TECHNICAL DATA

8161
3CX2500A3

MEDIUM 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

	Min.	Nom.	Max.	
Filament: Thoriated Tungsten				
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 (Ib=830 ma., Eb=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.

Printed in U.S.A.

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	VOLTS
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.

[1]Adjust 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 EXCEEDNG 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.

[1]When 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.

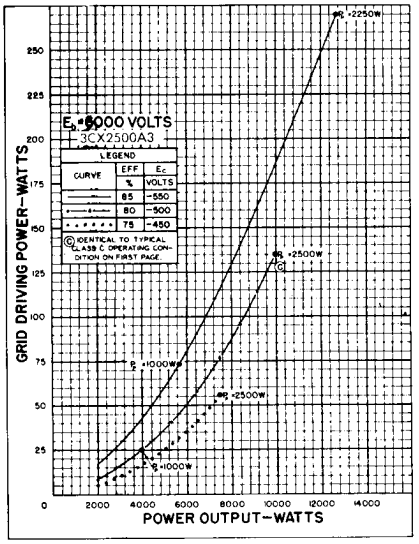
Bias Voltage — There is little advantage in using bias voltages in excess of those given under "TYPICAL OPERATION" except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event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

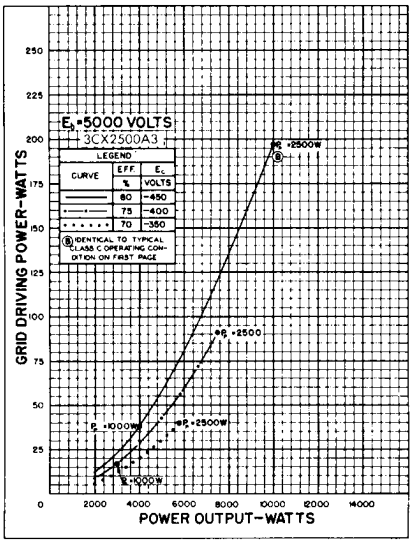
Plate Voltage — The plate-supply voltage for the 3CX2500A3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "TYPICAL OPERATION" for the power output desired.

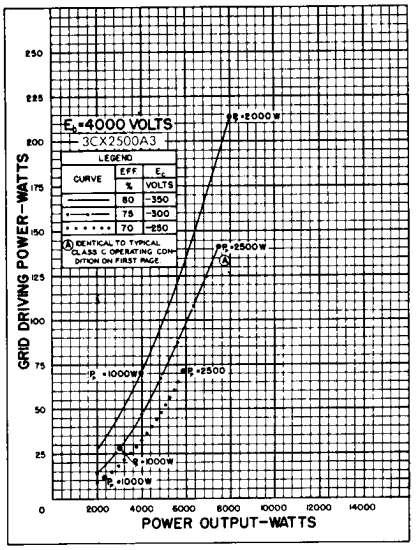
Grid Dissipation — The power dissipated by the grid of the 3CX2500A3 must never exceed 150 watts. Grid dissipation is the product of dc current and peak positive grid voltage.

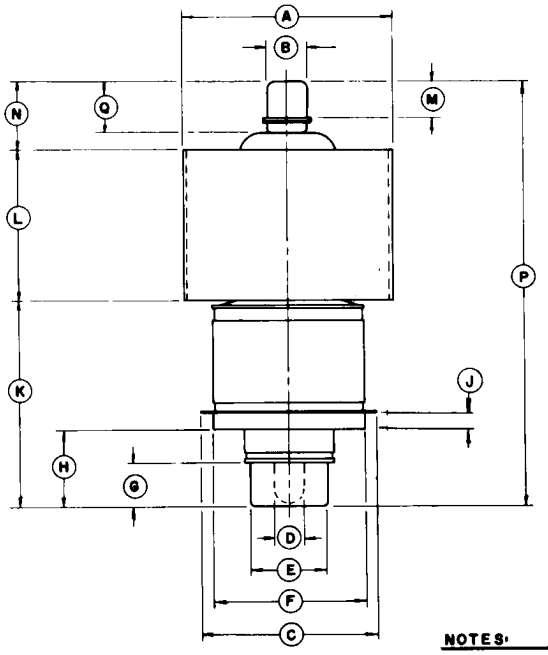
In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

InVHF 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.

