**EITEL-McCULLOUGH, INC.**
SAN CARLOS · CALIFORNIA

**TENTATIVE DATA**

# 4CX1000A

**CERAMIC**
**POWER TETRODE**


The Eimac 4CX1000A is a ceramic and metal, forced air-cooled, radial beam tetrode with a rated maximum plate dissipation of 1000 watts. It is a low voltage, high current tube specifically designed for Class $AB_1$ RF linear amplifier or audio amplifier applications where its high gain and low distortion characteristics may be used to advantage. At its rated maximum plate voltage of 3000 volts, it is capable of producing 1680 watts of single-tone output power in single sideband suppressed carrier applications. Two 4CX1000As operating in Class $AB_1$ will produce 3360 watts of useful audio power.

## GENERAL CHARACTERISTICS

### ELECTRICAL

| | |
|---|---|
| Cathode: Oxide Coated, Unipotential | |
| Heating Time (See Application) | 5 Minutes |
| Cathode Internally Connected to One Side of Heater | |
| Heater: Voltage | 6.0 Volts |
| Current | 12.5 Amperes |
| Amplification Factor (Grid to Screen) | 5.0 |
| Transconductance ($I_b$ = 1.0 ampere) | 37,000 Micromhos |
| Direct Interelectrode Capacitance, Cathode Grounded | |
| Input | 85 $\mu\mu$fds |
| Output | 12 $\mu\mu$fds |
| Feedback | 0.02 $\mu\mu$fds |
| Direct Interelectrode Capacitance, Grid and Screen Grounded | |
| Input | 35 $\mu\mu$fds |
| Output | 12 $\mu\mu$fds |
| Feedback | 0.005 $\mu\mu$fds |
| Frequency For Maximum Ratings | To be determined |
| Highest Useful Frequency | To be determined |

### MECHANICAL

| | |
|---|---|
| Base | Special, Breechlock Terminal Surfaces |
| Maximum Operating Temperatures | |
| Ceramic to Metal Seals | 200° C Max. |
| Anode Core | 250° C Max. |
| Recommended Socket | SK-800 |
| Cooling | Forced Air |
| Maximum Overall Dimensions | |
| Height | 4 21/32 Inches |
| Diameter | 3 11/32 Inches |
| Net Weight | 27.0 Ounces |
| Shipping Weight (Approx.) | 3.0 Pounds |

## CLASS $AB_1$ RADIO FREQUENCY LINEAR AMPLIFIER

### SINGLE SIDE-BAND, SUPPRESSED CARRIER

MAXIMUM RATINGS (Per Tube)

| | |
|---|---|
| DC PLATE VOLTAGE | 3000 VOLTS MAX. |
| DC SCREEN VOLTAGE | 350 VOLTS MAX. |
| DC PLATE CURRENT | 1.0 AMPS. MAX. |
| PLATE DISSIPATION | 1000 WATTS MAX. |
| SCREEN DISSIPATION | 12 WATTS MAX. |
| GRID DISSIPATION | 0 WATTS MAX. |

### TYPICAL OPERATION (Per Tube, Grid Driven)

| | | | |
|---|---|---|---|
| DC Plate Voltage | 2000 | 2500 | 3000 volts |
| DC Screen Voltage | 325 | 325 | 325 volts |
| DC Grid Voltage (approx.)* | −55 | −55 | −55 volts |
| Zero-Signal DC Plate Current | 250 | 250 | 250 ma |
| Single-Tone DC Plate Current | 1.0 | 1.0 | 0.9 amps |
| Zero-Signal DC Screen Current (approx.) | −2 | −2 | −2 ma |
| Single-Tone DC Screen Current (approx.) | 30 | 30 | 30 ma |
| Single-Tone Peak RF Grid Voltage (approx.) | 55 | 55 | 55 volts |
| Single-Tone Driving Power (circuit losses excluded) | 0 | 0 | 0 watts |
| Single-Tone Output Power (actual power delivered to load) | 1080 | 1460 | 1680 watts |

*Adjust grid voltage to obtain specified zero-signal plate current.

