

Eitel-McCULLOUGH, Inc.

SAN BRUNO, CALIFORNIA

4-400A

POWER TETRODE

•

RF

AMPLIFIER

The Eimac 4-400A is a high vacuum power tetrode having a maximum plate dissipation rating of 400 watts. It is intended for power amplifier service in 1 kw FM broadcast transmitters on the 88-108 Mc. band. Two tubes operating in this service will deliver a useful power output in excess of 1000 watts while operating under conservative conditions and with low driving-power requirements. The 4-400A is of compact and rugged construction and its low grid-plate capacitance coupled with its low driving power requirement allows considerable simplification of the associated circuit and driver stage.

Cooling of the 4-400A is accomplished by radiation from the plate and with circulation of forced-air through the base around the envelope and over the plate seal. The problem of cooling is greatly simplified by using an Eimac Air-System Socket and its accompanying glass chimney. This system is designed to efficiently maintain the correct balance of cooling air between the component parts of the tube.*†

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten

Voltage - - - - - 5.0 volts

Current - - - - - 14.5 amperes

Grid-Screen Amplification Factor (Average) - - - - - 5.1

Direct Interelectrode Capacitances (Average)

Grid-Plate (without shielding, base grounded) - 0.12 $\mu\mu\text{fd}$

Input - - - - - 12.5 $\mu\mu\text{fd}$

Output - - - - - 4.7 $\mu\mu\text{fd}$

Transconductance ($i_b=100 \text{ ma.}$, $E_b=2500\text{V.}$, $E_{c2}=500\text{V.}$) - 4,000 μmhos

MECHANICAL

Base - - - - - 5-pin metal shell, No. 5008B

Basing - - - - - RMA type 5BK

*Cooling - - - - - Radiation and forced air.

When the Eimac Air-System Socket 4-400A/4000 is used, 14 cu. ft. of air per minute at 1/4 inch pressure as measured in the socket, is required per tube.

Maximum Overall Dimensions:

	Tube Only	Tube with Socket, Chimney and HR-6 Plate Connector
Length - - - - -	6.38 inches	8.00 inches
Diameter - - - - -	3.56 inches	5.44 inches
Net Weight - - - - -	9. ounces	
Shipping Weight (Avg.) - - - - -	2.5 pounds	

RATINGS

RADIO-FREQUENCY POWER AMPLIFIER

Class-C FM Telephony or Telegraphy(Key-down conditions, 1 tube)

MAXIMUM RATINGS (Frequencies up to 110-Mc.)

D-C PLATE VOLTAGE - - - - -	4000 MAX. VOLTS
D-C PLATE CURRENT - - - - -	350 MAX. MA.
D-C SCREEN VOLTAGE - - - - -	600 MAX. VOLTS
D-C GRID VOLTAGE - - - - -	—500 MAX. VOLTS
PLATE DISSIPATION - - - - -	400 MAX. WATTS
SCREEN DISSIPATION - - - - -	35 MAX. WATTS
GRID DISSIPATION - - - - -	5 MAX. WATTS

*Guarantee applies only when the 4-400A is used as specified with adequate air in the 4-400A/4000 Air-System Socket or equivalent.

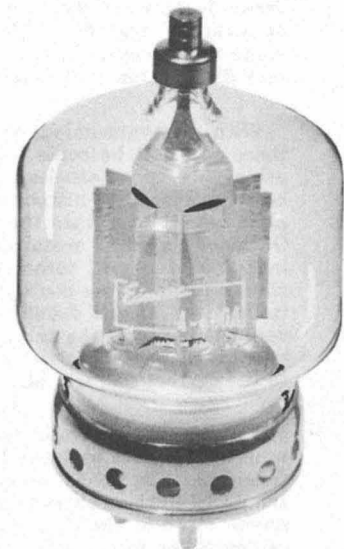
†The Radio-frequency losses in a vacuum tube increase with frequency

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TYPICAL OPERATION (110-Mc., Two Tubes)

D-C PLATE VOLTAGE - - - - -	3500	4000	VOLTS
D-C PLATE CURRENT - - - - -	500	540	MA.
D-C SCREEN VOLTAGE - - - - -	300	300	VOLTS
D-C SCREEN CURRENT - - - - -	40	45	MA.
D-C GRID VOLTAGE - - - - -	—170	—170	VOLTS
D-C GRID CURRENT - - - - -	20	20	MA.
DRIVING POWER (APPROX.) - - - - -	20	20	WATTS
PLATE POWER OUTPUT (APPROX.) - - - - -	1300	1600	WATTS
USEFUL POWER OUTPUT - - - - -	1160	1440	WATTS

and at 110-Mc. become an appreciable source of heat. Since these losses occur mainly in the leads and the glass surrounding these leads, adequate cooling must be provided to prevent the deterioration of the envelope at the point where the leads go through the glass.

