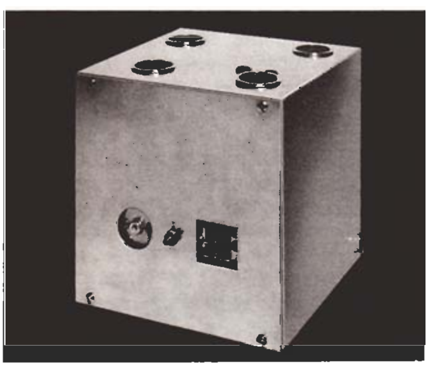
G-E HAM NEWS



Read herein how K2IOW has designed a clever bandswitching VFO around the high-C Colpitts oscillator circuit from our 150-WATT SINGLE BANDER transmitters in G-E HAM NEWS a year ago.

—Lighthouse Larry

MARCH–APRIL, 1959

In This Issue . . . .

High-C

BANDSWITCHING VFO

Also—

MEET THE DESIGNER . . . .

K2IOW—Robert A. Hall, tailored the high-C oscillator circuit to his own station needs; specifically, driving his 6AG7 oscillator-paralleled 6L6-GB transmitter (adapted from the popular *QST/Radio Amateur's Handbook* design) on all bands. Bob, who enjoys building as much as operating on 3.9, 7.2, 14.2 and 21.3 megacycle phone, is an engineer with General Electric's Manufacturing Engineering Services operation in Schenectady, N. Y.

Starting as a Novice two years ago, Bob has logged thousands of hours of hamming to date, both on the air and at his workbench. Another item of his handiwork—a desk-top all-band one-kilowatt final amplifier, with paralleled GL-810 triodes, driven by the above 75-watter —will be described in the September-October, 1959 issue of *G-E HAM NEWS.* Bob even called upon another of his hobbies—photography—to supply us with pictures of his neat kilowatt package.

QUITE OFTEN we're asked what "Design-Maximum ratings" on our receiving, Five-Star and special purpose tubes means. And casting about for an answer, the most comprehensive explanation we could find appears on the Description and Rating sheet published by our technical data people for each of our tubes.

This statement says:

"Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a normal tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

"The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

"The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a normal tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions."

High-C

BANDSWITCHING VFO

EVER SINCE K7BGI *helped revive interest in high-capacitance oscillator circuits,[1] many requests have been received for a bandswitching oscillator utilizing this principle. Two models are described; one showing a Millen 10039 dial, and the other a National SCN dial.*

ONCE A NOVICE radio amateur earns his General class license, usually his first thought is directed toward adding a variable frequency oscillator (hereafter known as VFO) to his transmitter. Although there are several VFO kits on the market at moderate cost, some fellows simply like to "roll their own." Thus, the High-C BANDSWITCHING VFO was designed to answer this need.

The output frequency of this VFO is either at the transmitter frequency, or one half of it. This permits the oscillator in a two-stage transmitter to operate as a straight amplifier or doubler, respectively, assuring plenty of driving power for the output stage.

Rather than have just one basic oscillator tuning range—with the resultant crowding of some amateur bands into a small portion of the tuning dial—a circuit was developed whereby each of the popular amateur bands could be spread out over most of the dial. Even though the switching circuitry in the left side of the schematic diagram, FIG. 1, looks complex, it largely consists of extra fixed capacitances switched in parallel and in series with one or two sections of the main tuning capacitor, C_1, to obtain the desired oscillator tuning range.

TABLE I SHOWS the oscillator grid and plate frequencies for each amateur band and the actual components in use. Capacitors C_9 and C_{10} (0.002 mfd each) are always in series across the frequency determining circuit. They form the capacitive r.f. voltage divider for feedback.

The 6AH6 oscillator tube always doubles or triples the grid circuit frequency in the plate circuit. This helps reduce ***pulling*** of the oscillator frequency due to changes in loading on the output circuit. The value of C_{15} (200 mmf) was selected for a 2-foot length of RG-58/U coaxial cable on J_2; reduce this capacitance to 100 mmf for cable lengths between 2 and 5 feet. A link coupled output circuit also could be employed by substituting a 2-pole switch wafer at S_{1D} to connect the proper link coil to J_2.

The power requirement is quite low; 6.3 volts AC or DC for the 6AH6 heater, and 150 to 250 volts DC at 15 milliamperes for the plate circuit. The recommended plate and screen voltage regulating circuitry for the VFO is shown in FIG. 2.

continued on page 6

[1]S. G. Reque, K7BGI, "Technical Tidbits—HIGH-C OSCILLATORS," *G-E HAM NEWS*, November–December, 1957, page 6.