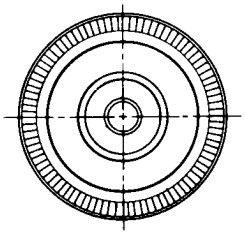








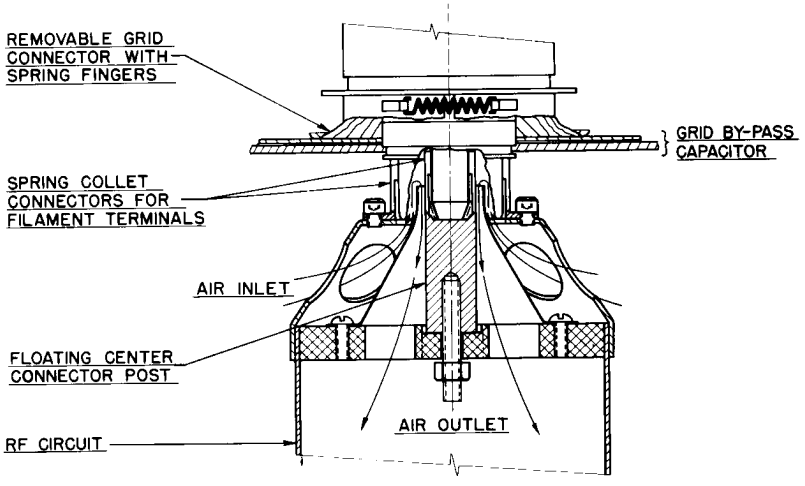
DIMENSIONAL DATA			
REF.	MIN.	MAX.	NOM.
A	4 3/32	4 5/32	
B	25/32	27/32	
C		3 5/8	
D	.615	.635	
E	1.490	1.510	
F	2.990	3.010	
G	13/16	15/16	
H	1 3/8	1 5/8	
J	3/8	7/16	
K	3 7/8	4 1/4	
L	2 15/16	3 1/16	
M	11/16	13/16	
N	1 3/16	1 11/16	
P	8	9	
Q	1	1 1/8	



BOTTOM VIEW

NOTES:

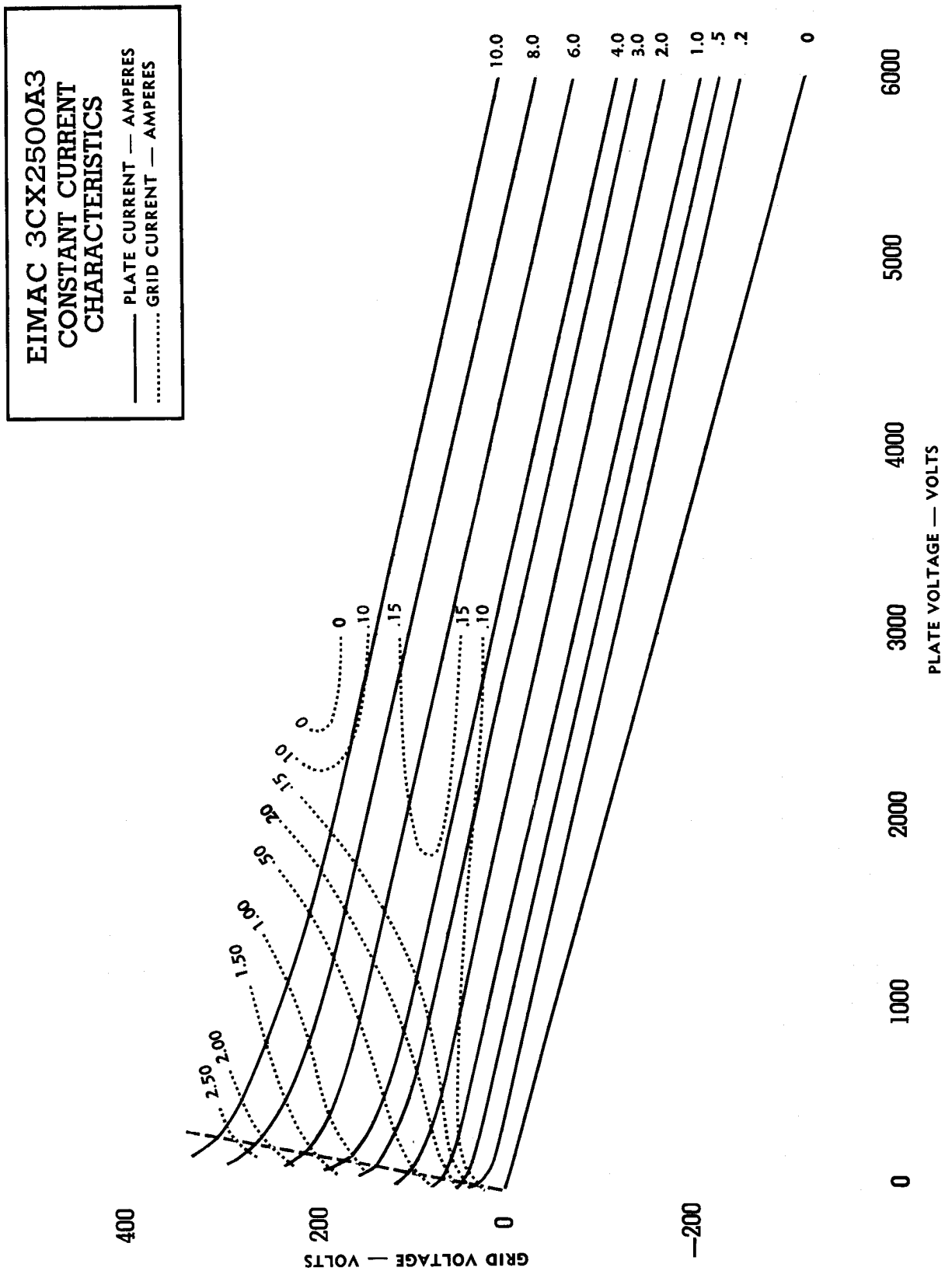
1. .040 MAXIUM RUNOUT OF GRID CONTACT SURFACE WITH RESPECT TO AXIS DETERMINED BY ANODE AND OUTER FILAMENT CONTACT SURFACE.
2. .025 MAXIUM RUNOUT OF INNER FILAMENT CONTACT SURFACE WITH RESPECT TO OUTER FILAMENT CONTACT SURFACE.
3. DIMENSIONS IN INCHES.



TYPICAL TUBE CONNECTORS AND STEM COOLING

DRIVING POWER vs. POWER OUTPUT

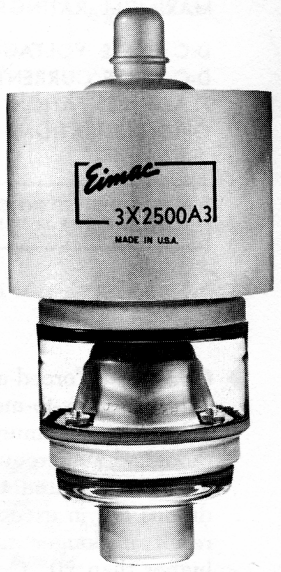
The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The 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.


EIMAC 3CX2500A3
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
10.0
8.0
6.0
4.0
3.0
2.0
1.0
.5
.2
0
2.50
2.00
1.50
1.00
.50
.20
.15
.10
0
.10
.15
.15
.10
0
400
200
0
—200
GRID VOLTAGE — VOLTS
0
1000
2000
3000
4000
5000
6000
PLATE VOLTAGE — VOLTS

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

8161
3X2500A3

MEDIUM MU TRIODE



The Eimac 8161/3X2500A3 is a 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. A single tube will deliver a radio-frequency output of 7500 watts at 4000 plate volts at frequencies up to 110 Mc., as well as at lower frequencies.

The tube has a rugged, low-inductance cylindrical filament-stem structure, which readily becomes part of a linear filament tank circuit for V.H.F. 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 8161/3X2500A3 may be installed or removed without the aid of tools.