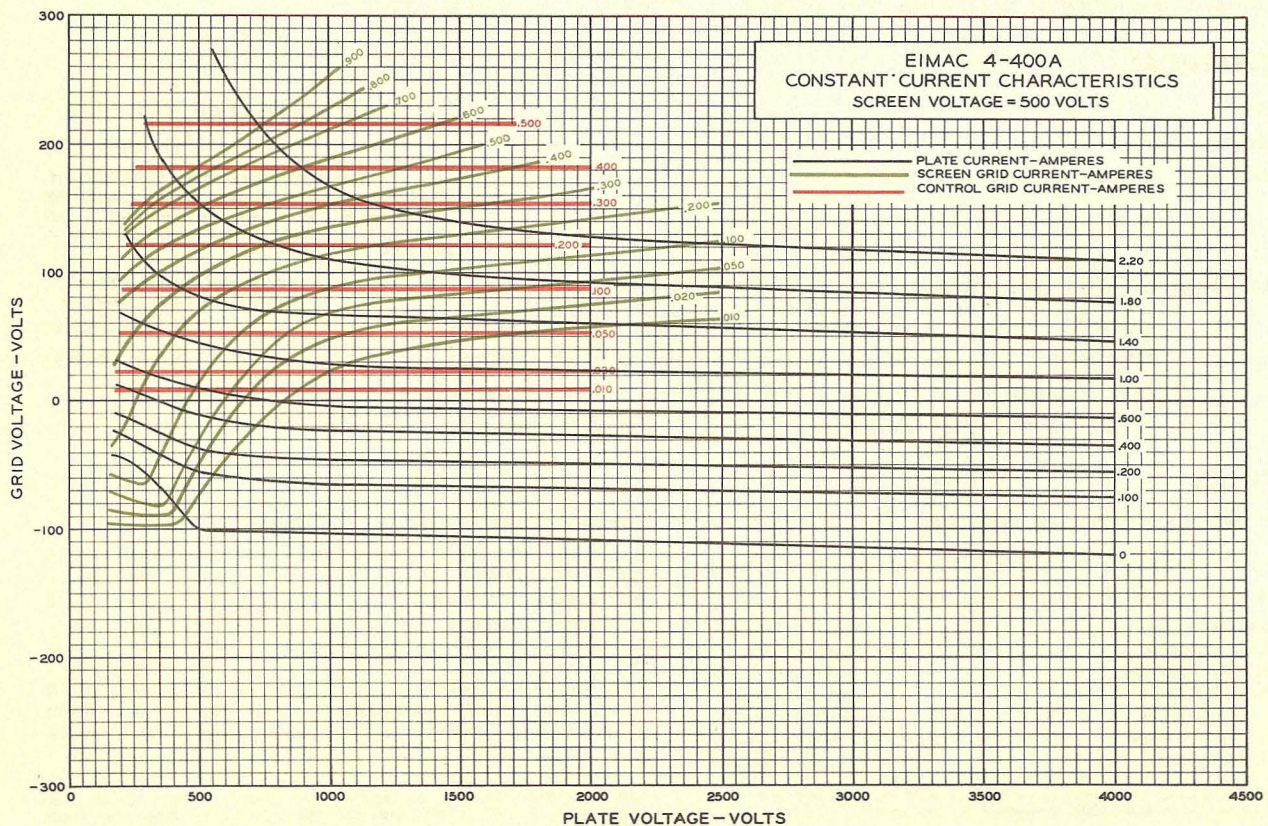
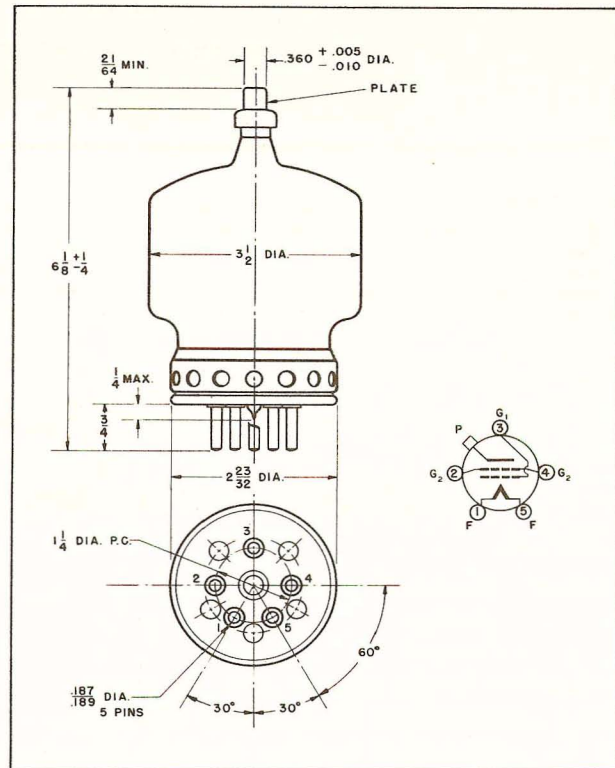


