

EIMAC

EITEL-McCULLOUGH, INC.

SAN BRUNO, 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 Mc.

The 304TH in class-C r-f 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 μf
Grid-Filament	13.5 μf
Plate-Filament	0.7 μf
Transconductance ($I_b = 1.0 \text{ amp.}, E_b = 3000 \text{ v.}$)	16,700 μmhos
Highest Frequency for Maximum Ratings	40 Mc

MECHANICAL

Base	Special 4-pin
Basing	See outline drawing
Socket	Johnson type No. 124-213 or equivalent
Mounting Position	
Cooling	
Maximum Temperature of Plate and Grid Seals	
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



Vertical, base down or up
Convection and radiation
225° C

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy (Key-down conditions, one tube)
MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	900 MAX. MA
PLATE DISSIPATION	300 MAX. WATTS
GRID DISSIPATION	60 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1500	2000	3000 volts
D-C Grid Voltage	-125	-200	-300 volts
D-C Plate Current	665	600	500 ma
D-C Grid Current*	115	125	135 ma
Peak R-F 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 Mc.)

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	750 MAX. MA
PLATE DISSIPATION	200 MAX. WATTS
GRID DISSIPATION	60 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1500	2000	2500 volts
D-C Grid Voltage	-200	-300	-350 volts
D-C Plate Current	420	440	400 ma
D-C Grid Current*	55	60	60 ma
Peak R-F 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)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	900 MAX. MA
PLATE DISSIPATION	300 MAX. WATTS

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

D-C Plate Voltage	1500	2000	3000 volts
D-C Grid Voltage ¹	-65	-90	-150 volts
Zero Signal D-C Plate Current	265	200	135 ma
Max. Signal D-C Plate Current	1065	900	665 ma
Effective Load Plate-to-Plate	2840	4820	10,200 ohms
Peak A-F 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

*Approximate values.
¹Adjust to give stated Zero-Signal D-C 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

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 Mc. 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 ± 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.

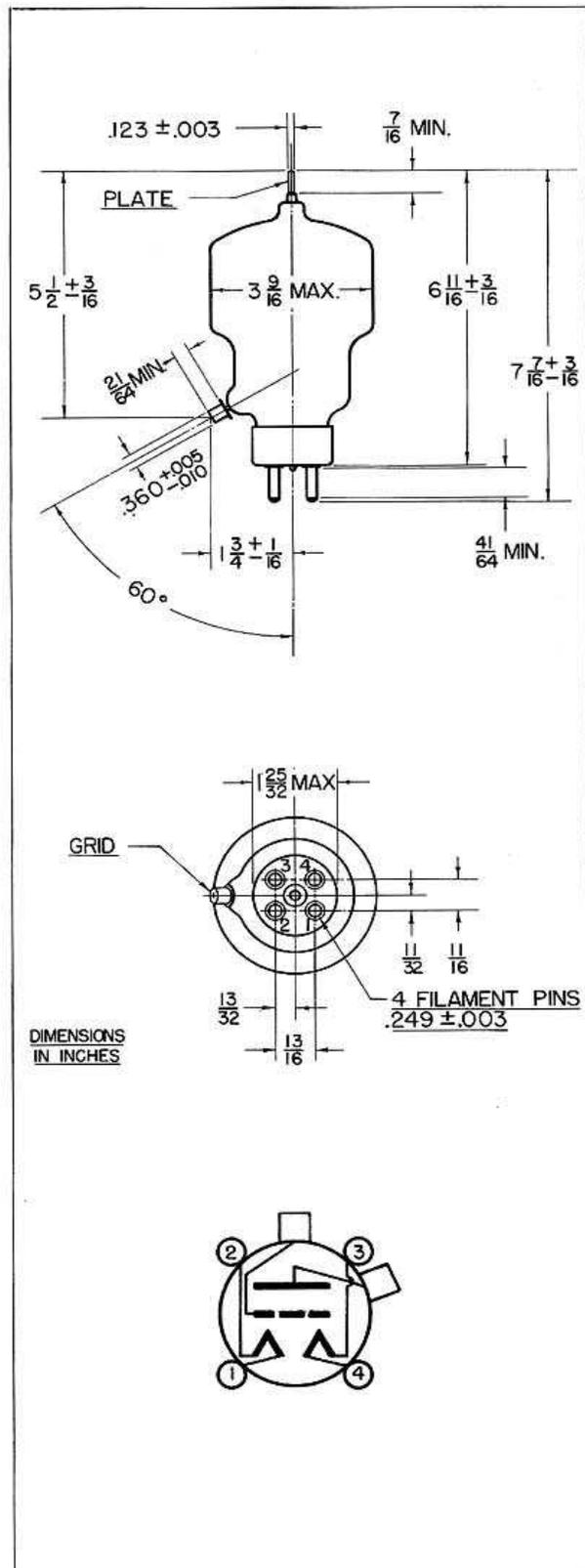
$$P_g = e_{cmp} I_c$$

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-reading voltmeter connected between filament and grid.¹ 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.

¹For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," *Eimac News*, January, 1945. This article is available in reprint form on request.



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 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.

