



TECHNICAL DATA

8161
3CX2500A3MEDIUM MU
TRIODE

The EIMAC 3CX2500A3 is an all ceramic and metal, medium-mu, forced-air cooled, external anode transmitting triode with a maximum plate dissipation rating of 2500 watts. Relatively high power output as an amplifier, oscillator, or modulator may be obtained from this tube at low plate voltages. The 3CX2500A3 is an exact replacement for the EIMAC 3X2500A3 and is suggested for use where higher ambient temperatures are to be expected or greater reliability is required. The all ceramic and metal construction allows a greater margin of safety with respect to tube operating temperatures while permitting higher processing temperatures to insure longer life.

The tube has a rugged, low-inductance cylindrical filament-stem structure, which readily becomes part of a linear filament tank circuit for VHF operation. The grid provides thorough shielding between the input and output circuits for grounded-grid applications and is conveniently terminated in a ring between the plate and filament terminals. The 3CX2500A3 may be installed or removed without the aid of tools.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten		<i>Min.</i>	<i>Nom.</i>	<i>Max.</i>	
Voltage	- - - - -		7.5		volts
Current	- - - - -	49		53	amperes
Amplification Factor	- - - - -	19		26	
Direct Interelectrode Capacitances					
Grid-Plate	- - - - -	16.8		23.2	pF
Grid-Filament	- - - - -	29.2		40.2	pF
Plate-Filament	- - - - -	0.6		1.2	pF
Tranconductance (I _b =830 ma., E _b =3000 v.)	-		20,000		umhos
Highest Frequency for Maximum Ratings	-			75	MHz

MECHANICAL

Base	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	See drawing
Mounting	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	Vertical, base down or up
Cooling	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	Forced Air
Maximum Anode Core and Seal Temperatures	-	-	-	-	-	-	-	-	-	250°C
Maximum Over-all Dimensions:										
Length	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	8.6 inches
Diameter	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	4.16 inches
Net Weight	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	6.25 pounds
Shipping Weight (Average)	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	17 pounds

RADIO-FREQUENCY POWER
AMPLIFIER OR OSCILLATOR

Conventional Neutralized Amplifier,
(Frequencies below 75 MHz.)
Class-C FM or Telegraphy (Key-down
conditions, per tube)

MAXIMUM RATINGS

DC PLATE VOLTAGE	-	6000 VOLTS
DC PLATE CURRENT	-	2.5 AMPS
PLATE DISSIPATION	-	2500 WATTS
GRID DISSIPATION	-	150 WATTS

TYPICAL OPERATION (Frequencies below 75 MHz per tube)

DC Plate Voltage	- - - - -	4000	5000	6000	volts
DC Plate Current	- - - - -	2.5	2.5	2.08	amps
DC Grid Voltage	- - - - -	—300	—450	—500	volts
DC Grid Current*	- - - - -	245	265	180	ma
Peak RF Grid Input Voltage*	- - - - -	580	750	765	volts
Driving Power*	- - - - -	142	197	136	watts
Grid Dissipation*	- - - - -	68	78	46	watts
Plate Power Input	- - - - -	10,000	12,500	12,500	watts
Plate Dissipation	- - - - -	2500	2500	2500	watts
Plate Power Output	- - - - -	7500	10,000	10,000	watts

*Approximate values.

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Conventional Neutralized Amplifier,
(Frequencies below 75 MHz.)
Class-C Telephony (Carrier conditions,
per tube)

MAXIMUM RATINGS

DC PLATE VOLTAGE - 5000 VOLTS
DC PLATE CURRENT - 2.0 AMPS
PLATE DISSIPATION - 1670 WATTS
GRID DISSIPATION - 150 WATTS

TYPICAL OPERATION (Frequencies below 75 MHz per tube)

DC Plate Voltage	-	-	-	-	-	4000	4500	5000	volts
DC Plate Current	-	-	-	-	-	1.67	1.47	1.25	amps
DC Grid Voltage	-	-	-	-	-	-450	-500	-550	volts
DC Grid Current*	-	-	-	-	-	180	140	150	ma
Peak RF Grid Input Voltage*	-	-	-	-	-	685	715	760	volts
Driving Power*	-	-	-	-	-	125	100	115	watts
Grid Dissipation*	-	-	-	-	-	43	30	32	watts
Plate Power Input	-	-	-	-	-	6670	6615	6250	watts
Plate Dissipation	-	-	-	-	-	1670	1315	950	watts
Plate Power Output	-	-	-	-	-	5000	5300	5300	watts

*Approximate values.

