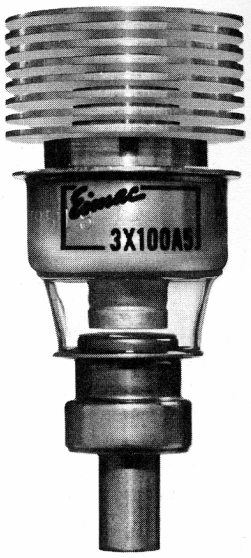
3X100A5

HIGH-MU

TRIODE

EITEL-McCULLOUGH, INC.
SAN BRUNO · CALIFORNIA



The Eimac 3X100A5 is a high-mu transmitting triode of planar construction designed for use as a power amplifier, oscillator, or frequency multiplier in the VHF and UHF ranges. The 3X100A5 is physically and electrically identical to the Eimac 2C39A but additional production tests, including long-pulse cathode evaluation, assure higher quality.

The 3X100A5 will deliver a minimum of 12 watts useful power output as an r-f oscillator at 2500 megacycles and up to 27 watts power output as an amplifier at 500 megacycles.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Cathode: Oxide-Coated, Unipotential				
Heating Time		60		seconds
Heater: Voltage (See "Applications")		6.3		volts
Current	0.95		1.10	amperes
Amplification Factor		100		
Direct Interelectrode Capacitances:				
Grid-Plate	1.86		2.16	uuf
Grid-Cathode	5.60		7.60	uuf
Plate-Cathode			0.035	uuf
Tranconductance (I_b=70 ma.)	20,000		30,000	umhos
Frequency for Maximum Ratings			2,500	mc

MECHANICAL

Base, Socket and Connections	See drawing
Operating Position	Any
Cooling	Forced Air
Maximum Operating Temperatures:	
Metal-to-Glass Seals	175° C
Anode Core	175° C

Maximum Over-all Dimensions:	
Length	2.75 inches
Diameter	1.27 inches
Net Weight	2.8 ounces
Shipping Weight (Approximate)	7 ounces

RADIO-FREQUENCY POWER AMPLIFIER, OR OSCILLATOR

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	1000 MAX. VOLTS
D-C CATHODE CURRENT	125 MAX. MA
D-C GRID VOLTAGE	—150 MAX. VOLTS
D-C GRID CURRENT	50 MAX. MA
HEATER VOLTAGE	SEE APPLICATION NOTES
INSTANTANEOUS PEAK POSITIVE GRID VOLTAGE	30 MAX. VOLTS
INSTANTANEOUS PEAK NEGATIVE GRID VOLTAGE	400 MAX. VOLTS
PLATE DISSIPATION	100 MAX. WATTS
GRID DISSIPATION	2 MAX. WATTS

TYPICAL OPERATION (Key-down conditions, per tube)
(Power-Amplifier Grid-Isolation Circuit, CW Operation, 500 Mc.)

D-C Plate Voltage	800 volts
D-C Grid Voltage	—20 volts
D-C Plate Current	80 ma
D-C Grid Current	32 ma
Driving Power (approx.)[1]	6 watts
Useful Power Output	27 watts

TYPICAL OPERATION
(R-F Oscillator, 2500 Mc.)[2]

D-C Plate Voltage	900 volts
D-C Grid Voltage	—22 volts
D-C Plate Current	90 ma
D-C Grid Current	27 ma
Useful Power Output	12 watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS (Carrier conditions, per tube)

D-C PLATE VOLTAGE[3]	600 MAX. VOLTS
D-C GRID VOLTAGE	—150 MAX. VOLTS
D-C GRID CURRENT	50 MAX. MA
D-C CATHODE CURRENT	100 MAX. MA
PEAK INSTANTANEOUS POSITIVE GRID VOLTAGE	30 MAX. VOLTS
PEAK INSTANTANEOUS NEGATIVE GRID VOLTAGE	400 MAX. VOLTS
PLATE DISSIPATION	70 MAX. WATTS
GRID DISSIPATION	2 MAX. WATTS

