

EITEL-McCULLOUGH, INC.

SAN BRUNO, CALIFORNIA

3X2500F3

MEDIUM MU TRIODE

The Eimac 3X2500F3 is a medium-mu, forced-air cooled, external-anode power triode intended for amplifier, oscillator and modulator service. It has a maximum plate dissipation rating of 2500 watts and is capable of high output at relatively low plate voltages. A single 3X2500F3 will deliver a radio frequency plate power-output of 7500 watts at a plate voltage of 4000 volts.

The tube is equipped with flexible filament and grid leads which simplifies socketing and equipment design for industrial and communication frequencies below 30 Mc.

The approved Federal Communications Commission rating for the 3X2500F3 as a plate modulated amplifier is 5000 watts of carrier power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	7.5 volts
Current	51 amperes
Maximum allowable starting current	100 amperes
Amplification Factor (Average)	20
Direct Interelectrode Capacitances (Average)	
Grid-Plate	20 $\mu\mu\text{f}$
Grid-Filament	36 $\mu\mu\text{f}$
Plate-Filament	1.2 $\mu\mu\text{f}$
Transconductance ($i_b = 830 \text{ ma.}$, $E_b = 3000 \text{ v.}$)	20,000 μmhos
Frequency for Maximum Ratings	30 Mc.

MECHANICAL

Base	See Drawing
Mounting	Vertical, base down or up.
Maximum Overall Dimensions:	
Length (Does not include filament connectors)	9.0 inches
Diameter	4.156 inches
Net weight	7.5 pounds
Shipping weight (Average)	17 pounds
Cooling	

A minimum flow of 120 cubic feet of air per minute must be passed through the anode cooler. The pressure drop across the cooler at this flow equals 1.0 inch of water. A minimum air-flow of 6 cubic feet per minute must also be directed toward the filament-stem structure, between the inner and outer filament conductors. Cooling air in the above quantities must be supplied to both anode cooler and filament seals before applying filament voltage and should be continued for five minutes after the filament power is removed. Anode-cooler core, grid and filament seal temperatures must not exceed 150° C. These figures are for an ambient temperature of 20° C at sea level and do not include duct or filter losses.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

(Frequencies below 30 Mc.)

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
ANODE-COOLER CORE TEMPERATURE	150 MAX. °C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION

(Frequencies below 30 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 (approx.)	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

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

(Frequencies below 30 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
ANODE-COOLER CORE TEMPERATURE	150 MAX. °C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION

(Frequencies below 30 Mc., per tube)

D-C Plate Voltage	4000	4500	5000	Volts
D-C Plate Current	1.67	1.55	1.45	Amps
Total Bias Voltage	—450	—500	—550	Volts
Fixed Bias Voltage	—230	—325	—410	Volts
Grid Resistor	1500	1500	1400	Ohms
D-C Grid Current	150	120	100	Ma.
Peak R. F. Grid Input Voltage	680	720	760	Volts
Driving Power (approx.)	102	86	76	Watts
Grid Dissipation	35	26	21	Watts
Plate Power Input	6670	6970	7250	Watts
Plate Dissipation	1670	1670	1670	Watts
Plate Power Output	5000	5300	5580	Watts



► AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	- - - -	6000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	- - - -	2.5 MAX. AMPS
PLATE DISSIPATION, PER TUBE	- -	2500 MAX. WATTS
ANODE-COOLER CORE TEMPERATURE	- -	150 MAX. °C

TYPICAL OPERATION CLASS AB₂ (Two Tubes)

D-C Plate Voltage	- - -	4000	5000	6000	Volts
D-C Grid Voltage (approx.)*	-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 (approx.)	- -	170	115	113	Watts
Max-Signal Plate Power Output	- - -	11,000	11,000	13,000	Watts

*Adjust to give stated zero-signal plate current.

TYPICAL OPERATION CLASS AB₂ (Two Tubes)

Modulator service for 4000 and 5000 volt operation, to modulate one or two tubes, as shown under "Plate Modulated Radio Frequency Amplifier" (Page 1)

D-C Plate Voltage	-	4000	5000	4000	5000	Volts
D-C Grid Voltage (approx.)*	- - -	-155	-200	-145	-190	Volts
Zero-Signal D-C Plate Current	- - -	0.4	0.4	0.6	0.5	Amps
Max-Signal D-C Plate Current	- - -	1.35	1.13	2.70	2.26	Amps
Effective Load, Plate to Plate	- - -	6600	10,000	3300	5000	Ohms
Peak A-F Grid Input Voltage (per tube)	- - -	240	275	285	310	Volts
Max-Signal Peak Driving Power	- -	42	40	134	118	Watts
Max-Signal Nominal Driving Power (approx.)	- - -	21	20	67	59	Watts
Max-Signal Plate Power Output	- -	3700	4000	7400	8000	Watts
Will Modulate one Tube R. F. Final Input of	- - - -	6670	7250			Watts
Will Modulate two tubes R. F. Final Input of	- - -			13,340	14,500	Watts

*Adjust to give stated zero-signal plate current.

► APPLICATION

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 3X2500F3 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 service, where a plate modulation transformer is used, the protective choke is not normally required.

Grid Dissipation—The power dissipated by the grid of the 3X2500F3 must never exceed 150 watts. Grid dissipation may be calculated from the following expression

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation
 e_{cmp} = Peak positive grid voltage, and
 I_c = D-C grid current

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. Any suitable peak v.t.v.m. circuit may be used (one is shown in "Vacuum Tube Ratings", Eimac News, January 1945. This article is available in reprint form on request).

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.

► DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and 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.