## CLASS AB, AUDIO AMPLIFIER OR MODULATOR

| MAXIMUM RATINGS (Per Tube) | |
|---|---|
| DC PLATE VOLTAGE | 3000 VOLTS MAX. |
| DC SCREEN VOLTAGE | 350 VOLTS MAX. |
| DC PLATE CURRENT | 1.0 AMPS. MAX. |
| PLATE DISSIPATION | 1000 WATTS MAX. |
| SCREEN DISSIPATION | 12 WATTS MAX. |
| GRID DISSIPATION | 0 WATTS MAX. |

### TYPICAL OPERATION (Two Tubes, Sinusoidal Wave)

| | | | | |
|---|---|---|---|---|
| DC Plate Voltage | 2000 | 2500 | 3000 | volts |
| DC Screen Voltage | 325 | 325 | 325 | volts |
| DC Grid Voltage (approx.)* | −55 | −55 | −55 | volts |
| Zero-Signal DC Plate Current | 500 | 500 | 500 | ma |
| Max.-Signal DC Plate Current | 2.0 | 2.0 | 1.8 | amps |
| Zero-Signal DC Screen Current (approx.) | −4 | −4 | −4 | ma |
| Max.-Signal DC Screen Current (approx.) | 60 | 60 | 60 | ma |
| Effective Load, Plate to Plate | 2800 | 3100 | 3850 | ohms |
| Peak Audio Input Voltage | 55 | 55 | 55 | volts |
| Max.-Signal Output Power (actual power delivered to load) | 2160 | 2920 | 3360 | watts |

*Adjust grid voltage to obtain specified zero-signal plate current.

NOTE: Tube operation depends on the electrode voltages. TYPICAL OPERATION data are based on the adjustment of the grid bias to obtain the specified zero-signal plate current at the specified screen and plate voltages. When the grid drive is then adjusted to obtain the specified plate current, there will be little variation in output from tube-to-tube, even though there may be some differences in screen currents. The screen current which may flow when the desired plate current is obtained is merely incidental and often varies from tube to tube. These minor current variations cause no difficulty so long as the circuit maintains the correct voltages in the presence of the variations in current.

## APPLICATION

### MECHANICAL

**Cooling**—Sufficient cooling must be provided for the anode and ceramic to metal seals to maintain operating temperatures below the rated maximum values:

| | |
|---|---|
| Ceramic to Metal Seals | 200° C |
| Anode Core | 250° C |

At sea level, with an inlet air temperature of 20° C (68° F), at least 35 cubic feet per minute of air flow is required to cool the 4CX1000A, when the tube is installed in an Eimac Air-System Socket with Air Chimney and operated at the rated maximum plate dissipation. Operation at higher altitudes or with higher inlet temperatures requires increased volumes of flow to obtain equivalent cooling. A source of design information for such conditions is the article "Blower Selection for Forced Air-Cooled Tubes" by A. G. Nekut, Electronics, August, 1950.

The cooling air must be maintained on the ceramic and metal seals during standby periods when only the heater voltage is applied to the tube, if reliable long life operation is to be obtained.

If cooling methods other than forced air are used, if the recommended air flow rates are not supplied or if there is any doubt that the cooling is adequate, it should be borne in mind that the operating temperatures of the ceramic to metal seals and the anode core are the sole criteria of cooling effectiveness.

One method of measuring the surface temperatures is the use of a temperature sensitive lacquer, such as "Tempilaq". This product can be obtained from the Tempil Corporation, 11 West 25th Street, New York 10, New York. When temperature sensitive materials are used, extremely thin coatings must be applied to avoid interference with the transfer of heat from the tube to the air stream. Excessively heavy applications will result in inaccurate indications.

### ELECTRICAL

**Heater**—The rated heater voltage for the 4CX1000A is 6.0 volts and the operating voltage, as measured at the socket, should be maintained within plus or minus 5% of this value if long life operation is to be obtained.

The cathode and one side of the heater are internally connected.

**Cathode Operation**—The oxide-coated unipotential cathode in the 4CX1000A must be protected against excessively high emission currents. For all types of operation, the maximum rated DC plate input current is 1.0 ampere.

It is recommended that the heater be run at rated voltage for a period of not less than 3 minutes before other operating voltages are applied. From an initial cold condition, tube operation will stabilize after a period of approximately 5 minutes.

**Control Grid Operation**—The grid dissipation rating of the 4CX1000A is zero watts. The design features which make the tube capable of maximum power operation without driving the grid into the positive region also make it necessary to avoid positive grid operation. Although the average grid current rating is zero, peak grid currents of less than one milliampere may be permitted to flow for peak-signal monitoring purposes.

