



TECHNICAL DATA

8165

4-65A

RADIAL-BEAM
POWER TETRODE

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 8165/4-65A is a small radial-beam tetrode with a maximum plate-dissipation rating of 65 watts. In most applications, no forced air is required, normal radiation and convection cooling being adequate. An instant-heating, thoriated tungsten filament is employed, allowing all electrode voltages to be applied simultaneously and permitting the conservation of power during standby periods. The 8165/4-65A is, therefore, a good choice for many mobile applications.

Short, heavy leads and low interelectrode capacities assure stable, efficient operation at high frequencies and permit its use at maximum ratings through 150 megacycles. The 8165/4-65A is equally useful in audio-amplifier or modulator service.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated Tungsten				
Voltage	-	6.0		volts
Current	3.2		3.8	amperes
Grid-Screen Amplification Factor	5		7	
Direct Interelectrode Capacitances:				
Grid-Plate	-		0.12	uuf
Input	6.0		8.3	uuf
Output	1.9		2.6	uuf
Frequency for Maximum Ratings	-	-	150	mc

MECHANICAL

Base	-	-	-	-	-	-	-	-	5-pin—National HX-29 or Johnson	122-101
Maximum Seal Temperature	-	-	-	-	-	-	-	-	-	200° C
Maximum Envelope Temperature	-	-	-	-	-	-	-	-	-	225° C
Recommended Socket Operating Position	-	-	-	-	-	-	-	-	-	Vertical, base down or up
Cooling	-	-	-	-	-	-	-	-	-	Convection and radiation
Recommended Heat Dissipating Connector	-	-	-	-	-	-	-	-	-	Eimac HR-6
Maximum Over-all Dimensions										
Length	-	-	-	-	-	-	-	-	-	4.19 inches
Diameter	-	-	-	-	-	-	-	-	-	2.38 inches
Net Weight	-	-	-	-	-	-	-	-	-	3 ounces
Shipping Weight (Approximate)	-	-	-	-	-	-	-	-	-	1.5 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telephony or FM Telephony

MAXIMUM RATINGS (Key-down conditions)

D-C PLATE VOLTAGE	-	-	-	3000 MAX. VOLTS
D-C SCREEN VOLTAGE	-	-	-	400 MAX. VOLTS
D-C GRID VOLTAGE	-	-	-	—500 MAX. VOLTS
D-C PLATE CURRENT	-	-	-	150 MAX. MA
PLATE DISSIPATION	-	-	-	65 MAX. WATTS
SCREEN DISSIPATION	-	-	-	10 MAX. WATTS
GRID DISSIPATION	-	-	-	5 MAX. WATTS

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Class-C Telephony

MAXIMUM RATINGS (Carrier conditions)

D-C PLATE VOLTAGE	-	-	-	2500 MAX. VOLTS
D-C SCREEN VOLTAGE	-	-	-	400 MAX. VOLTS
D-C GRID VOLTAGE	-	-	-	—500 MAX. VOLTS
D-C PLATE CURRENT	-	-	-	120 MAX. MA
PLATE DISSIPATION	-	-	-	45 MAX. WATTS
SCREEN DISSIPATION	-	-	-	10 MAX. WATTS
GRID DISSIPATION	-	-	-	5 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 150 megacycles)

D-C Plate Voltage	-	-	-	1500	2000	2500	3000 volts
D-C Screen Voltage	-	-	-	250	250	250	250 volts
D-C Grid Voltage	-	-	-	—105	—105	—105	—105 volts
D-C Plate Current	-	-	-	150	137	124	112 ma
D-C Screen Current*	-	-	-	39	32	26	22 ma
D-C Grid Current*	-	-	-	19	15	13	9 ma
Peak R-F Grid Voltage*	-	-	-	205	195	185	175 volts
Driving Power*	-	-	-	3.9	2.9	2.4	1.6 watts
Plate Input Power	-	-	-	225	275	310	335 watts
Plate Output Power	-	-	-	160	210	245	270 watts

*Approximate values

TYPICAL OPERATION (Frequencies up to 150 megacycles)