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB or B

MAXIMUM RATINGS

DC PLATE VOLTAGE - 6000 VOLTS
DC PLATE CURRENT - 2.5 AMPS
PLATE DISSIPATION - 2500 WATTS
GRID DISSIPATION - 150 WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

DC Plate Voltage	-	-	-	-	-	4000	5000	6000	volts
DC Grid Voltage ¹	-	-	-	-	-	-150	-190	-240	volts
Zero-Signal DC Plate Current	-	-	-	-	-	0.6	0.5	0.4	amps
Max-Signal DC Plate Current	-	-	-	-	-	4.0	3.2	3.0	amps
Effective Load, Plate to Plate	-	-	-	-	-	2200	3600	4650	ohms
Peak AF Grid Input Voltage (per tube)*	-	-	-	-	-	340	360	390	volts
Max-Signal Peak Driving Power*	-	-	-	-	-	340	230	225	watts
Max-Signal Nominal Driving Power*	-	-	-	-	-	170	115	113	watts
Max-Signal Plate Output Power	-	-	-	-	-	11,000	11,000	13,000	watts

*Approximate values.

¹Adjust to give listed zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION," POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EIMAC DIVISION OF VARIAN, FOR INFORMATION AND RECOMMENDATIONS.

APPLICATION

Cooling—Forced-air cooling must be provided to hold the ceramic-to-metal seals and anode core temperature below the maximum rating of 250°C. At ambient temperatures above 50°C, at higher altitudes and at operating temperatures above 30 MHz, additional air flow must be provided. Sea level and 10,000 foot altitude air-flow requirements to maintain seal temperatures below 200°C in 50°C ambient air are tabulated below (for operation below 30 MHz).

Anode-to-Base Air Flow ¹				
Sea Level			10,000 Feet	
Anode Dissipation Watts	Air Flow CFM	Pressure Drop Inches Water	Air Flow CFM	Pressure Drop Inches Water
1500	33	.6	48	.9
2500	66	1.25	96	1.82

Base-to-Anode Air Flow				
Sea Level			10,000 Feet	
Anode Dissipation Watts	Air Flow CFM	Pressure Drop Inches Water	Air Flow CFM	Pressure Drop Inches Water
1500	32	.6	47	.9
2500	57	1.0	83	1.5

*Since the power dissipated by the filament represents about 400 watts and since grid dissipation can, under some conditions represent another 150 watts, allowance has been made in preparing this tabulation for an additional 550 watts.

¹When air is supplied in the anode-to-base direction, a minimum of 3 cfm must be directed into the filament-stem structure between the inner and outer filament terminals to maintain the base seals below 250°C. No separate air is required with base-to-anode airflow.

Simultaneous removal of all power and air (as in the case of a power failure) will not

ordinarily injure the tube, but it is recommended that cooling airflow continue for at least three minutes after filament power has been removed.