The approved Federal Communications Commission rating for the 8161/3X2500A3 is 5000 watts of carrier power when used as a plate-modulated amplifier and 1250 watts of carrier power when used as a grid-modulated or linear amplifier.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated Tungsten				
Voltage		7.5		volts
Current	49		54	amperes
Amplification Factor	19		26	
Direct Interelectrode Capacitances				
Grid-Plate	16.8		23.2	uuf
Grid-Filament	29.2		40.2	uuf
Plate-Filament	0.6		1.2	uuf
Transconductance (I_b = 830 ma., E_b = 3000 v.)		20,000		umhos
Highest Frequency for Maximum Ratings			75	mc

MECHANICAL

Base	See drawing
Mounting	Vertical, base down or up
Cooling	Forced air
▶ Maximum Anode Cooler Core and Seal Temperatures	175° 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 75Mc.)
Class-C FM or Telegraphy (Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	2500 MAX. WATTS
▶ PLATE COOLER CORE TEMPERATURE	175 MAX. ° C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc. per tube)

D-C Plate Voltage	4000	5000	6000 volts
D-C Plate Current	2.5	2.5	2.08 amps
D-C Grid Voltage	—300	—450	—500 volts
D-C Grid Current*	245	265	180 ma
Peak R-F 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

RADIO-FREQUENCY POWER AMPLIFIER

Grounded-Grid Circuit
Class-C FM Telephony

MAXIMUM RATINGS (Frequencies between 75 and 110 Mc.)

D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
D-C GRID CURRENT	200 MAX. MA
PLATE DISSIPATION	2500 MAX. WATTS
▶ PLATE COOLER CORE TEMPERATURE	175 MAX. ° C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (110 Mc., per tube)

D-C Plate Voltage	3700	4000 volts
D-C Grid Voltage	—450	—500 volts
D-C Plate Current	1.8	1.85 amps
D-C Grid Current*	190	190 ma
Driving Power*	1600	1900 watts
Useful Power Output	6850	7500 watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

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

MAXIMUM RATINGS

D-C PLATE VOLTAGE	5000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
PLATE DISSIPATION	1670 MAX. WATTS
▶ PLATE COOLER CORE TEMPERATURE	175 MAX. ° C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc., per tube)

D-C Plate Voltage	4000	4500	5000 volts
D-C Plate Current	1.67	1.47	1.25 amps
D-C Grid Voltage	—450	—500	—550 volts
D-C Grid Current*	180	140	150 ma
Peak R-F 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.

▶ Indicates change from sheet dated 1-1-61

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.

[1]Adjust 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				
	Sea Level		10,000 Feet	
Plate Dissipation (Watts)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)
2000	58.5	0.8	85.5	1.15
2500	85.5	1.6	125	2.3

Base-to-Anode Air-Flow				
	Sea Level		10,000 Feet	
Plate Dissipation (Watts)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)
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.

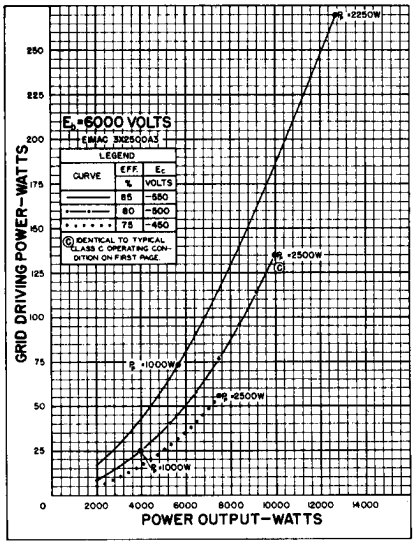
In Class-C FM or Telegraphy service a 0.1 —henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high-voltage plate-supply capacitor to offer protection from transients and surges. In plate-modulated services where a plate-modulation transformer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

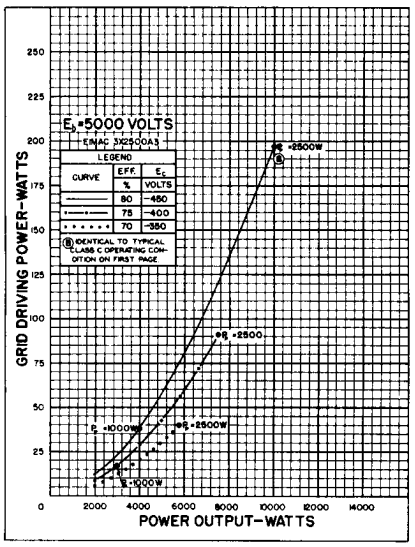
Grid Dissipation—The power dissipated by the grid of the 3X2500A3 must never exceed 150 watts. Grid dissipation is the product of d-c grid current and peak positive grid voltage.