**Screen Grid Operation**—Tetrode tubes may exhibit reversed screen current to a greater or lesser degree depending on individual tube design. This characteristic is prominent in the 4CX1000A and, under some operating conditions, indicated negative screen currents in the order of 25 milliamperes may be encountered.

It is difficult to measure screen dissipation in the presence of secondary emission. The usual product of current and voltage may not provide an accurate picture of actual screen dissipation. Experience has shown that the screen will operate within the limits

established for this tube if the indicated screen current, plate voltage and drive voltage approximate the "Typical Operation" values.

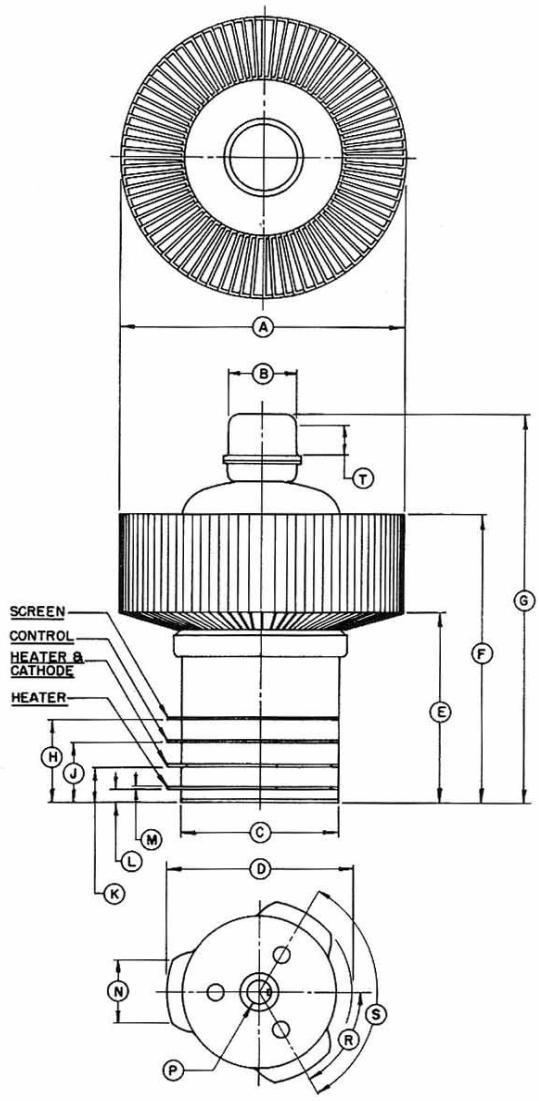
The screen supply voltage must be maintained constant for any values of negative and positive screen currents that may be encountered. Dangerously high plate currents may flow if the screen power supply exhibits a rising voltage characteristic with negative screen current. Stabilization may be accomplished in several different ways. A bleeder resistor may be connected from screen to cathode; a combination of VR tubes may be connected from screen to cathode; or an electron tube regulator circuit may be used in the screen supply. It is absolutely essential to use a bleeder if a series electron tube regulator is employed. The screen bleeder current should approximate 70 milliamperes to adequately stabilize the screen voltage. It should be observed that this bleeder power may be usefully employed to energize low power stages of the transmitter.

**Plate Operation**—The maximum rated plate dissipation power is 1000 watts. Except for brief periods during circuit adjustments, this maximum value should not be exceeded.

