



E I M A C
Division of Varian
SAN CARLOS
CALIFORNIA

304TH

MEDIUM-MU TRIODE

**MODULATOR
OSCILLATOR
AMPLIFIER**

The EIMAC 304TH is a medium-mu power triode intended for use as an amplifier, oscillator or modulator. It has a maximum plate-dissipation rating of 300 watts and a maximum plate-voltage rating of 3000 volts at frequencies up to 40 MHz.

The 304TH in Class-C rf service will deliver up to 1200 watts plate power output with 53 watts driving power. Two 304TH's in Class-AB₂ modulator service will deliver up to 1400 watts maximum-signal plate power output with 14 watts nominal driving power.

GENERAL CHARACTERISTICS

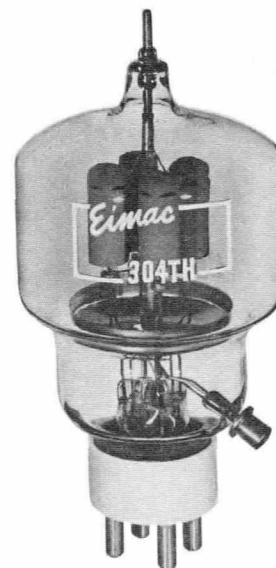
ELECTRICAL

Filament: Thoriated Tungsten

Voltage	- - - - -	5.0 or 10.0	volts
Current	- - - - -	25.0 or 12.5	amperes
Amplification Factor (Average)	- - - - -	20	
Direct Interelectrode Capacitances (Average)			
Grid-Plate	- - - - -	10.2	pF
Grid-Filament	- - - - -	13.5	pF
Plate-Filament	- - - - -	0.7	pF
Transconductance ($I_b=1.0$ amp., $E_b=3000$ v.)	- - - - -	16,700	μ mhos
Highest Frequency for Maximum Ratings	- - - - -	40	MHz

MECHANICAL

Base	- - - - -	- - - - -	Special 4-pin
Basing	- - - - -	- - - - -	See outline drawing
Socket	- - - - -	- - - - -	Johnson type No. 124-213 or equivalent
Mounting Position	- - - - -	- - - - -	Vertical, base down or up
Cooling	- - - - -	- - - - -	Convection and radiation
Maximum Temperature of Plate and Grid Seals	- - - - -	- - - - -	225°C
Recommended Heat-Dissipating Connectors:			
Plate	- - - - -	- - - - -	EIMAC HR-7
Grid	- - - - -	- - - - -	EIMAC HR-6
Maximum Over-all Dimensions:			
Length	- - - - -	- - - - -	7.63 inches
Diameter	- - - - -	- - - - -	3.56 inches
Net Weight	- - - - -	- - - - -	9 ounces
Shipping Weight	- - - - -	- - - - -	3.0 pounds



RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy (Key-down conditions, one tube)

MAXIMUM RATINGS (Frequencies up to 40 MHz)

DC PLATE VOLTAGE	- - - - -	3000 VOLTS
DC PLATE CURRENT	- - - - -	900 MA
PLATE DISSIPATION	- - - - -	300 WATTS
GRID DISSIPATION	- - - - -	60 WATTS

TYPICAL OPERATION (Frequencies up to 40 MHz)

DC Plate Voltage	- - - - -	1500	2000	3000	volts
DC Grid Voltage	- - - - -	-125	-200	-300	volts
DC Plate Current	- - - - -	665	600	500	ma
DC Grid Current*	- - - - -	115	125	135	ma
Peak RF Grid Voltage	- - - - -	250	325	395	volts
Driving Power*	- - - - -	25	39	53	watts
Grid Dissipation*	- - - - -	16	12	16	watts
Plate Dissipation	- - - - -	300	300	300	watts
Plate Power Input	- - - - -	1000	1200	1500	watts
Plate Power Output	- - - - -	700	900	1200	watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 MHz)

DC PLATE VOLTAGE	- - - - -	2500 VOLTS
DC PLATE CURRENT	- - - - -	750 MA
PLATE DISSIPATION	- - - - -	200 WATTS
GRID DISSIPATION	- - - - -	60 WATTS

TYPICAL OPERATION (Frequencies up to 40 MHz)

DC Plate Voltage	- - - - -	1500	2000	2500	volts
DC Grid Voltage	- - - - -	-200	-300	-350	volts
DC Plate Current	- - - - -	420	440	400	ma
DC Grid Current*	- - - - -	55	60	60	ma
Peak RF Grid Voltage	- - - - -	330	440	485	volts
Driving Power*	- - - - -	18	26	29	watts
Grid Dissipation*	- - - - -	7	8	8	watts
Plate Dissipation	- - - - -	200	200	200	watts
Plate Power Input	- - - - -	700	880	1000	watts
Plate Power Output	- - - - -	500	680	800	watts

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB₂

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE	- - - - -	3000 VOLTS
DC PLATE CURRENT	- - - - -	900 MA
PLATE DISSIPATION	- - - - -	300 WATTS

*Approximate values.