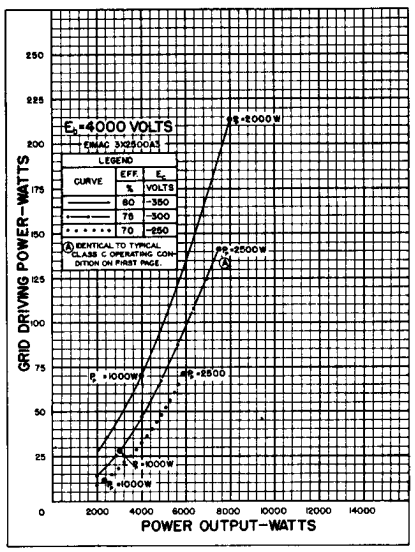
In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

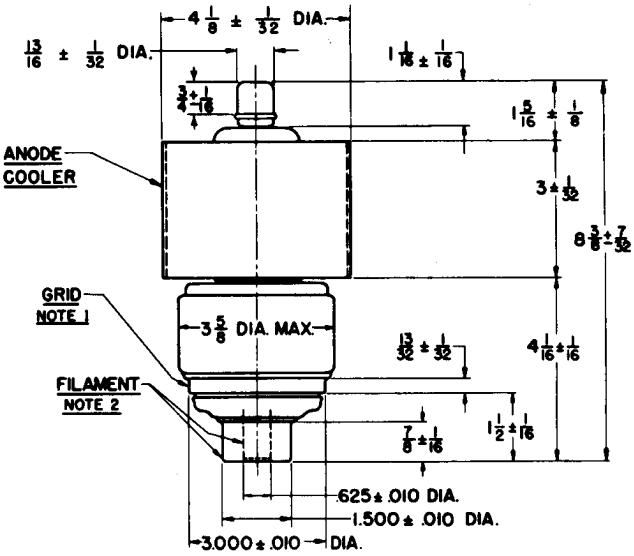
In VHF operation, particularly above 75 Mc., the d-c grid current must not exceed 200 ma. under any conditions of plate loading. With lightly loaded conditions the grid driving power should be reduced so that the grid current does not exceed one-tenth of the plate current.

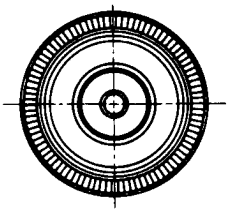
Indicates change from sheet dated 1-1-61