TYPICAL OPERATION
(Plate-Modulated Radio-Frequency Power Amplifier Grid-Isolation Circuit, 500 Mc., Per Tube)

D-C Plate Voltage	600 volts
D-C Grid Voltage	—16 volts
D-C Plate Current	65 ma
D-C Grid Current	35 ma
Driving Power (approx.)[1]	5 watts
Useful Carrier Power Output	16 watts

[1]Driving power listed is the total power which must be supplied to a practical grid circuit at the frequency shown.
[2]These 2500-megacycle conditions conform to the minimum requirements of the MIL-E-1 specifications for the 2C39A.
[3]For less than 100% modulation, higher d-c plate voltage may be used if the sum of the peak positive modulating voltage and the d-c plate voltage does not exceed 1200 volts.

APPLICATION

MECHANICAL

Mounting—The 3X100A5 may be operated in any position. It should be firmly held in place by spring-finger collets bearing on the terminal surfaces. The tube should seat against the under side of the "anode flange" (see outline drawing). In applications involving severe shock and vibration, the tube may be clamped in place by applying a suitable clamping device to the anode flange. It is recommended that no other portion of the tube be subjected to clamping forces.

Connections—The tube terminals are in the form of concentric cylinders of graduated diameters so that the 3X100A5 may be conveniently used with coaxial tuning devices. Spring-finger collets should be used to make contact with the anode, grid, cathode, and heater terminals. Adequate contact area and spring pressure should be provided to minimize heating and to prevent erratic circuit performance at the higher frequencies. Non-contacting or intermittently-contacting collet fingers will cause troublesome circuit behavior, especially at very-high and ultra-high frequencies. Electrode contact surfaces should be kept clean and free of oxide coatings.

Cooling—Forced air must be supplied to the anode cooler and to the metal-to-glass seals in sufficient quantity to maintain their temperatures below 175° C.

At sea level, with an inlet air temperature of 20° C, 12.5 cubic feet per minute of air flow is required to cool the anode at 100 watts plate dissipation when the illustrated air cowling is used. Operation at higher altitudes or with higher inlet air temperatures will require increased volumes of flow to obtain equivalent cooling. When using the anode cowling as illustrated here, it is necessary to provide air for seal cooling separately.

It should be borne in mind that operating temperature is the sole criterion of cooling effectiveness, regardless of the coolant type, flow rate, or coolant temperature. One method of measuring surface temperatures is by the use of a temperature-sensitive lacquer, such as "Tempilaq." This product can be obtained from the Tempil Corporation, 132-34 West 22nd Street, New York 11, N.Y. or from various chemical or scientific-equipment suppliers. When temperature-sensitive materials are used, extremely thin applications must be used to avoid inaccurate indications and interference with the heat transfer from the tube to the air stream.

ELECTRICAL

Heater Operation—The rated heater voltage for the 3X100A5 is 6.3 volts and the working voltage should be determined from the table below. The heater voltage should be maintained within plus or minus 10% of its intended value to minimize variations in circuit performance and to obtain maximum tube life.

At ultra-high frequencies transit-time effects can influence the cathode temperature. The amount of r-f driving power diverted to heating the cathode by back-bombardment will depend upon the frequency, the plate current, and the r-f driving power being supplied to the tube. The following table is intended as a general guide.

Frequency (Mc.)	E_f (Volts)
Up to 400	6.3
400 to 1000	6.0
1000 to 1500	5.5
1500 to 2000	5.0
2000 and above	4.5

If the conditions of operation result in extreme cathode back-heating, it may be necessary to start dynamic tube operation at normal heater voltage followed by a reduction of heater voltage to the proper value.

Cathode Operation—The oxide-coated unipotential cathode in the 3X100A5 and one side of the heater are connected internally. The absolute maximum rated d-c current is 125 milliamperes.

It is recommended that rated heater voltage be applied for a minimum of 30 seconds before other operating voltages are applied. Tube performance will become stabilized approximately 60 seconds after the heater voltage is applied.

Control-Grid Operation—The maximum rated grid dissipation is 2.0 watts.