Filament Voltage — The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

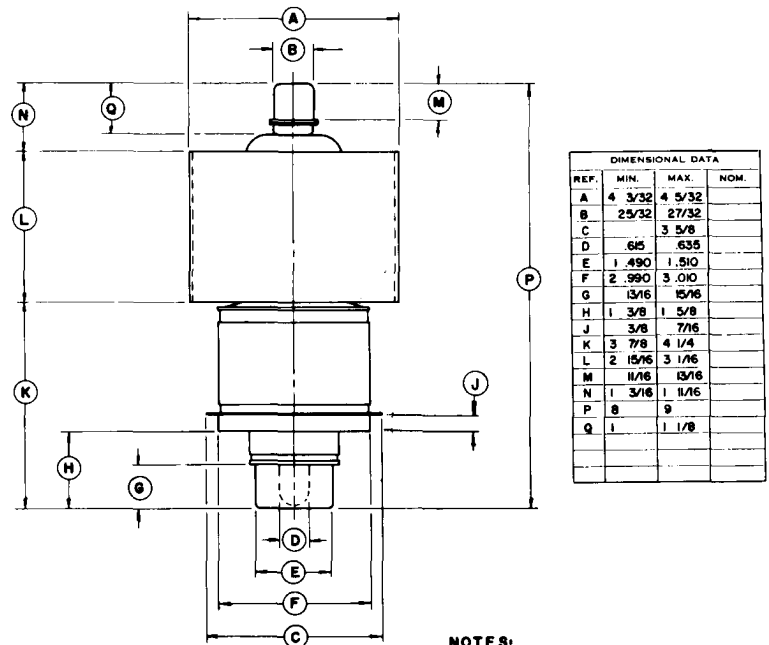
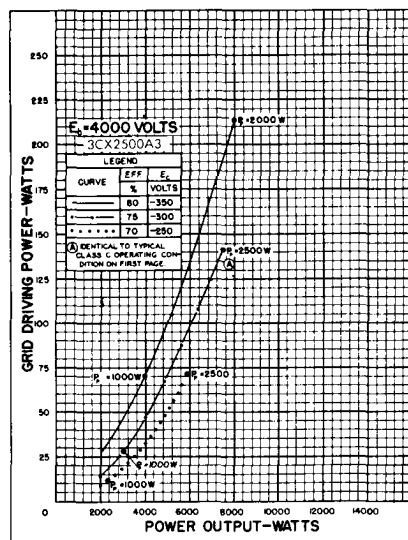
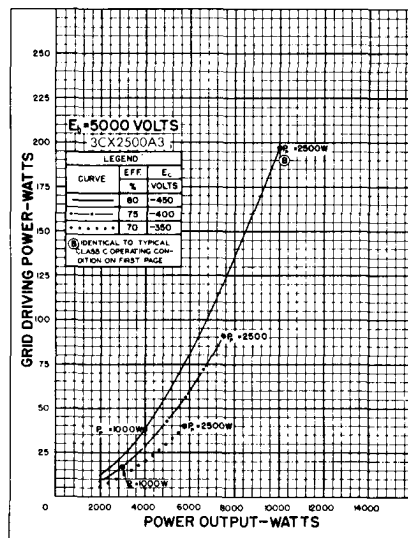
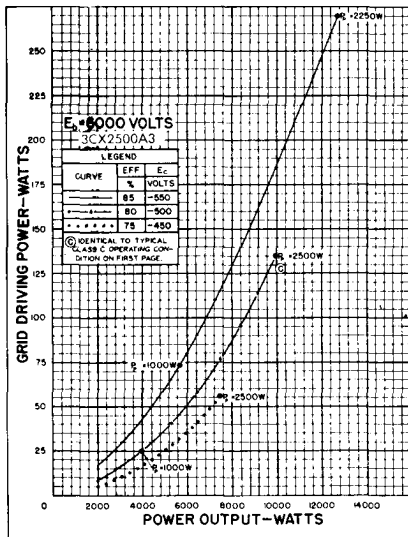
Bias Voltage — There is little advantage in using bias voltages in excess of those given under "TYPICAL OPERATION" except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage — The plate-supply voltage for the 3CX2500A3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "TYPICAL OPERATION" for the power output desired.

Grid Dissipation — The power dissipated by the grid of the 3CX2500A3 must never exceed 150 watts. Grid dissipation is the product of dc current and peak positive grid voltage.

In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

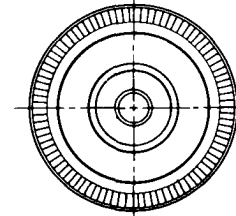
In VHF operation, particularly above 75 MHz the dc grid current must not exceed 200 ma under any conditions of plate loading. With lightly loaded conditions the grid driving power should be reduced so that the grid current does not exceed one-tenth of the plate current.



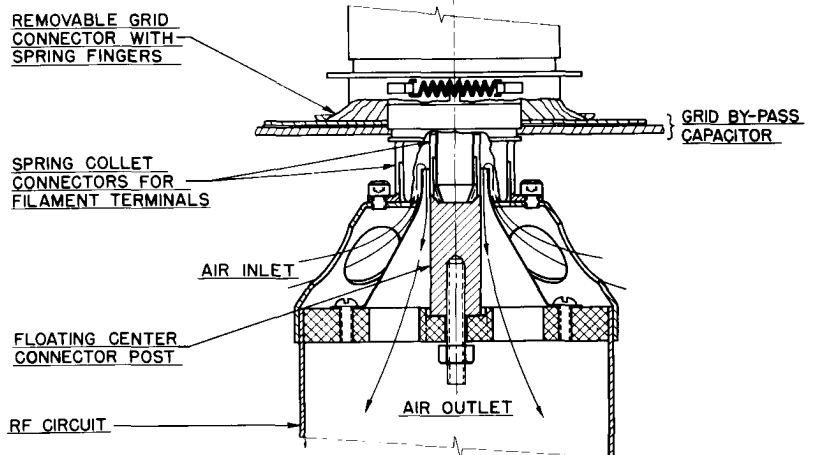
DIMENSIONAL DATA			
REF.	MIN.	MAX.	NOM.
A	4 3/32	4 5/32	
B	25/32	27/32	
C		3 5/8	
D	.615	.635	
E	1.490	1.510	
F	2.990	3.010	
G	13/16	15/16	
H	1 3/8	1 5/8	
J	3/8	7/16	
K	3 7/8	4 1/4	
L	2 15/16	3 1/16	
M	11/16	13/16	
N	1 3/16	1 1/2	
P	8	9	
Q	1	1 1/8	