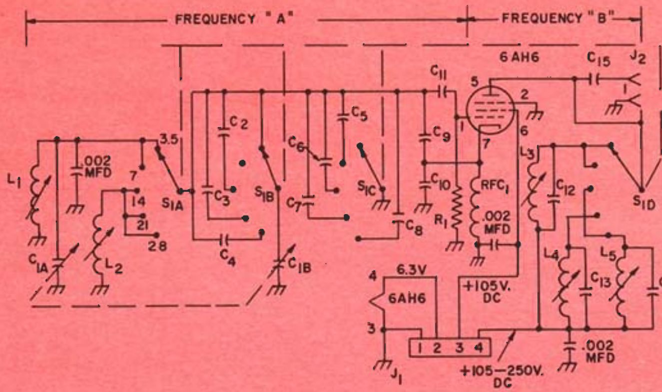


FIG. 1. **SCHEMATIC DIAGRAM** of the bandswitching high-c variable frequency oscillator VFO. Capacitors across the oscillator grid tuned circuit for each band are described in the text. Grid and plate circuit frequencies, "A" and "B" respectively, are listed in Table I. All capacitances are in mmf unless otherwise specified. Chassis grounds should be made at points shown.

TABLE I—HIGH-C OSCILLATOR FREQUENCY CHART

Transmitter Output, MC.	Grid Circuit		Plate Circuit—Output	
	Tuning Range, MC.	Active Components in Circuit	Oscillator Output, MC.	Active Components in Circuit
3.5–4.0	1.75–2.0	.022 mfd, C_{1A}, C_{1B}, C_9, C_{10}, L_1	3.5–4.0	C_{12}, L_3
7.0–7.3	1.75–1.825	.002 mfd, C_{1A}, C_5, C_9, C_{10}, L_1	3.5–3.65	C_{12}, L_3
14.0–14.35	7.0–7.2	C_{1B}, C_2, C_6, C_9, C_{10}, L_2	14.0–14.4	C_{14}, L_5
21.0–21.45	7.0–7.150	C_{1B}, C_3, C_7, C_9, C_{10}, L_2	21.0–21.45	C_{13}, L_4
28.0–29.7	7.0–7.45	C_{1B}, C_4, C_8, C_9, C_{10}, L_2	14.0–14.9	C_{14}, L_5

PARTS LIST—COIL TABLE

C_{1A}, C_{1B}. . . . _ section broadcast variable, 15—420-mmf per section (Philmore 9046).
C_2. . . . . .120-mmf silvered mica
C_3. . . . . .100-mmf silvered mica
C_4. . . . . .500-mmf silvered mica
C_5. . . . . . . .450-mmf silvered mica (400 and 50)
C_6. . . . . .300-mmf silvered mica
C_7. . . . . . . .320-mmf silvered mica (300 and 20)
C_8. . . . . .250-mmf silvered mica
C_9, C_{10}. . . . . .0.002-mfd silvered mica
C_{11}, C_{15}. . . . . .200-mmf silvered mica
C_{12}, C_{14}. . . . . .30-mmf silvered mica
C_{16}. . . . . .20-mmf silvered mica
J_1. . . . . .4-prong male plug (Jones P-304-AB)
J_2. . . . . .1-prong female chassis phono jack
L_1. . . .3 uh, 17 turns, No. 18 enameled wire on ½-inch diameter iron slug-tuned coil form, 1 1/16-inch winding length. (National XR-50).
L_2. . . .0.4 uh, 6 turns, No. 16 enameled wire on ½-inch diameter iron slug tuned coil form, 11/16-inch winding length (National XR-50).
L_3. . . .30—70 uh, scramble-wound iron slug-tuned coil (CTC LS-3, 5-MC ready-wound coil, marked with green dot on winding).
L_4. . . .1.0—2.0 uh, 12 turns, No. 24 enameled wire spacewound ⅜ of an inch long on ⅜-inch diameter iron slug-tuned coil form (CTC-LS-3 blank form).
L_5. . . .1.5—3 uh, 18 turns, No. 24 enameled wire, closewound ⅜ of an inch long on ⅜-inch diameter form (CTC LS-3 blank form).
R_1. . . .47,000 to 100,000-ohms, 1 watt (see text).
RFC$_1$. . 1 mh pi-wound r.f. choke (National R-50).
S_1. . . .4 pole, 5 position, steatite rotary tap switch, assembled from the following Centralab 2000 series miniature switch parts: 1—PA-302 index assembly; 1—PA-2007 switch wafer (3 poles, 5 positions, for S_{1A}, S_{1B} and S_{1C}); 1—PA-2001 switch wafer (1 pole, 11 positions; only 5 positions used for S_{1D}).