At operating frequencies near 500 megacycles, the driving power necessary for maximum output of a typical grounded-grid amplifier is in the order of 6 watts and as the operating frequency is increased, the driving power requirements increase. Most of this additional driving power is absorbed in circuit losses other than grid dissipation, however, and the actual grid dissipation will increase very little.

The grid bias required by various 3X100A5 tubes may vary between limits approximately 50% above and below the nominal value and means should be provided in the equipment to accommodate such variations.

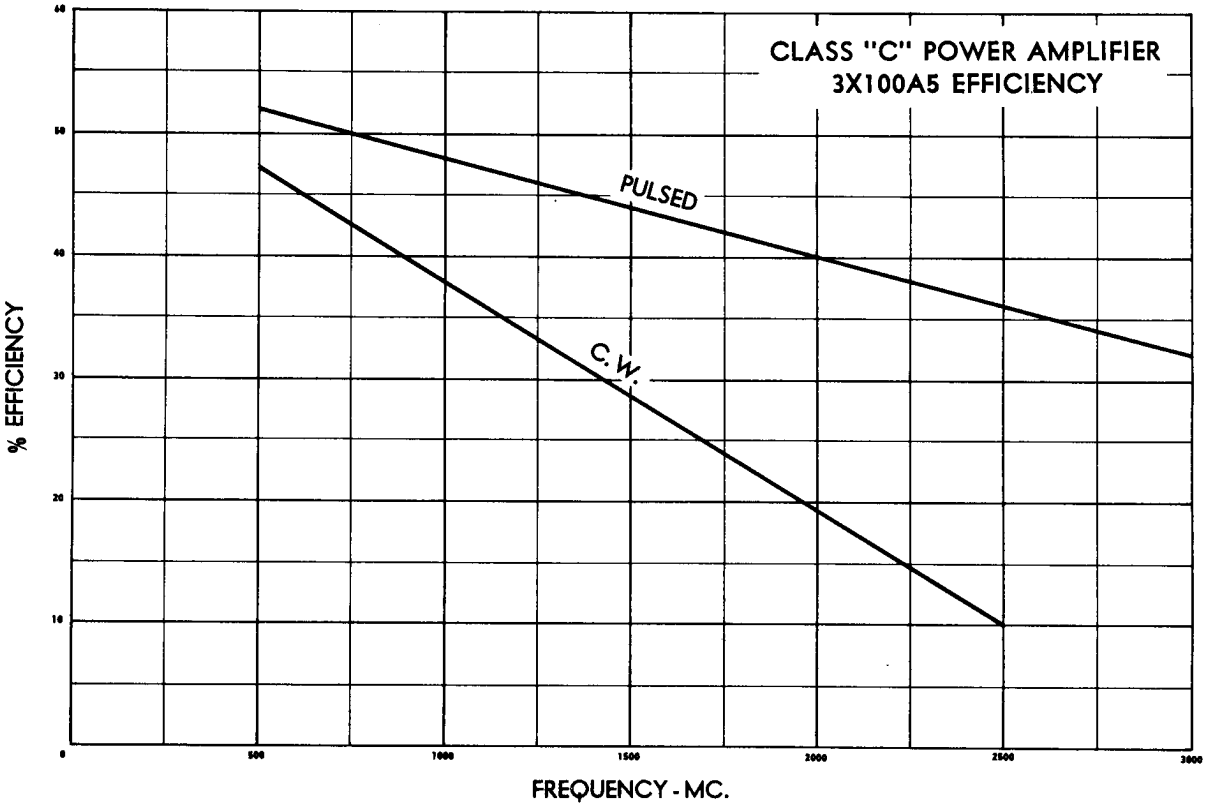
When grid-leak bias is used, suitable means must be provided to protect the tube against loss of excitation at plate voltages above 600 volts and the grid-leak resistor should be made variable to facilitate maintaining the bias voltage and plate current at the desired values when tubes are changed in the equipment.