NOTES

1. .040 MAXIMUM RUNOUT OF GRID CONTACT SURFACE WITH RESPECT TO AXIS DETERMINED BY ANODE AND OUTER FILAMENT CONTACT SURFACE.
2. .025 MAXIMUM RUNOUT OF INNER FILAMENT CONTACT SURFACE WITH RESPECT TO OUTER FILAMENT CONTACT SURFACE.
3. DIMENSIONS IN INCHES.



BOTTOM VIEW



TYPICAL TUBE CONNECTORS AND STEM COOLING

DRIVING POWER vs. POWER OUTPUT

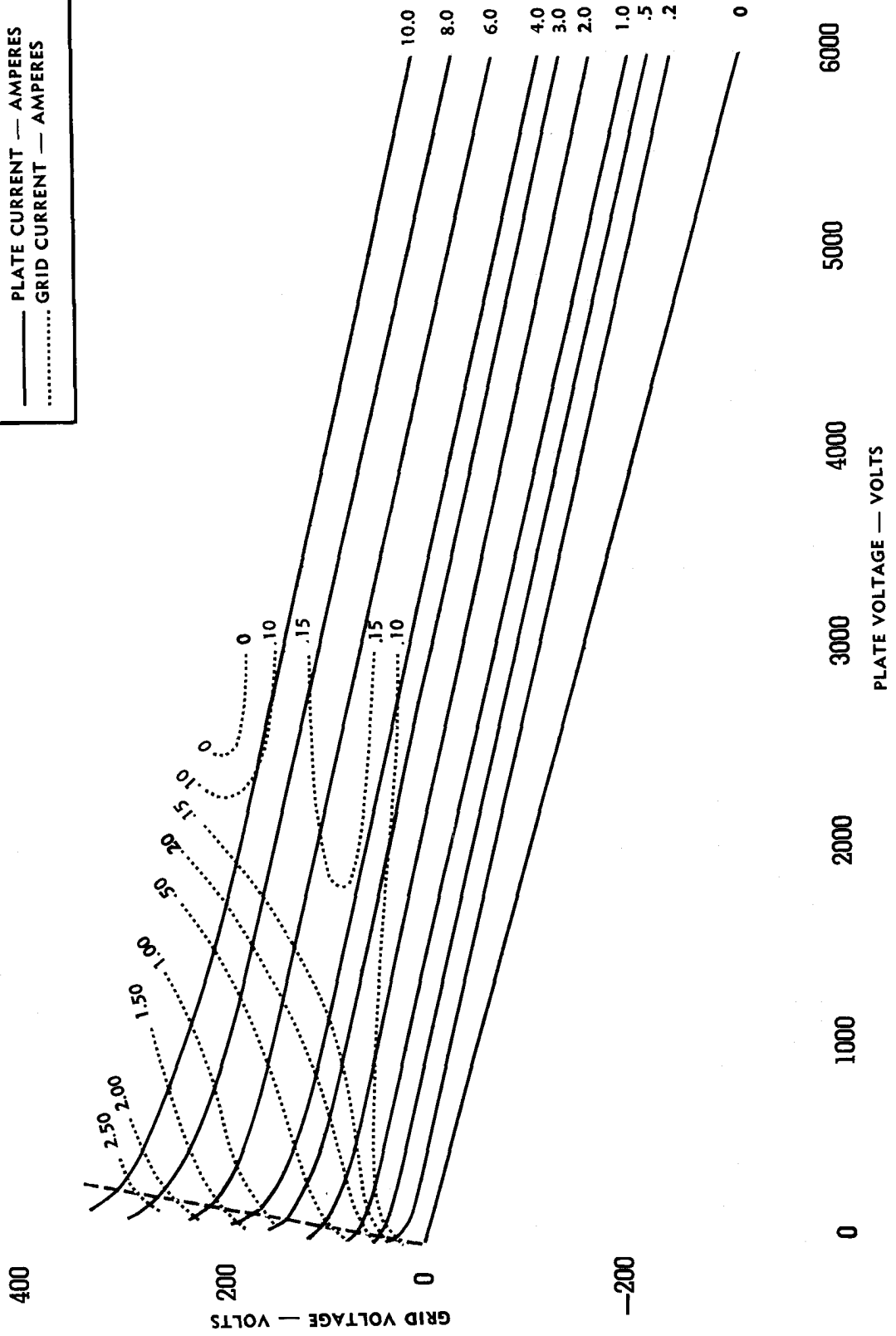
The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p . Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.