APPLICATION

Conventional capacitance-shortened quarter wave linear grid and plate tank circuits may be used at 110-Mc. The circuit elements should be silver-plated for best results at this frequency. The 4-400A screen lead inductance is minimized by two screen leads brought through the base of the tube. In order to take advantage of this design feature the screen lead terminals on a socket must be strapped together and all R-F connections must be made to the center of this strap to provide balanced current distribution to ground.

With adequate shielding on frequencies above 30-Mc. there will still be some feed-back present, which is due principally to screen-lead-inductance effects. This may be neutralized by introducing inphase voltage from the plate circuit back into the grid circuit of the same tube. Ordinarily a small metal tab 1 inch by 1½ inches connected to the grid terminal and located parallel to the plate outside of the cooling chimney will suffice for neutralization. Means should be provided for adjusting the distance between the tab and the plate until the correct amount of neutralization is obtained. Trimming the tab to the correct size will also accomplish the same result.

An alternate neutralization method would be to series-tune each screen to ground by means of a small variable capacitor. The leads to each capacitor and to ground should be kept as short as possible and the lead from the screen strap to the capacitor should be brought from the center of the screen strap as previously mentioned.



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4-400A/4000

**AIR-SYSTEM
 SOCKET**

In order to simplify the cooling problem of the Eimac 4-400A Tetrode and assure adequate air-flow to the various seals, the Eimac Air-System Socket was developed. This system is so designed that the correct amount of cooling air is distributed to the various seals in the right proportion.