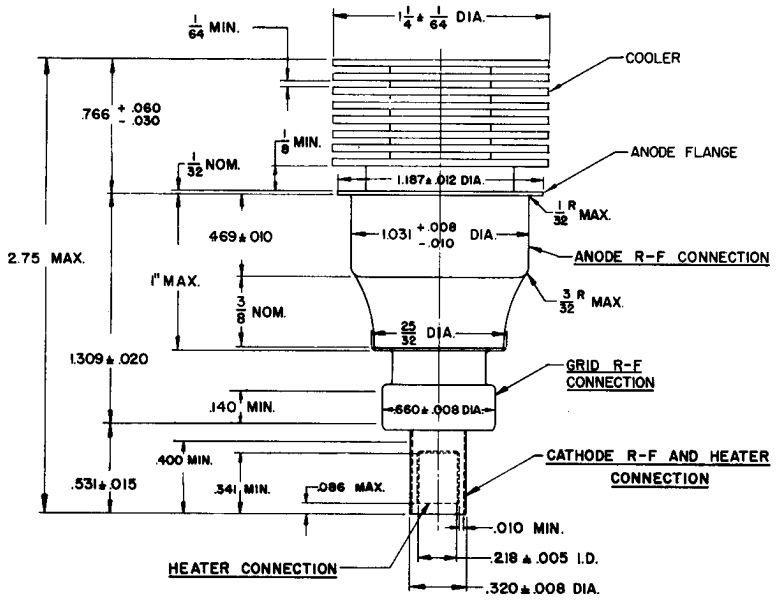
Plate Operation—The maximum rated plate dissipation is 100 watts. In plate-modulated applications, the plate dissipation under carrier conditions must be limited to 70 watts to avoid exceeding the plate-dissipation rating with 100% sine-wave modulation.

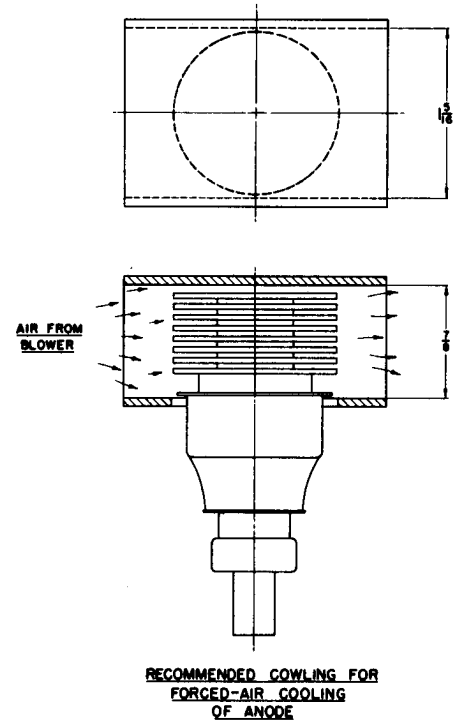
In general, low-voltage high-current operation is preferable to high-voltage low-current operation from the standpoint of optimum life.