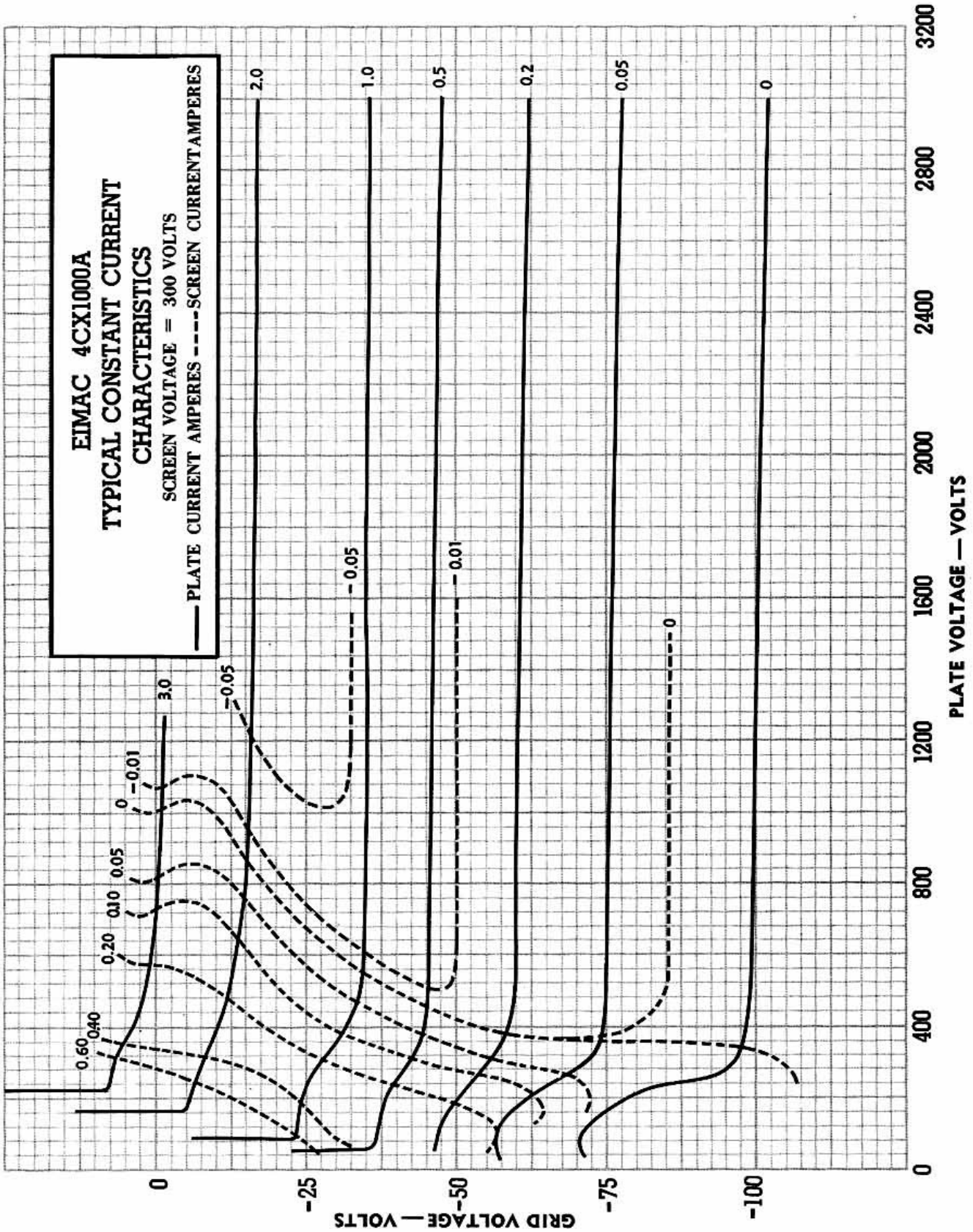
The top cap on the anode cooler may be used for a plate terminal or a circular clamp or spring-finger collet encircling the cylindrical outer surface of the anode cooler may be used.

Points of electrical contact with the anode cooler should be kept clean and free of oxide to minimize radio frequency losses. The anode cooler should be inspected periodically and cleaned when necessary to remove any dirt which might interfere with effective cooling.

**Special Applications**—If it is desired to operate this tube under conditions different from those given here, write to Application Engineering Department, Eitel-McCullough, Inc., San Carlos, California, for information and recommendations.




| DIMENSION DATA | | | |
|---|---|---|---|
| REF. | NOM. | MIN. | MAX. |
| A | 3 11/32 O.D. | | |
| B | 13/16 DIA. | | |
| C | 1 7/8 DIA. | | |
| D | | 2.254 DIA. | 2.278 DIA. |
| E | 2 15/64 | | |
| F | 3 1/2 | | |
| G | 4 21/32 | | |
| H | | .974 | .994 |
| J | | .697 | .717 |
| K | | .421 | .441 |
| L | | .147 | .167 |
| M | | .019 | .023 |
| N | 3/4 | | |
| P | | .316 | .326 |
| R | 60° | | |
| S | 120° | | |
| T | 3/8 | | |

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