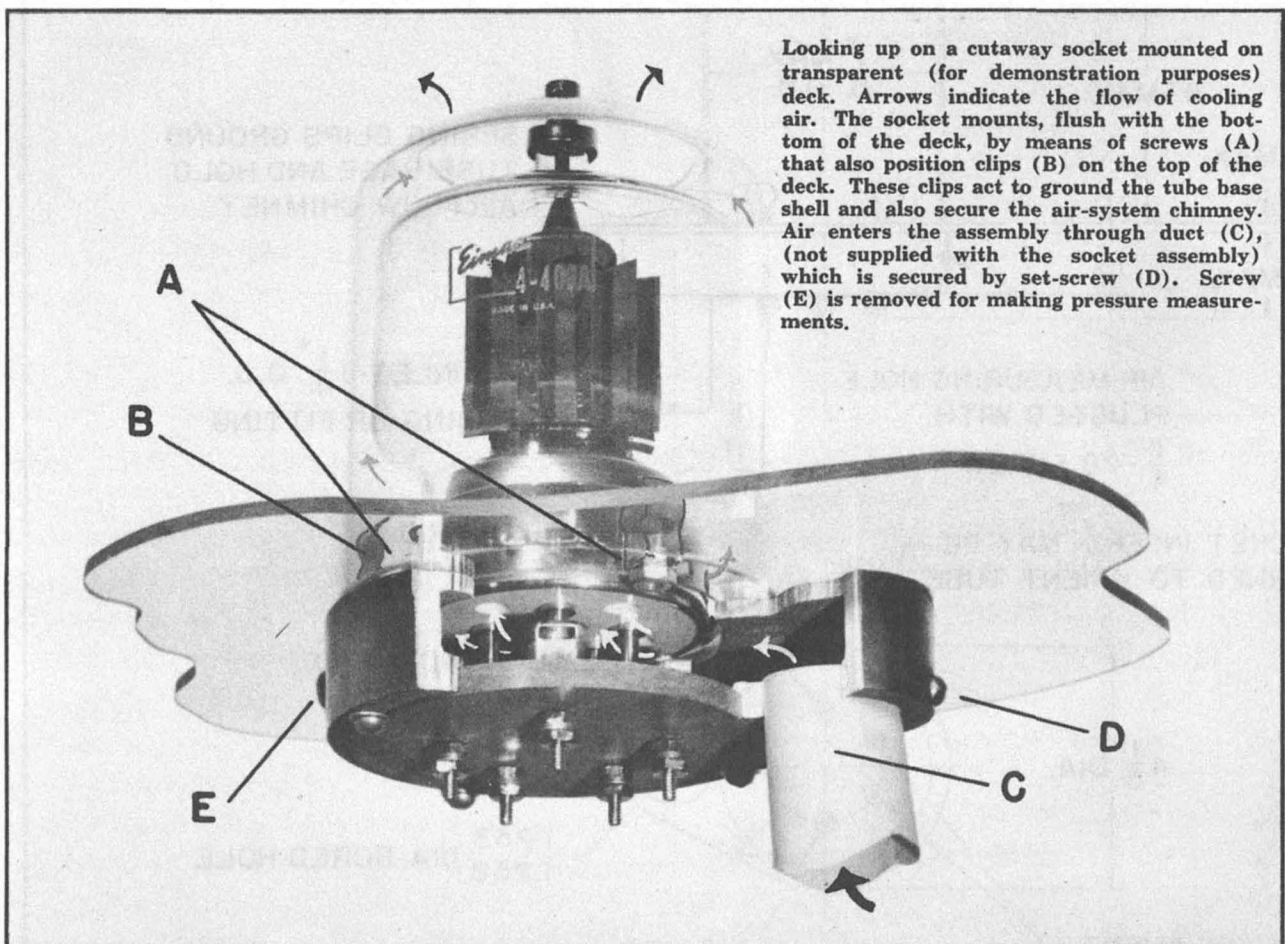
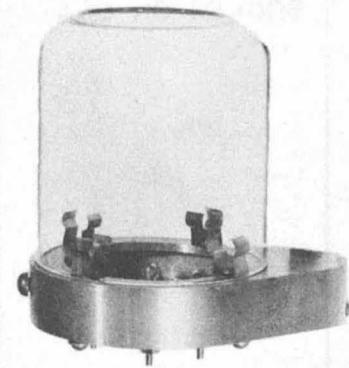
The system consists of two parts: a specially designed cooling socket and a glass chimney that fits over the tube envelope. The air is introduced into the system at a single port in the socket and then circulates through and around the base, cooling the base pins and seals. It then flows over the envelope, the plate seal and finally exhausts at the chimney top.

A $\frac{1}{4}$ inch diameter hole tapped 28 threads per inch is provided in the socket for the purpose of reading the static air pressure. Under full operating conditions at 110-Mc, with an ambient temperature of 25 degrees Centigrade, each tube requires cooling air at the rate of 14. cu. ft. per minute into the system with a static pressure of 0.25 inches of water as measured at the socket measuring port.

In selecting a blower, allowance should be made for pressure drop occurring in the duct and manifold between the blower and the socket. This drop will, of course, depend on the length and diameter of the air duct and manifold between the blower and the socket.

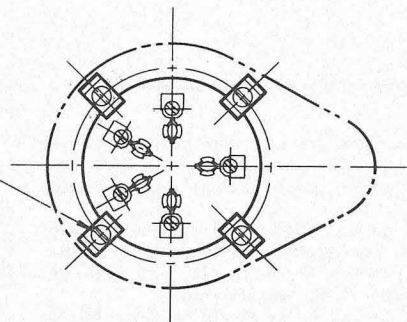
These air requirements are readily furnished by a small centrifugal blower of the dual type, with the output of each blower going to a socket. The single motor of this type of blower need require only 65 watts of power while furnishing 14 cu. ft. per minute air-flow at $\frac{1}{2}$ inch pressure from each of two blowers.