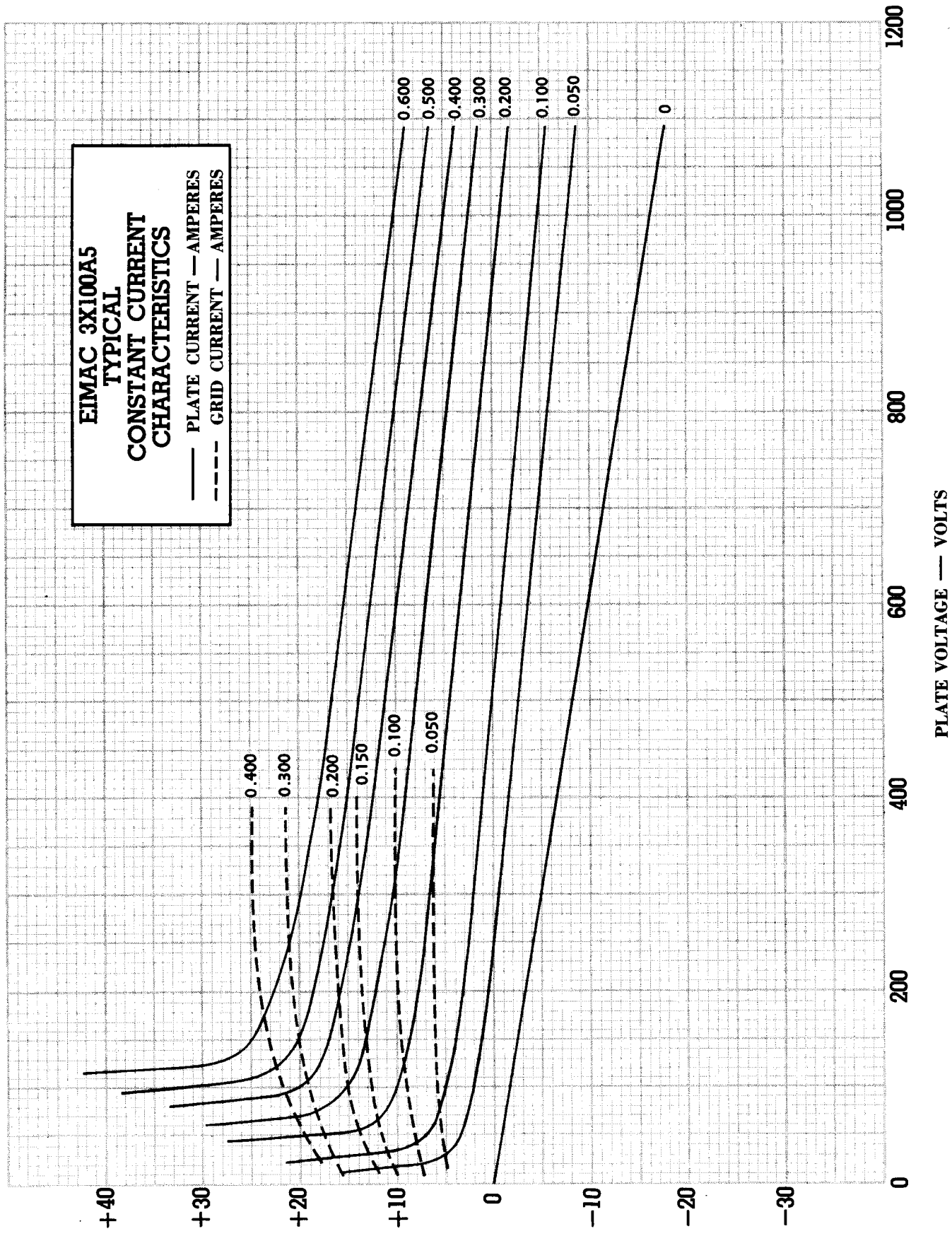
An excellent indication of operating conditions is the ratio of grid current to plate current; when the 3X100A5 is operated with grid-current values greater than half those of the plate current, either the drive is excessive or the plate loading is too light for the excitation present. The tube should never be operated unloaded, even for short periods of time. Drive should be held to the lowest value consistent with reasonable efficiency.

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


CLASS "C" POWER AMPLIFIER
3X100A5 EFFICIENCY
PULSED
C.W.
% EFFICIENCY
FREQUENCY - MC.
500
1000
1500
2000
2500
3000


1/64 MIN.
1 1/4 ± 1/64 DIA.
COOLER
.766 +.060 -.030
1/8 MIN.
1/32 NOM.
ANODE FLANGE
1.187 ± .012 DIA.
1/32 R MAX.
.469 ± .010
1.031 +.008 -.010 DIA.
ANODE R-F CONNECTION
2.75 MAX.
1" MAX.
3/32 R MAX.
3/8 NOM.
25/32 DIA.
1.309 ± .020
GRID R-F CONNECTION
.140 MIN.
.660 ± .008 DIA.
.400 MIN.
CATHODE R-F AND HEATER CONNECTION
.531 ± .015
.341 MIN.
.086 MAX.
.010 MIN.
.218 ± .005 I.D.
HEATER CONNECTION
.320 ± .008 DIA.


AIR FROM BLOWER
RECOMMENDED COWLING FOR FORCED-AIR COOLING OF ANODE



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