D-C Plate Voltage	-	-	-	1000	1500	2000	2500 volts
D-C Screen Voltage	-	-	-	250	250	250	250 volts
D-C Grid Voltage	-	-	-	—150	—150	—150	—150 volts
D-C Plate Current	-	-	-	120	120	113	102 ma
D-C Screen Current*	-	-	-	40	40	37	26 ma
D-C Grid Current*	-	-	-	20	20	18	13 ma
Peak R-F Voltage*	-	-	-	255	255	250	235 volts
Driving Power*	-	-	-	5.1	5.1	4.8	3.1 watts
Plate Input Power	-	-	-	120	180	226	255 watts
Plate Output Power	-	-	-	85	140	182	210 watts

*Approximate values





AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB₁

MAXIMUM RATINGS

D-C PLATE VOLTAGE	-	-	-	3000 MAX. VOLTS
D-C SCREEN VOLTAGE	-	-	-	600 MAX. VOLTS
D-C PLATE CURRENT	-	-	-	150 MAX. MA
PLATE DISSIPATION	-	-	-	65 MAX. WATTS
SCREEN DISSIPATION	-	-	-	10 MAX. WATTS

RADIO-FREQUENCY SSB POWER AMPLIFIER

Class-AB₁

MAXIMUM RATINGS

D-C PLATE VOLTAGE	-	-	-	3000 MAX. VOLTS
D-C SCREEN VOLTAGE	-	-	-	600 MAX. VOLTS
D-C PLATE CURRENT	-	-	-	150 MAX. MA
PLATE DISSIPATION	-	-	-	65 MAX. WATTS
SCREEN DISSIPATION	-	-	-	10 MAX. WATTS

TYPICAL OPERATION

Class-AB₁ (Sinusoidal wave, two tubes except where noted)

D-C Plate Voltage	-	-	-	1500	2000	2500	3000	volts
D-C Screen Voltage	-	-	-	500	500	400	400	volts
D-C Grid Voltage ¹	-	-	-	-90	-105	-85	-90	volts
Zero-Signal D-C Plate Current	-	-	-	60	40	30	30	ma
Max.-Signal D-C Plate Current	-	-	-	166	150	132	120	ma
Max.-Signal D-C Screen Current*	-	-	-	10	6	6	6	ma
Peak A-F Grid Voltage (per tube)*	-	-	-	70	80	77	77	volts
Effective Plate-to-Plate Load	-	-	-	13,300	24,000	37,500	50,000	ohms
Max.-Signal Plate Input Power	-	-	-	250	300	330	360	watts
Max.-Signal Plate Output Power	-	-	-	120	170	200	240	watts

¹Adjust to obtain listed zero-signal d-c plate current.

*Approximate values.

TYPICAL OPERATION

Class-AB₁ (Frequencies to 150 megacycles)

D-C Plate Voltage	-	-	-	1500	2000	2500	3000	volts
D-C Screen Voltage	-	-	-	500	500	400	400	volts
D-C Grid Voltage ¹	-	-	-	-90	-105	-85	-90	volts
Zero-Signal D-C Plate Current	-	-	-	30	20	15	15	ma
Max.-Signal D-C Plate Current	-	-	-	83	75	66	60	ma
Max.-Signal D-C Screen Current*	-	-	-	5	3	3	3	ma
Peak R-F Grid Voltage*	-	-	-	70	80	77	77	volts
Max.-Signal Plate Input Power	-	-	-	125	150	165	180	watts
Max.-Signal Plate Output Power	-	-	-	60	85	100	120	watts

¹Adjust to obtain listed zero-signal d-c plate current.

*Approximate Values.

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made.

In class-C operation, adjustment of the r-f grid drive to obtain listed plate current at the listed grid bias, screen voltage, and plate voltage is assumed. Resultant screen and grid currents will vary from tube to tube, but little change in output power will be noted.

In class-AB₁ linear operation, screen current will also vary from tube to tube but is a useful indicator of relative linearity. In general, less screen current means better linearity, providing other conditions are held constant. The same degree of linearity will be obtained from different tubes if loading and drive are adjusted to give the same plate and screen current, although output power may vary from tube to tube.

