



amateur service newsletter
W6SAI

**A 2 KILOWATT P.E.P. LINEAR AMPLIFIER
FOR SINGLE SIDEBAND SERVICE**

The new Eimac 3-1000Z is an air cooled power triode designed for zero bias, class B, r.f. and audio service. It is particularly well suited for single sideband linear amplifier service, delivering 1360 watts of single tone power at a plate potential of 3000 volts. At this power level intermodulation distortion products are 30 db or more below peak power level. At a plate potential of 2500 volts, two kilowatts p.e.p. input may run, with intermodulation distortion products 35 decibels or more below peak power level.

Shown in the drawing is a schematic of an all-band (3.5-29.7 Mc) grounded grid amplifier designed around the 3-1000Z. A tuned cathode circuit is employed to achieve minimum intermodulation distortion and ease of drive*, and a bandswitching Pi-L network is used in the plate output circuit to obtain maximum harmonic reduction and efficient power transfer to low impedance coaxial lines. Use of the Pi-L configuration reduces second harmonic transmission by over 15 db compared to a simple pi-network and permits the use of a less expensive network loading capacitor.

The amplifier may be driven to full output by any single sideband exciter having a p.e.p. output of 65 watts or better. Drive is monitored by a grid current meter (M-1) placed in the grid-cathode return circuit. The grid terminals of the 3-1000Z are grounded directly to the metal chassis for maximum circuit isolation. The plate current meter (M-2) is placed in the B-minus lead to the power supply. A diode voltmeter (M-3) indicates relative r.f. output, and may be used for tuning purposes.

The amplifier can be constructed within a cabinet measuring 10½" high, 15" wide and 14" deep. Alternatively, a standard 14" x 17" x 4" aluminum chassis may be used. The tuned input circuit (L1, C1, C2) and filament choke (CH1) are mounted below deck, and the plate circuit components are placed atop the chassis. The chassis is pressurized by means of a bottom plate. Air is forced into the chassis by a "squirrel cage" blower and then exhausted through the air system socket. Plate circuit components are enclosed in a TVI-proof screen made of perforated aluminum sheet. The meters should be removed from the enclosure or, if placed within the enclosure, are shielded from the r.f. field by means of a metal cap placed over the rear of the meter.

* "The Grounded Grid Linear Amplifier," QST, August, 1961, page 16.



Parts List:

B1--20 cu. feet/min. at socket. Dayton #1C-180.

C1--Three gang b.c. capacitor with sections in parallel. J. W. Miller #2113.

C2--800 $\mu\mu\text{fd}$ mica. Use .0005 $\mu\mu\text{fd}$ and .0003 $\mu\mu\text{fd}$ in parallel. Cornell

C2--800 $\mu\mu\text{fd}$ mica. Use .0005 $\mu\mu\text{fd}$ and .0003 $\mu\mu\text{fd}$ in parallel. Cornell-Dubilier type 4, or type 9. 1200 volt d.c. test.

C3--Four .001 μfd , 5KV Centralab type 858-S capacitors in parallel.

C4--350 $\mu\mu\text{fd}$. 3 KV. Johnson #154-10 (type 350E30).

C5--Two 500 $\mu\mu\text{fd}$, 2KV in parallel. Johnson #154-3 (type 500E20). Capacitors are driven together by gears, or may be ganged with metal shaft coupling.

C6-7--0.1 μfd , 600 volt Sprague "Hypass" capacitor, type 80P3.

CH1--Four windings. 50 turns each #10 e. Two layers, bifilar wound on $\frac{1}{2}$ -inch diam. ferrite rod. Winding length is 4 inches. Rod is 4-3/8" long. Lafayette #M-333. Lafayette Radio Co., New York. A Barker & Williamson type FC-30 choke may be substituted. Windings paralleled to make two coils.

L1--9 turns #10 e., 1" diam., 1 $\frac{1}{2}$ " long. 40 meter tap 4 $\frac{1}{2}$ turns, 20 meter tap 2 $\frac{1}{2}$ turns, 15 meter tap 1 $\frac{3}{4}$ turns, 10 meter tap $\frac{1}{2}$ turn plus 2" lead. (All taps measured from "hot" end). Taps adjusted so circuit resonates with tube in socket with following total capacitance: 3.5 mc, 1660 $\mu\mu\text{fd}$; 7 mc, 830 $\mu\mu\text{fd}$; 14 mc, 415 $\mu\mu\text{fd}$; 21 mc, 240 $\mu\mu\text{fd}$; 28 mc, 210 $\mu\mu\text{fd}$.