†Adjust to give stated Zero-Signal DC Plate Current.

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

DC Plate Voltage	- - - - -	1500	2000	3000	volts
DC Grid Voltage†	- - - - -	-65	-90	-150	volts
Zero Signal DC Plate Current	- - - - -	265	200	135	ma
Max. Signal DC Plate Current	- - - - -	1065	900	665	ma
Effective Load Plate-to-Plate	- - - - -	2840	4820	10,200	ohms
Peak AF Grid Voltage (per tube)	- - - - -	165	175	210	volts
Max. Signal Peak Driving Power*	- - - - -	50	37	27	watts
Max. Signal Nominal Driving Power*	- - - - -	25	19	14	watts
Max. Signal Plate Power Input	- - - - -	1600	1800	2000	watts
Max. Signal Plate Power Output	- - - - -	1000	1200	1400	watts

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 Power Grid Tube Marketing, EIMAC Division of Varian, 301 Industrial Way, San Carlos, Calif. for information and recommendations.



MECHANICAL

Mounting—The 304TH must be mounted vertically, base down or up. The plate and grid leads should be flexible, and the tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (EIMAC HR-7 and HR-6 or equivalent) must be used at the plate and grid terminals of the 304TH. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 MHz. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling.

The temperature of the plate and grid seals must not be allowed to exceed 225°C. One method of measuring these temperatures is by the use of "Tempilaq," a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 W. 22nd St., New York 11, N.Y.

ELECTRICAL

Filament Voltage—The filaments of the 304TH may be operated either at 10.0 volts when connected in series or at 5.0 volts when connected in parallel (see basing diagram). For maximum tube life the filament voltage should be maintained at the rated value. Variations must not be allowed to exceed $\pm 5\%$.

Bias Voltage—When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

Grid Dissipation—The power dissipated by the grid of the 304TH must not exceed 60 watts. Grid dissipation may be calculated from the following expression.

$$P_g = e_{\text{cmp}} I_c$$

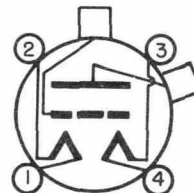
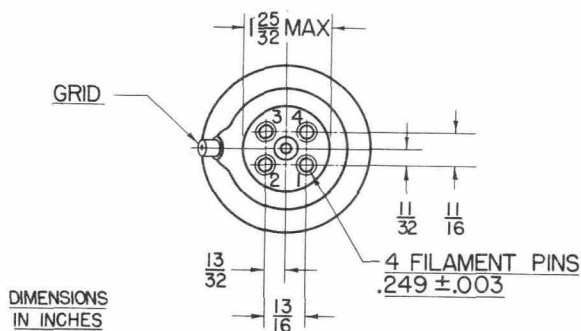
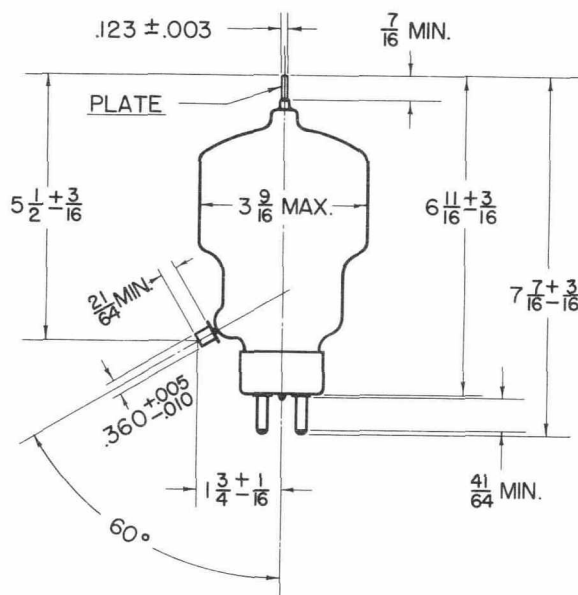
where P_g = grid dissipation,

e_{cmp} = peak positive grid voltage, and

I_c = dc grid current.

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid. 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.