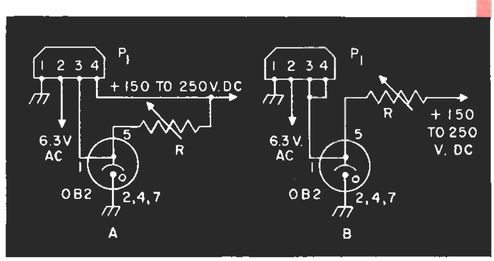


FIG. 2. SCHEMATIC DIAGRAM for the recommended voltage regulator circuit for the high-c oscillator. Diagram "A" places 105 volts DC on the 6AH6 and screen and full power supply voltage on the plate. Diagram "B" places 105 volts DC on both plate and screen. The plug (P_1) should be a Jones type S-304-CCT to match J_1 in FIG. 1. Resistor "R" should be a 10,000-ohm, 10-watt adjustable wire-wound type.

1958 EDISON AWARD RECIPIENT——K2KGJ

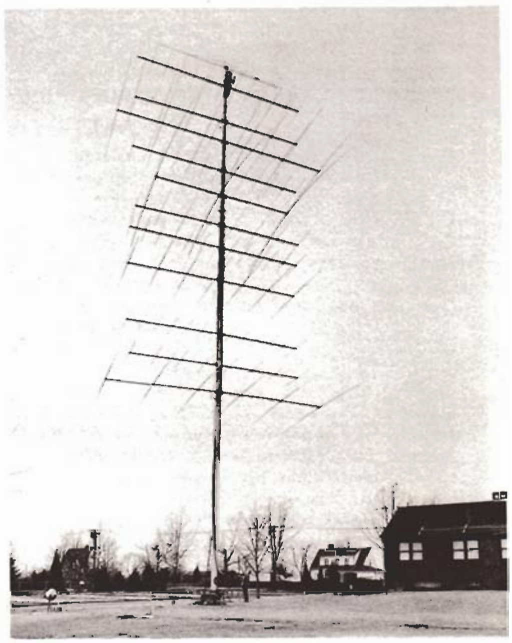
K2KGJ—JULIUS M. J. MADEY, *18, of Clark, N. J., is the recipient of General Electric's annual Edison Radio Amateur Award for public service in 1958.*

From this operating position (left), more than 12,000 messages have been handled for personnel at isolated Antarctic, Arctic and South Pacific bases. Madey devotes more than 90 hours weekly to this service, maintaining almost continuous contact with these outposts from mid-afternoon to 8 a.m. He has several times handled official Navy and Coast Guard messages, and arranged for hundreds of orders for flowers and gifts from isolated personnel to their families in the United States.

JUDGES:

E. Roland Harriman, Chairman, American National Red Cross.
Rosel H. Hyde, Commissioner, Federal Communications Commission.
Goodwin L. Dosland, President, American Radio Relay League.

MADEY'S NOMINATOR, Mayor Jay A. Stemmer of Clark Township, N. J., observes message-handling operations at K2KGJ. Stemmer had also nominated Julius for the 1956 and 1957 Edison Awards. Among nominating material submitted was a personal letter of appreciation to Madey from Rear Adm. George Dufek, commander, U. S. Naval support force, Antarctica.



FROM THIS 112-FOOT-HIGH rotary beam antenna radiates one of the most consistent signals heard by the Antarctic stations from U.S. amateur stations. Julius is at the top of the mast, while his younger brother (John, K2KGH), at base, provides relative comparison of antenna height. Their mother and father are hams, too, K2SPJ and K2SPI, respectively.

PRESENTATION OF TROPHY and $500 check was made to Madey by L. Berkley Davis (right), chairman of the Edison Award Council, and General Manager of G.E.'s Electronic Components Division, sponsors of the Award each year.

YOUNG MADEY acknowledges receipt of the Award at the presentation, held in Washington, D. C., on February 28, 1959. Attending were nearly two hundred prominent figures in the amateur, commercial, government and military communications fields.