EIMAC 3CX2500A3

CONSTANT CURRENT
CHARACTERISTICS

— PLATE CURRENT — AMPERES
..... GRID CURRENT — AMPERES



AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB or B

MAXIMUM RATINGS

D-C PLATE VOLTAGE	-	-	-	6000 MAX. VOLTS
D-C PLATE CURRENT	-	-	-	2.5 MAX. AMPS
PLATE DISSIPATION	-	-	-	2500 MAX. WATTS
GRID DISSIPATION	-	-	-	150 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

D-C Plate Voltage	-	-	-	4000	5000	6000 volts
D-C Grid Voltage ¹	-	-	-	—150	—190	—240 volts
Zero-Signal D-C Plate Current	-	-	-	0.6	0.5	0.4 amps
Max-Signal D-C Plate Current	-	-	-	4.0	3.2	3.0 amps
Effective Load, Plate to Plate	-	-	-	2200	3600	4650 ohms
Peak A-F Grid Input Voltage (per tube)*	-	-	-	340	360	390 volts
Max-Signal Peak Driving Power*	-	-	-	340	230	225 watts
Max-Signal Nominal Driving Power*	-	-	-	170	115	113 watts
Max-Signal Plate Output Power	-	-	-	11,000	11,000	13,000 watts

*Approximate values.

¹Adjust to give listed zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS

APPLICATION

► **Cooling**—Forced-air cooling must be provided to hold the glass-to-metal seals and the anode cooler core below the maximum rated temperature of 175° C. Although the air requirements stated below are sufficient to maintain rated tube temperatures under many conditions, air in excess of the amounts shown will usually result in longer tube life. At ambient temperatures higher than 20° C., at high altitudes, and at operating frequencies above 30 megacycles, additional air flow must be provided. In all cases, tube temperatures are the criteria which govern air requirements. Surface temperatures may be measured conveniently with the aid of temperature-sensitive paints.

Anode-to-Base Air-Flow				
Plate Dissipation (Watts)	Sea Level		10,000 Feet	
	Air-Flow (CFM)	Pressure Drop (Inches H ₂ O)	Air-Flow (CFM)	Pressure Drop (Inches H ₂ O)
2000	58.5	0.8	85.5	1.15
2500	85.5	1.6	125	2.3

Base-to-Anode Air-Flow				
Plate Dissipation (Watts)	Sea Level		10,000 Feet	
	Air-Flow (CFM)	Pressure Drop (Inches H ₂ O)	Air-Flow (CFM)	Pressure Drop (Inches H ₂ O)
2000	35.5	0.25	52	0.35
2500	42	0.5	61.5	0.75

Under the same conditions, a minimum air-flow rate of 6 CFM directed into the filament-stem structure between the inner and outer filament terminals is required to maintain the base seals below 175°C.

Simultaneous removal of all power and air (as in the case of a power failure) will not ordinarily injure the tube, but it is not recommended as a standard operating practice.

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation" except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