M1--0-300 ma. M-2--0-1000 ma. M-3--0-1 ma.

PC--Three 100 ohm, 2 watt composition resistors in parallel. Shunt coil is portion of plate lead strap, two turns, 5/8" diam., 1 inch long.

RFC--1-Solenoid choke, 1 ampere, 8 μh . Barker & Williamson #800.

RFC-2--VHF choke, Ohmite #Z-50.

S1--Single pole, 5 position ceramic switch. Centralab #CRL-2501.

S2A-B--Two pole, 5 position ceramic switch. Radio Switch Corp. Model #86 shorting switch, two section. Type H wafers (one circuit, one pole, 12-position, including "off"). Sixty-degree detent, standard bearing.

T1--7.5 volts at 21 amperes. Stancor #P-6457. Chicago-Standard Transformer Co.

Socket and Chimney--Eimac SK-510 and SK-516 respectively. See tube data sheet for cooling requirements of 3-1000Z.

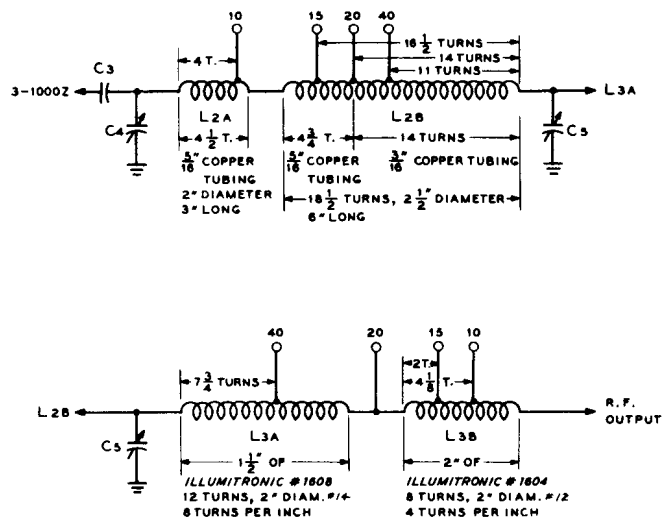
Anode connector--Eimac type HR-8.

Figure 2. Detail of Pi-L Network Coils

PLATE PI-NETWORK CONFIGURATION

Q=15

ITEM	AMATEUR BAND				
	80	40	20	15	10
C4 (UUF)	343	172	86	56	43
L2A-B (UH)	9.2	4.06	2.03	1.35	1.02
C5 (UUF)	891	446	223	149	112
L3A-B (UH)	6.34	4.17	2.08	1.39	1.04



Makeup of the Pi-L plate network coils is shown in figure 2. Coils are wound and positioned in the amplifier then taps adjusted with the aid of a grid-dip meter to provide circuit resonance with capacitance values of C4 and C5 as listed in the table. The tube should be in the socket and connected to the plate circuit for these measurements. Coil taps are made by flexible, 1/4-inch copper strap, looped around coil tubing and fixed in place with 4-40 machine screws and bolts. When correctly positioned, joints are soldered with a heavy iron or blow torch and coil is removed and silver plated. The 10 meter tap is positioned near end of coil L2A so that resonance is obtained at 29.7 mc with plate tuning capacitor about 5° meshed. Coils are arranged at right angles to each other to reduce mutual coupling to a minimum.

Plate parasitic suppressor (PC) is required to eliminate tendency to VHF oscillation caused by high gain of 3-1000Z, together with residual inductances in plate and filament circuits. Too many coil turns will cause suppressor to overheat when amplifier is operated on 10 meters, and too few turns will fail to completely "de-Q" the parasitic circuit. In general, two to four turns seem to be correct in most cases.

During standby periods, the 3-1000Z may be biased close to cutoff by placing a 50,000 ohm, 10 watt resistor in series with the lead connecting meter M-1 to the filament center-tap (point X, figure 1). The resistor may be shorted out by external VOX relay contacts.

The new Eimac SK-510 Air-System Socket and SK-516 Chimney are recommended for use with the 3-1000Z. The older SK-500 socket may be used provided additional air is applied to the socket and care is taken to see that the contacts are free to move about, and do not place lateral strain on the tube pins. In either case, the SK-516 chimney should be used.