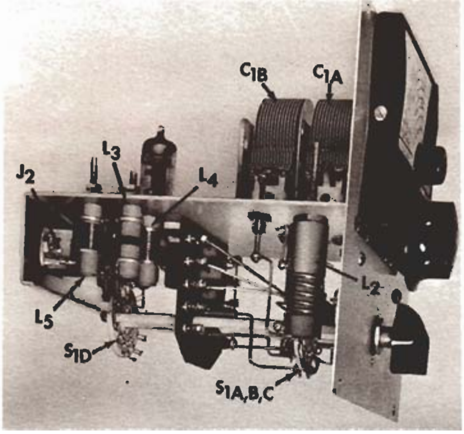
CONGRATULATIONS ARE OFFERED Madey after the presentation by Reverend Daniel J. (Father Dan) Linehan, S.J. (left), principal speaker at the ceremony. Reverend Linehan, W1HWK, is chairman of the department of Geophysics at Boston College. During the period he spent in the Antarctic in connection with the International Geophysical Year, Father Dan talked with Madey many times over KC4USC.

SPECIAL CITATION RECIPIENTS

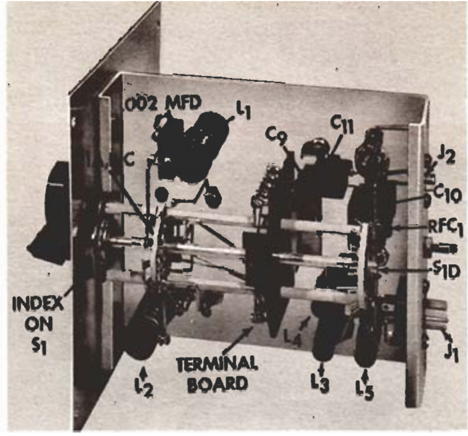
THREE RADIO AMATEURS *were awarded Special Citations by the 1958 Award judges. In addition to W4IYT and W7BA below, W6PIV, Kenneth M. Blaney, Sacramento, Calif., was cited for devoting 12 hours daily to message handling and contributing important data on observation of satellite radio signals to moonwatch observers.*

W4IYT—Andrew C. Clark, Miami Springs, Fla., receives news of his Edison Award Special Citation awarded for organizational service in the Florida weather reporting network, civil defense, Red Cross and youth training activities. Andy also is Editor of *FLORIDA SKIP*. Mrs. Clark—she's Betty, W4GGQ—and their seemingly bored junior operator share the good news.

W7BA—Loyd A. Peek, Seattle, Wash., received a Special Citation for transmitting a large volume of messages for overseas military personnel, participating in civil defense communications and serving the civilian Air Force and Army affiliate radio systems.



SIDE VIEW of the oscillator showing locations of major parts. Note that a 2-inch wide terminal board helps support the side rods and shaft of S_1. This model—also shown in its 6 x 6 x 6-inch utility box on page 1—has the Millen 10039 dial. The switch wafer behind L_2 is the 3-pole, 5-position switch, S_{1A}, S_{1B}, and S_{1C}.



BOTTOM VIEW of the oscillator chassis showing assembly details of the bandswitch (S_1). The rear section of this switch (S_{1D}) connects the proper plate circuit coils for each band. Holes should be cut in the rear of the cabinet to provide access to the power plug (J_1) and r.f. output connector (J_2), as shown in the rear view on page 1.

BANDSWITCHING VFO

continued from page 3

A STANDARD CHASSIS and cabinet was used for both models of this VFO shown in the photos. The chassis—4⅞ x 5¾ x 1½ inches in size (Bud CB-1629 miniature aluminum chassis)—was tailor-made for the 6 x 6 x 6-inch aluminum utility box (Bud AU-1039) housing the VFO. When the whole assembly is fastened together with self-tapping screws—and a nut is tightened on the stud which protrudes through the cabinet rear plate—a surprisingly rigid structure results.

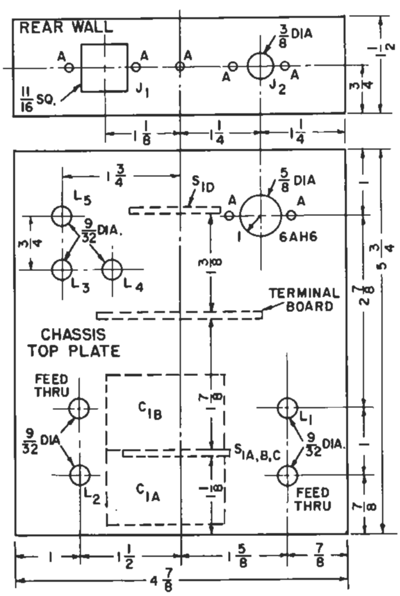


FIG. 3. CHASSIS DRILLING DIAGRAM for the high-c oscillator. The location shown for C_1 is for a Millen 10039 dial; it should be moved back 1 inch for a National SCN dial. Holes marked "A" should be drilled about ⅛ inch in diameter to clear No. 4 and No. 6 machine screws.