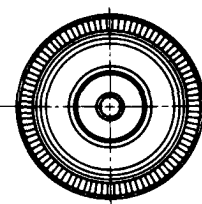
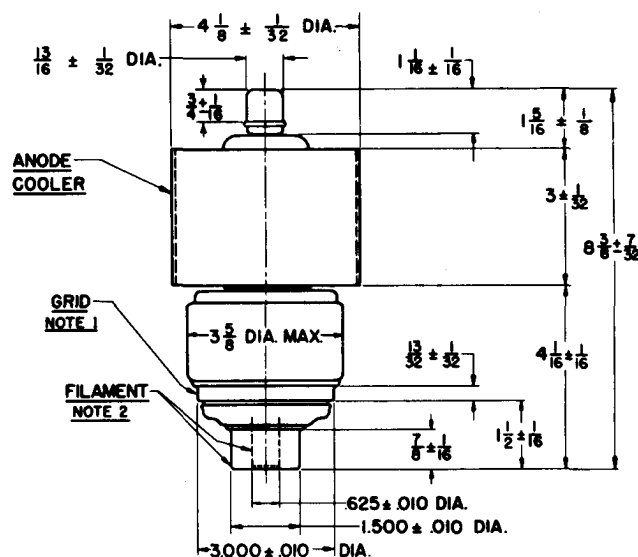
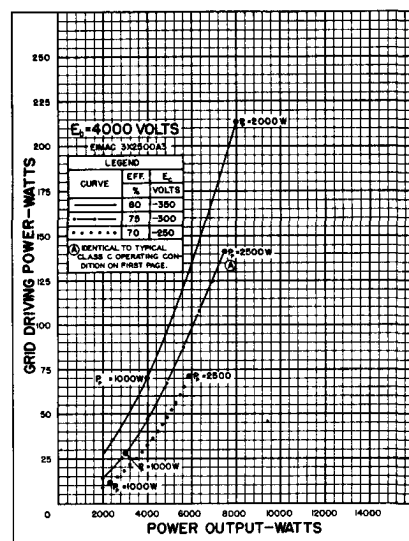
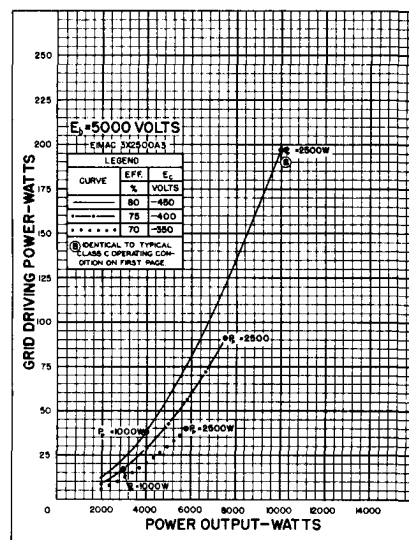
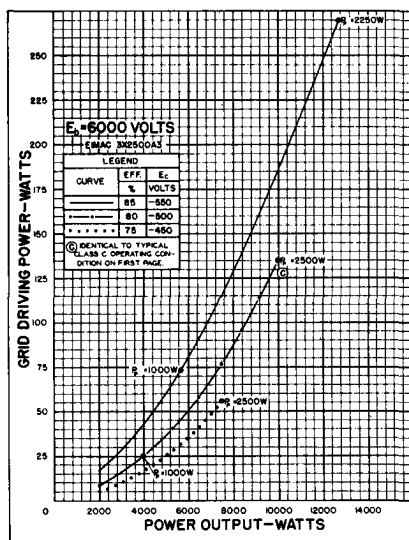
Plate Voltage — The plate-supply voltage for the 3X2500A3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

In Class-C FM or Telegraphy service a 0.1 —henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high-voltage plate-supply capacitor to offer protection from transients and surges. In plate-modulated services where a plate-modulation transformer is used the protective choke is not normally required.

Grid Dissipation—The power dissipated by the grid of the 3X2500A3 must never exceed 150 watts. Grid dissipation is the product of d-c grid current and peak positive grid voltage.

In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

In VHF operation, particularly above 75 Mc., the d-c grid current must not exceed 200 ma. under any conditions of plate loading. With lightly loaded conditions the grid driving power should be reduced so that the grid current does not exceed one-tenth of the plate current.



BOTTOM VIEW

NOTE 1
0.40" MAXIMUM RUNOUT OF GRID CONTACT SURFACE WITH RESPECT TO AXIS DETERMINED BY ANODE AND OUTER FILAMENT CONTACT SURFACE.

NOTE 2
0.25" MAXIMUM RUNOUT OF INNER FILAMENT CONTACT SURFACE WITH RESPECT TO OUTER FILAMENT CONTACT SURFACE.

DIMENSIONS IN INCHES

REMOVABLE GRID CONNECTOR WITH SPRING FINGERS

SPRING COLLET CONNECTORS FOR FILAMENT TERMINALS

AIR INLET

FLOATING CENTER CONNECTOR POST

RF CIRCUIT

AIR OUTLET

GRID BY-PASS CAPACITOR

TYPICAL TUBE CONNECTORS AND STEM COOLING

DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.



3X2500A3

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