50      | 206.38 | --    |

NOTE: REF. DIMS ARE FOR INFO ONLY AND NOT REQ. FOR INSPECTION PURPOSES.



| DIM. | INCHES |       |       | MILLIMETERS |        |       |
|------|--------|-------|-------|-------------|--------|-------|
|      | MIN.   | MAX.  | REF.  | MIN.        | MAX.   | REF.  |
|      |        |       |       |             |        |       |
| A    | 3.245  | 3.255 | --    | 82.42       | 82.68  | --    |
| B    | 1.109  | 1.141 | --    | 28.17       | 28.98  | --    |
| C    | --     | 3.625 | --    | --          | 92.08  | --    |
| D    | 6.375  | 6.625 | --    | 161.93      | 168.28 | --    |
| E    | 0.859  | 0.890 | --    | 21.82       | 22.61  | --    |
| F    | 7.000  | 7.500 | --    | 177.80      | 190.50 | --    |
| G    | 0.812  | 0.938 | --    | 20.62       | 23.83  | --    |
| H    | 1.375  | 1.625 | --    | 34.93       | 41.28  | --    |
| J    | 0.359  | 0.422 | --    | 9.12        | 10.72  | --    |
| K    | --     | --    | 3.599 | --          | --     | 91.41 |
| L    | 3.625  | 3.875 | --    | 92.08       | 98.43  | --    |
| M    | 4.000  | 4.500 | --    | 101.60      | 114.30 | --    |
| N    | 3.250  | 3.750 | --    | 82.55       | 95.25  | --    |
| P    | 7.500  | 8.125 | --    | 190.50      | 206.38 | --    |
| R    | 7.000  | 7.500 | --    | 177.80      | 190.50 | --    |
| S    | 7.937  | 8.437 | --    | 201.60      | 214.30 | --    |
| T    | 8.937  | 9.437 | --    | 226.99      | 239.70 | --    |
| U    | 0.385  | 0.395 | --    | 9.78        | 10.03  | --    |
| V    | 0.194  | 0.200 | --    | 4.93        | 5.08   | --    |

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