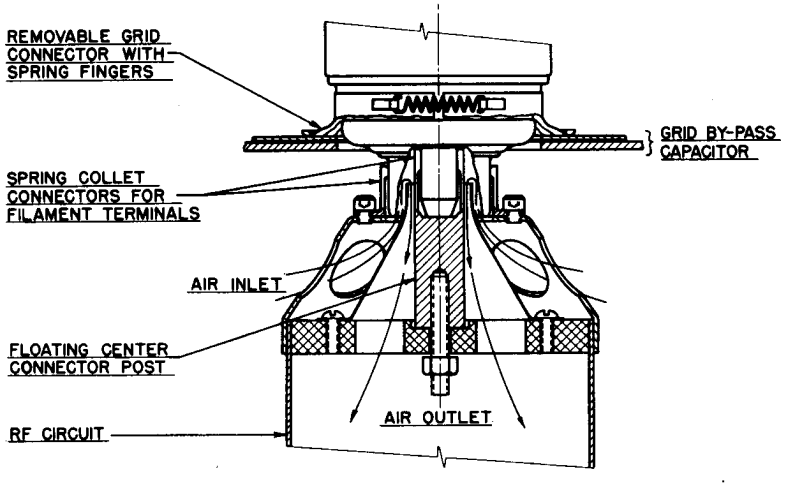


BOTTOM VIEW

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

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

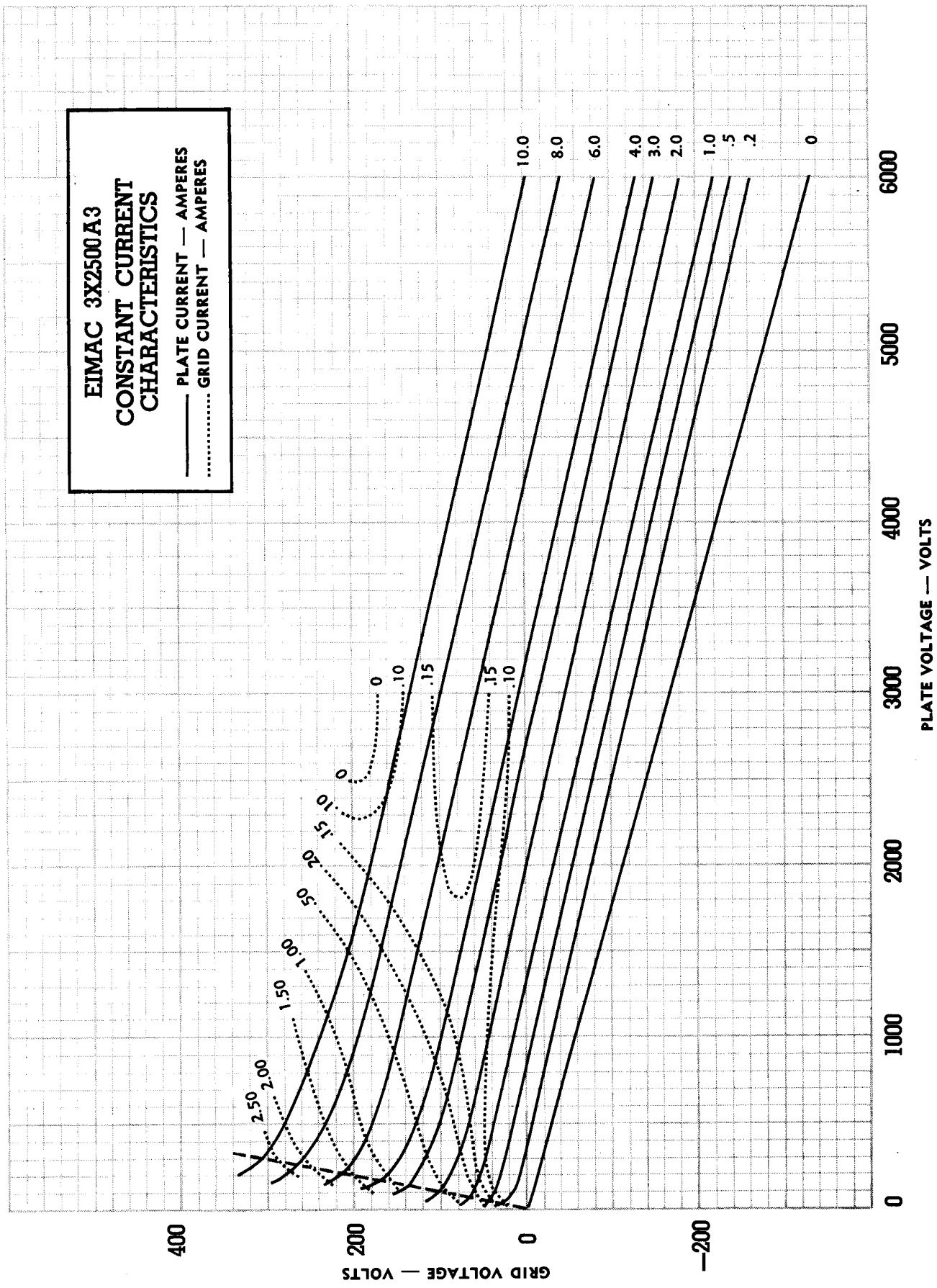
DIMENSIONS IN INCHES



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.



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