Locations of major parts are shown in the photos and the chassis drilling diagram, FIG. 3. Capacitors C_2 to C_8 were fastened to the terminal board which also supports the bandswitch; C_9, C_{10} and C_{11} were placed between the terminal board and the tube socket.

The location of the chassis on the panel will depend upon the type of tuning dial selected. The panel drilling diagram, FIG. 4, shows the hole locations and chassis position for two popular makes of dials. If another type of dial will be used on your model, first position the dial properly on the panel to find the shaft location for C_1. Then place the chassis at the height which permits the bottom of C_1 to rest on the chassis deck when the shaft lines up with the dial coupling.

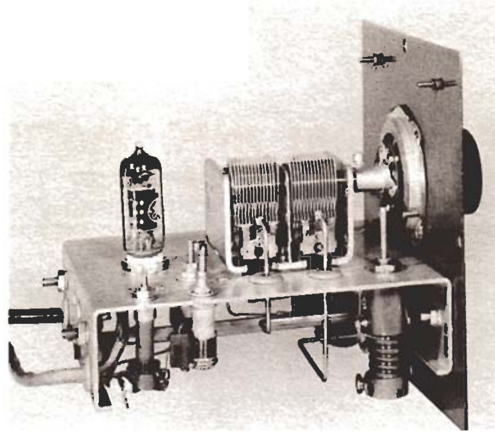
FIRST CHECK THE WIRING before applying heater and plate power. Next, check between pin 1 (control grid) on the 6AH6 socket and the chassis with a vacuum-tube or high-resistance voltmeter (20,000 ohms per volt) to see if a reading of about minus 10 volts is observed. This indicates that the oscillator is working.

THE ALIGNMENT PROCEDURE to follow will provide nearly full-dial bandspread for all five amateur bands. It also compensates for variations in parts values and hand-wound coils. The low frequency band edges probably will not fall at the same point on the dial, but should be within a few divisions of each other. For precise calibration, use a well-calibrated receiver and a 100-kilocycle frequency standard. Mark frequencies every 50 or 100 kilocycles on the dial card after alignment.

3.5 TO 4.0 MEGACYCLES:

Set S_1 and turn C_1 to maximum capacitance. Turn the slug in L_1 until the oscillator frequency is about 3.510 megacycles. Turn C_1 to minimum. The oscillator frequency should be about 3.990 megacycles.

FRONT VIEW of the high-c oscillator constructed by K2IOW, employing the National type SCN dial. Exact calibration of the dial will depend upon the shape of the rotor plates in the variable capacitor actually used for C_1. Screened snap-in hole plugs in the cabinet top (see rear view on page 1) provide ventilation and access to the tuning adjustments on the slug-tuned coils.



SIDE VIEW of the oscillator with the National SCN dial. Note that the tuning capacitor (C_1) has been moved back about an inch from the location shown in FIG. 3 to provide room for the planetary drive on this dial. No terminal board was used to hold the small silvered mica capacitors on this model; they were mounted directly on the front section of S_1.

7.0 TO 7.3 MEGACYCLES:

Do not disturb L_1. Set S_1 and turn C_1 to maximum. If the oscillator is below 7.0 megacycles, decrease size of C. by changing the 50 mmf capacitor to 30 mmf; change to 70 mmf if the frequency is high. Turn C_1 to minimum and the oscillator should be near 7.3 megacycles. If high, reduce the value of C_4 to 450 mmf; or, if low, increase C_4 to 550 mmf. Again turn C_1 to maximum, recheck the oscillator at 7.0 megacycles and reduce or increase C_4.

14.0 TO 14.35 MEGACYCLES:

Set S_1 and turn C_1 to maximum. Adjust the oscillator frequency to 14.010 megacycles with slug in L_2. Turn C_1 to minimum and if frequency is higher than 14.350 megacycles, reduce C_2 to 100 mmf. Again turn C_1 to maximum and set oscillator to 14.010 megacycles with L_2. Finally, tune L_3 for maximum output at 14.35 megacycles.