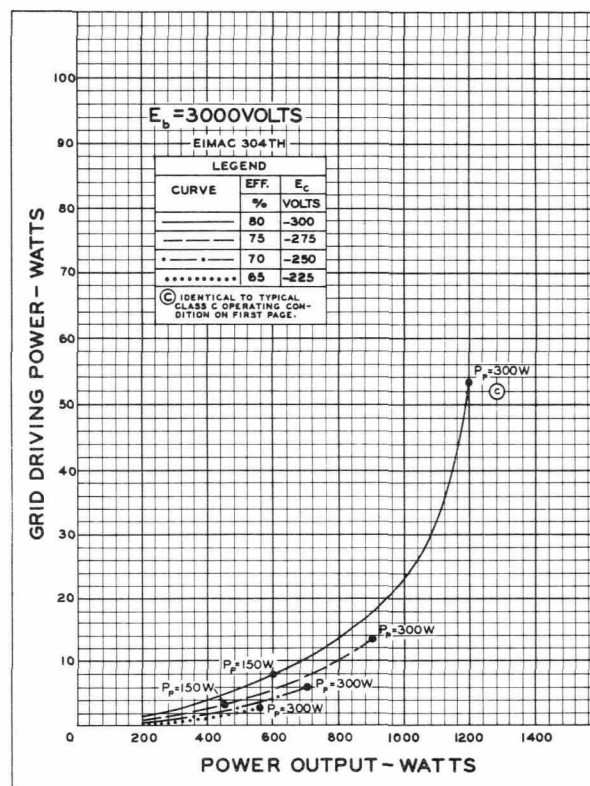
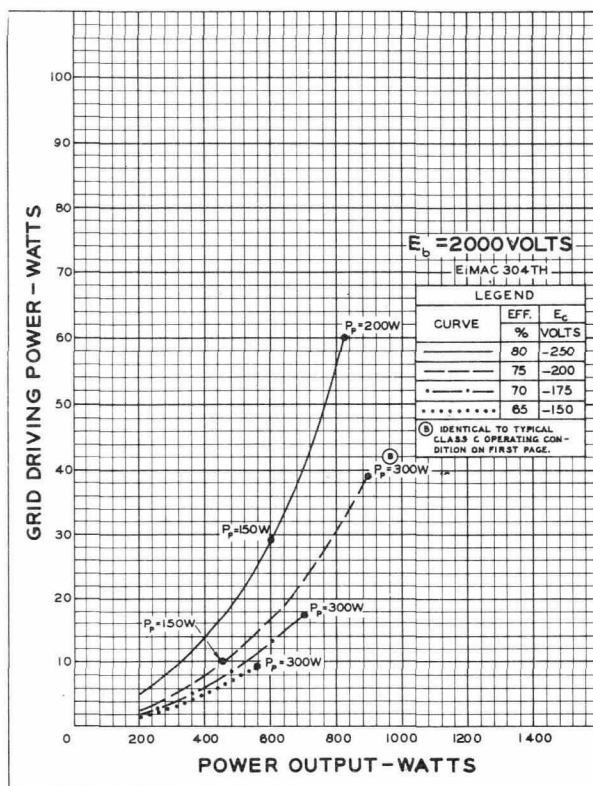
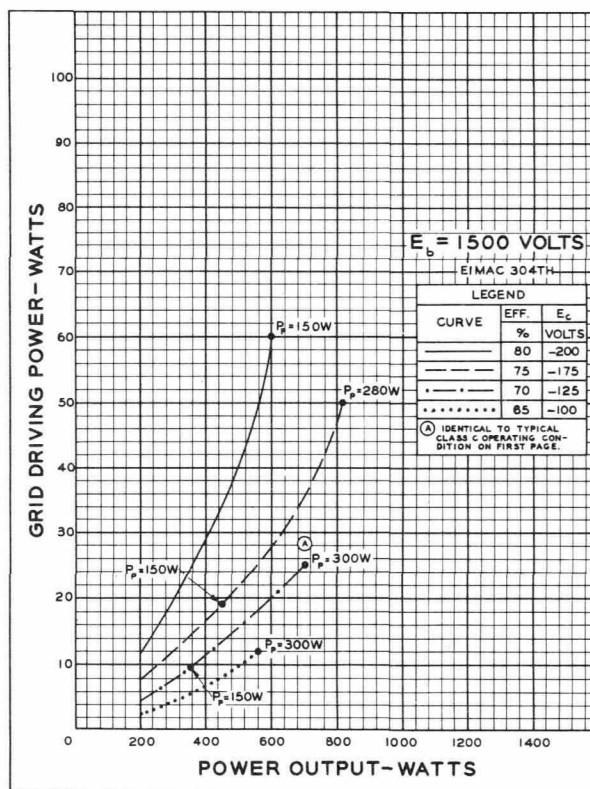
Plate Dissipation—The plates of the 304TH operate at a visible red color at the maximum rated dissipation of 300 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.



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 1500, 2000 and 3000 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 1500, 2000, and 3000 volts respectively.





304TH