The 4-400A/4000 Air-System Socket can also be used without modification for the Eimac 4-250A and 4-125A Tetrodes.



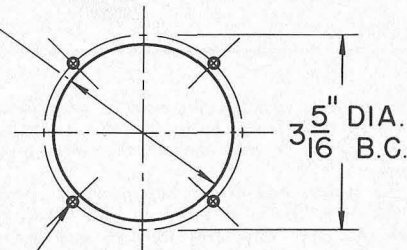
Looking up on a cutaway socket mounted on transparent (for demonstration purposes) deck. Arrows indicate the flow of cooling air. The socket mounts, flush with the bottom of the deck, by means of screws (A) that also position clips (B) on the top of the deck. These clips act to ground the tube base shell and also secure the air-system chimney. Air enters the assembly through duct (C), (not supplied with the socket assembly) which is secured by set-screw (D). Screw (E) is removed for making pressure measurements.

10-32 MACHINE
 SCREWS MOUNT
 SPRING CLIPS AND
 SOCKET ON CHASSIS



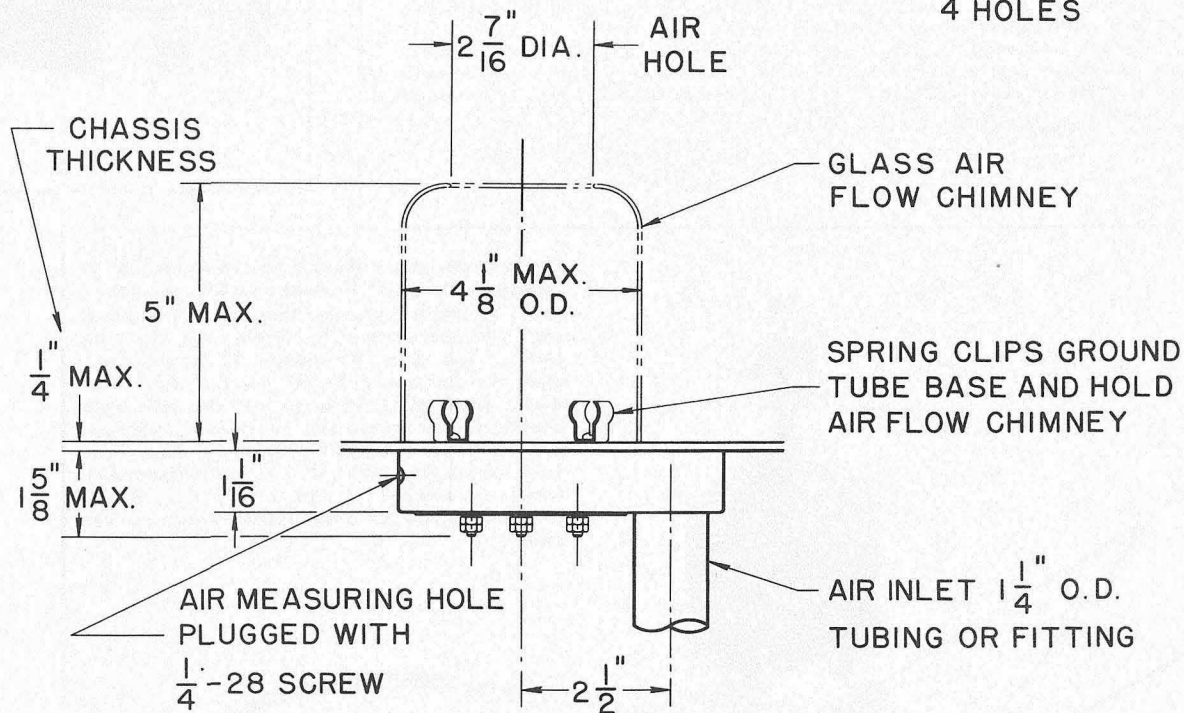
TOP VIEW

3" DIA. HOLE THRU
 CHASSIS



CHASSIS
 DRILLING

#9 (.196) DRILL THRU
 4 HOLES



SOCKET INSERT MAY BE
 TURNED TO ORIENT TUBE