21.0 TO 21.45 MEGACYCLES:

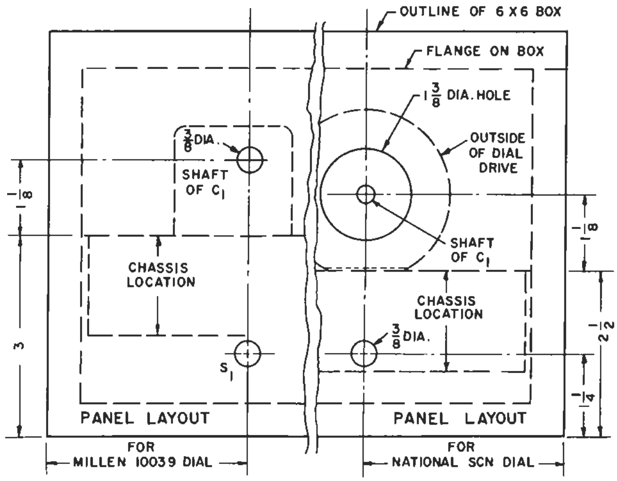
Set S_1 and turn C_1 to maximum. If the oscillator frequency is higher than 21.0 megacycles, increase C_7 to 330 mmf. Turn C_1 to minimum and if the oscillator frequency is higher than 21.450 megacycles, reduce C_3 to 90 mmf. Again turn C_1 to maximum and recheck oscillator at 21.0 megacycles. Finally, tune L_4 for maximum output at 21.25 megacycles.

28.0 TO 29.7 MEGACYCLES:

Do not disturb L_2. Set S_1 and turn C_1 to maximum. If the oscillator frequency is lower than 28.0 megacycles, reduce C_8 to 240 or 230 mmf. Turn C_1 to minimum and if the frequency is higher than 29.7 megacycles, reduce C_4 to 450 mmf. Again turn C_1 to maximum and check the oscillator at 28.0 megacycles. If the frequency is again too low, reduce C_8 to about 220 mmf. Do not disturb L_5.

Small air trimmer capacitors could be added across C_2 to C_8 to aid in the above adjustments, but mica insulated trimmers are not recommended. The oscillator as described is capable of maintaining good long-term calibration when quality components are used in its construction.

FIG. 4. PANEL LAYOUT diagrams for the high-c oscillator. Hole locations and chassis height for the Millen 10039 dial is shown at the left; those for the National SCN dial are at the right. The bandswitch (S_1) remains at the same location for either dial. The lip on the lower front edge of the chassis should be trimmed to clear the switch index plate.



TECHNICAL INFORMATION—6L6-GC

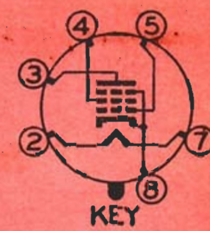
Beam pentode for AF power amplifier applications

The 6L6-GC is a beam-power pentode primarily designed for use in audio-frequency power amplifier applications. Features of the tube include high power output capabilities, high plate and screen dissipation ratings, high efficiency, high power sensitivity, and low distortion. The 6L6-GC is unilaterally interchangeable with the 6L6-GB.

Comparative ratings with the 6L6-GB below indicate that the 6L6-GC features lower interelectrode capacitances, higher maximum plate and screen voltages, and higher plate and screen dissipation ratings.

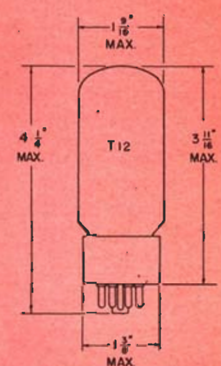
ELECTRICAL DATA	6L6-GB	6L6-GC	
Cathode—Coated Unipotential	6.3	6.3	Volts
Heater Voltage, AC or DC	0.9	0.9	Amperes
Heater Current			
Direct Interelectrode Capacitances, approximate			
Grid-Number 1 to Plate	0.9	0.6	uuf
Input	11.5	10.0	uuf
Output	9.5	6.5	uuf
DESIGN-MAXIMUM RATINGS			
Plate Voltage	360	500	Volts
Screen Voltage	270	450	Volts
Plate Dissipation	19	30	Watts
Screen Dissipation	2.5	5.0	Watts
Heater-Cathode Voltage			
Heater Positive with Respect to Cathode	180	200	Volts
Heater Negative with Respect to Cathode	180	200	Volts
Grid-Number 1 Circuit Resistance			
With Fixed Bias	0.1	0.1	Megohms
With Cathode Bias	0.5	0.5	Megohms

BASING DIAGRAM



EIA 7AC

PHYSICAL DIMENSIONS



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