APPLICATION

MECHANICAL

Mounting—The 4-65A must be operated vertically, base up or base down. The socket must provide clearance for the glass tip-off which extends from the center of the base. A flexible connecting strap should be provided between the plate terminal and the external plate circuit, and the Eimac HR-6 connector (or equivalent) used on the tube plate lead. The socket must not apply lateral pressure against the base pins. The tube must be protected from severe vibration and shock.

Adequate ventilation must be provided so that the seals and/or envelope under operating conditions do not exceed their rated maximum temperatures. For operation above 50 Mc. the plate voltage should be reduced, or special attention should be given to seal cooling.

When the ambient temperature does not exceed 30° C it will not ordinarily be necessary to provide forced-air cooling of the envelope or plate seal at frequencies below 50 Mc. provided that a heat-radiating plate connector is used and the tube is so located that normal circulation of air past the envelope is not impeded.

ELECTRICAL

Filament Voltage—The filament voltage, as measured at the filament pins, should be 6.0 volts. For long life, excursions from this value should not exceed ± 5 percent.

Bias Voltage—D-C bias voltage for the 4-65A should not exceed -500 volts. If grid-leak bias is used, suitable protective means must be provided to prevent excessive plate or screen dissipation in the event of loss of excitation.

Screen Voltage—The d-c screen voltage for the 4-65A should not exceed 400 volts except in the case of class-AB audio operation and Single-Side-Band r-f amplifier operation where it should not exceed 600 volts.

Screen Dissipation—The power dissipated by the screen of the 4-65A must not exceed 10 watts. Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage or plate load is removed with filament and screen voltages applied. Suitable protective means must be provided to limit screen dissipation to 10 watts in the event of circuit failure.

Plate Voltage—The plate-supply voltage for the 4-65A should not exceed 3000 volts. Above 50 Mc. it is advisable to use a lower plate voltage than the maximum, since the seal heating due to r-f charging currents in the screen leads increases with plate voltage and frequency. See instructions on seal cooling under "Mechanical" and "Shielding."

Plate Dissipation—Under normal operating conditions, the plate dissipation of the 4-65A should not be allowed to exceed 65 watts in unmodulated applications.

In high-level-modulated amplifier applications, the maximum allowable carrier-condition plate dissipation is 45 watts.

Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

OPERATION

Class-C FM or Telegraphy—The 4-65A may be operated as a class-C FM or telegraphy amplifier without

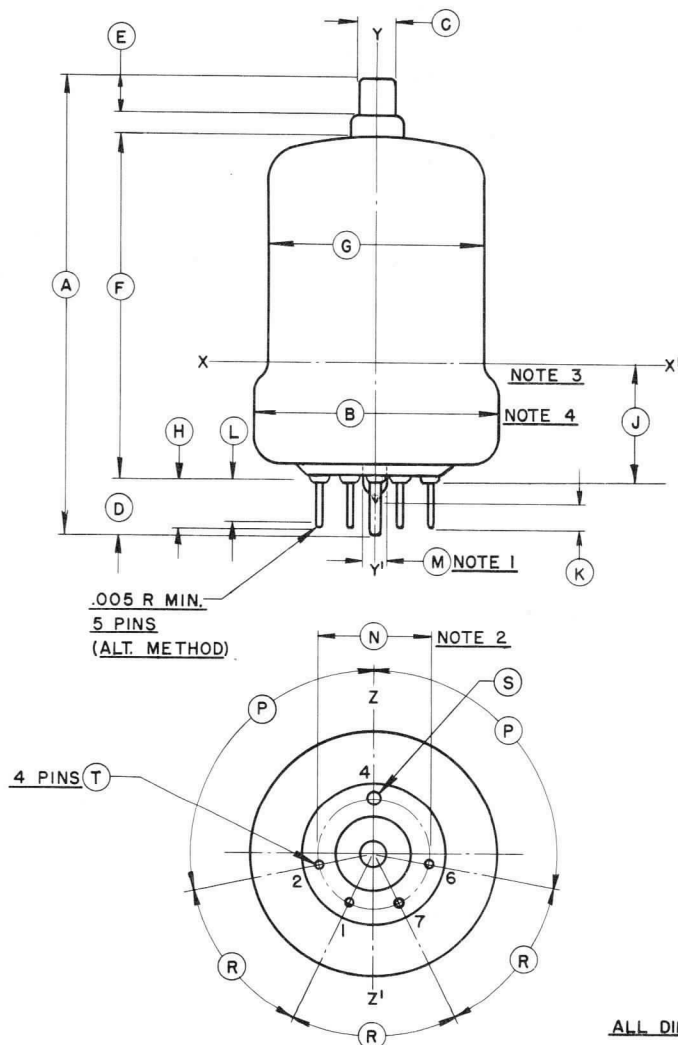
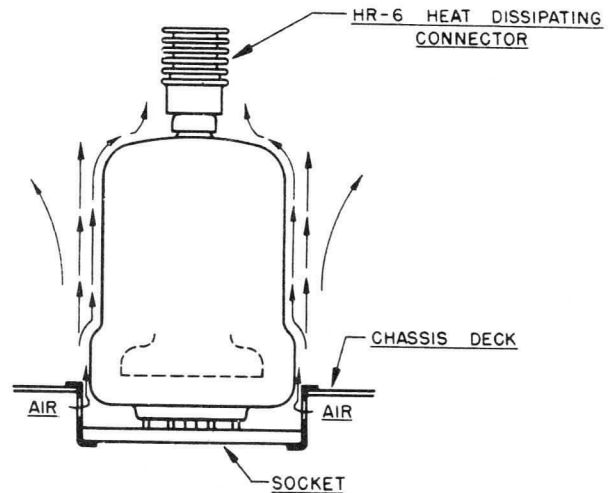
$$C_{(\mu\mu fd)} = \frac{640,000}{f^2 (M_c)} , \text{ approx.}$$

Shielding—The internal feedback of the tetrode has been substantially eliminated and in order to fully utilize this advantage, it is essential that the design of the equipment completely eliminate any feedback external to the tube. This means complete shielding of the output circuit from the input circuit and earlier stages, proper reduction to low values of the inductance of the screen lead to the r-f ground, and elimination of r-f feedback in any common power-supply leads.

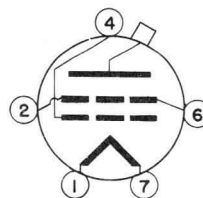
Complete shielding is easily achieved by mounting the socket of the tube flush with the deck of the chassis as shown in the sketch shown at the right.

The holes in the socket permit the flow of convection air currents from below the chassis up past the seals in the base of the tube. This flow of air is essential to cool the tube and in cases where the complete under-part of the chassis is enclosed for electrical shielding, screened holes or louvers should be provided to permit air circulation. Note that shielding is completed by aligning the internal screen shield with the chassis deck and by proper r-f by-passing of the screen leads to r-f ground. The plate and output circuits should be kept above deck and the input circuit and circuits of earlier stages should be kept below deck or completely shielded.

Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations. Copies of characteristic curves, either constant-grid-voltage or constant-current, for various screen potentials may be obtained from this department on request.



DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		4	4 ³ / ₁₆
B			2 ³ / ₈
C		.350	.365
D		⁷ / ₁₆	⁹ / ₁₆
E		2 ¹ / ₆₄	
F		2 ¹⁵ / ₁₆	3 ⁵ / ₁₆
G			2 ¹ / ₈
H		³ / ₈	¹ / ₂
J		.844	1.219
K		.000	
L		⁵ / ₁₆	
M			³ / ₈
N	1.000		
P	102°		
R	52°		
S		.122 DIA.	.128 DIA.
T		.055 DIA.	.061 DIA.



ALL DIMENSIONS IN INCHES.

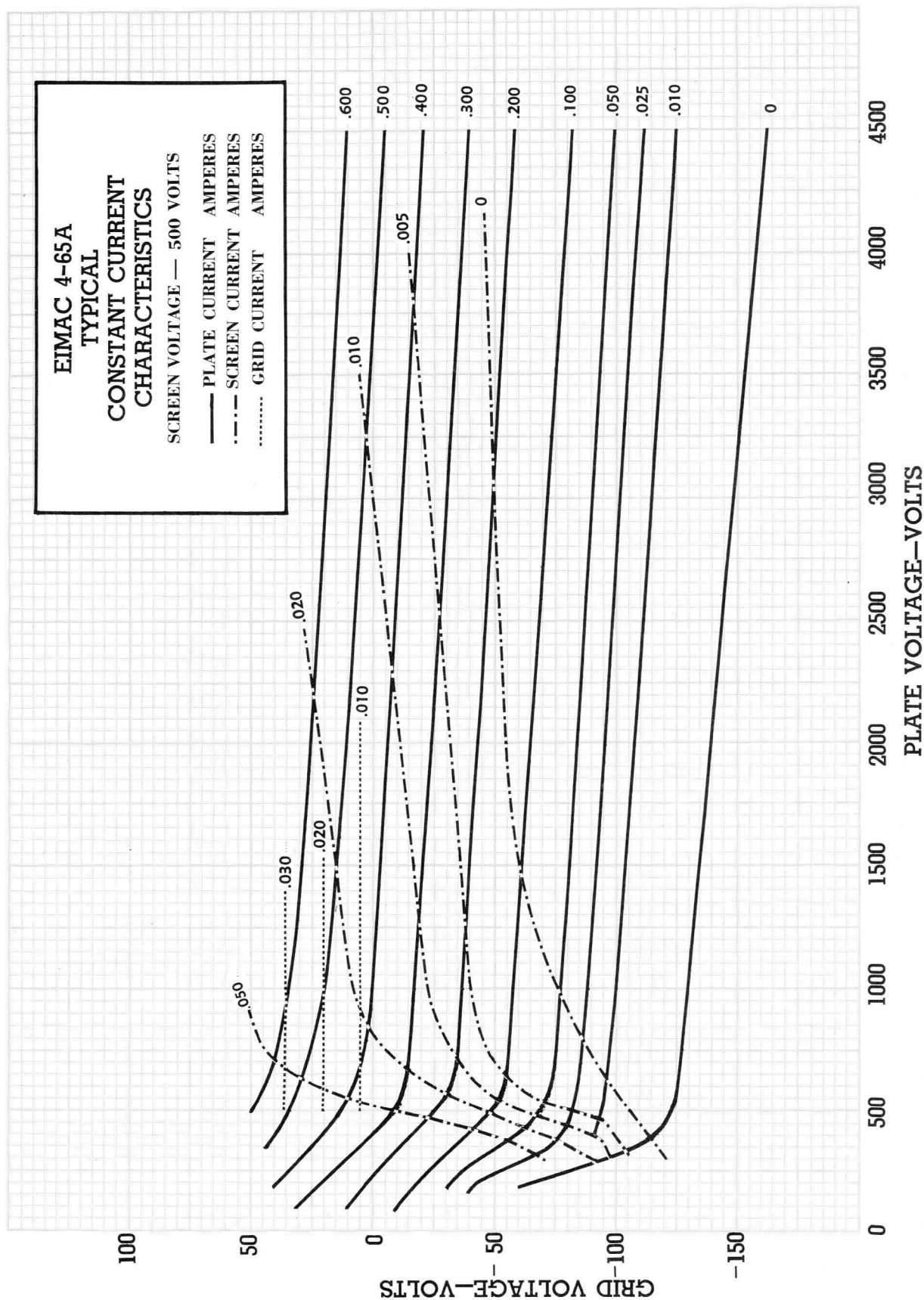
EIMAC 4-65A

TYPICAL

CONSTANT CURRENT CHARACTERISTICS

SCREEN VOLTAGE — 500 VOLTS

— PLATE CURRENT AMPERES
- - - SCREEN CURRENT AMPERES
..... GRID CURRENT AMPERES





EIMAC 4-65A

TYPICAL
CONSTANT CURRENT
CHARACTERISTICS

SCREEN VOLTAGE — 250 VOLTS

— PLATE CURRENT AMPERES
- - - SCREEN CURRENT AMPERES
..... GRID CURRENT AMPERES

