



# HAM NEWS

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## RIG-BUILDER'S CIRCUIT GUIDE

Recognizing the fact that most R-F and audio circuits change very little from tube to tube, this issue presents six standard circuits. With each circuit are listed the types of tubes which will operate in that circuit, together with the circuit constants which must vary from tube to tube. These six standard circuits are therefore the equivalent of eighty-nine separate circuits.

The single tube circuits (circuits A and B) may be employed as either buffer or final circuits. An untuned grid circuit is shown in order to keep the diagram as simple as possible. Circuits C and D are push-pull circuits and would normally be used as circuits for final amplifiers, although low power tubes in these circuits will allow their use as buffer amplifiers. Circuit E is a class B audio modulator circuit and circuit F is a class AB<sub>2</sub> modulator circuit.

The tube operating conditions given in the tables are, in most cases, the conditions for maximum input. It is important that these limits are not exceeded. The bias voltage given in circuits A, B, C and D is designed to protect the tubes in case of excitation failure, or in case the crystal or VFO circuit is keyed. In the case of these four circuits bias is obtained by a combination of grid resistance bias and fixed bias. These values may be changed if desired. For example the grid resistor can be omitted if the fixed bias is increased. This increase in fixed bias should be equal to the amount of bias that was obtained from the grid resistor due to the grid current ( $I_g$ ). Conversely the fixed bias can be removed and the grid resistor increased to give the proper bias. This is not recommended unless the stage is protected by an overload relay in the plate circuit.

Values for grid and plate coils and condensers are not specified. Manufactured assemblies may be used, or homemade coils employed. The table gives the airgap necessary for the plate condenser. In the case of split-stator condensers, the airgap given is still valid for each section. This value of spacing allows a 100 per cent factor of safety.

Neutralizing condensers (NC) should have an airgap 50 per cent greater than that of the plate condenser. Maximum usable capacity of the neutralizing condenser should be somewhat greater than the grid to plate capacitance of the tube it is used with.

The wattage of the various resistors is not given. This is easily computed by  $I^2R$ , where  $I$  is the current through the resistor (grid current or screen current). Use a wattage rating which is approximately double the computed value, as a safety factor.

### CIRCUIT A

The filament bypass condensers may be of the 600 volt paper type. The 0.001 mf plate bypass condenser should have a voltage rating of twice the d-c voltage for c-w operation and three to four times the d-c voltage for phone operation. The r-f choke should be of the all-band type and be capable of handling the d-c plate current.

### CIRCUIT B

The circuit as shown is for phone operation only. If c-w operation is desired, omit resistor  $R_3$ , and use a

separate source of voltage on the screen grid as indicated in the table. Circuit B is used for tetrodes, beam power tubes, and pentodes. If the beam-forming plates of the beam tubes are brought out to a pin connection, they should be connected to the center-tap of the filament transformer. If the tube has a cathode connection, it should be connected to ground. The suppressor grid in pentodes should also be grounded, unless the table indicates that a positive voltage is required. In the latter case a well-regulated source such as a battery should be used.

The filament bypass condensers may be of the 600 volt paper type. The 0.002 mf plate bypass condenser should have a working voltage of twice the d-c voltage for c-w operation and three to four times the d-c voltage for phone operation. The screen bypass condenser (0.005 mf) should be rated at twice the screen voltage for c-w work and three to four times the screen voltage for phone operation.

### CIRCUIT C

This circuit is the push-pull version of circuit A. The same comments apply regarding bypass condensers. In addition, the 0.01 mf grid circuit bypass condenser may be a 600 volt paper condenser for most circuits, unless the bias voltage is very high, in which case a 1250 or 2500 volt mica is preferable.

### CIRCUIT D

Push-pull tetrodes, beam power tubes or pentodes may be used in this circuit. As in the case with circuit B, the diagram shown is for phone operation only. For c-w operation remove  $R_2$  and supply screen voltage from a separate source. All remarks regarding beam-forming plates, cathodes and suppressor grids pertaining to circuit B also apply to circuit D. Similarly, the comments on bypass condensers also apply.

### CIRCUIT E

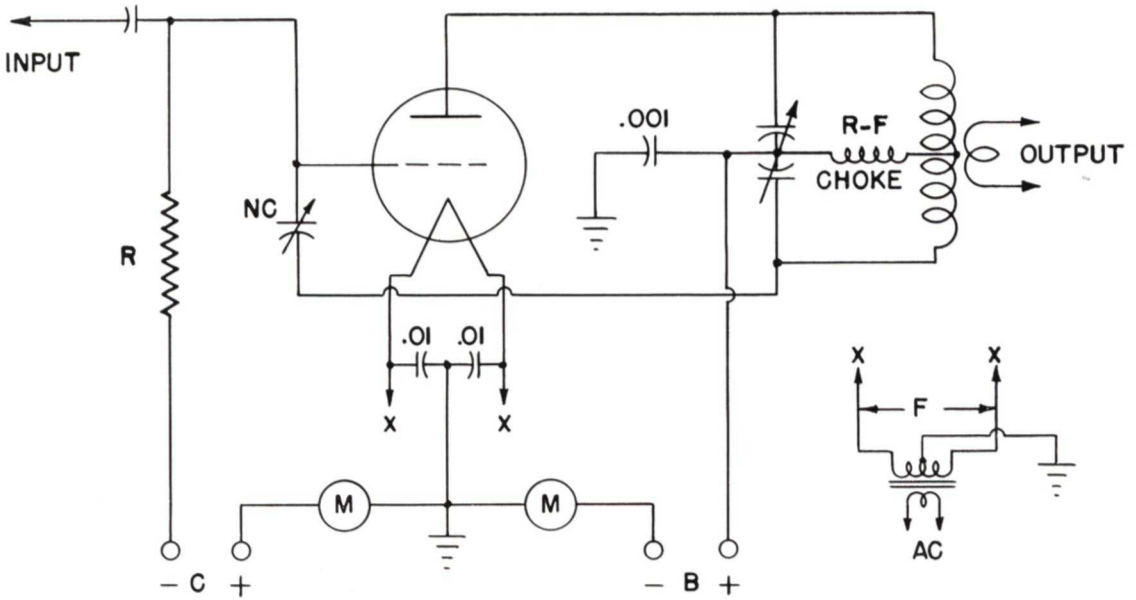
This class B modulator circuit is quite straightforward. The table gives complete operating data, including output impedance, plate-to-plate. Grid bias requirements are small, so that batteries may be used in most cases. Two tubes, the GL-811 and the GL-838, are zero bias tubes. In this case the C- and C+ terminals may be tied together.

### CIRCUIT F

Tetrodes, beam tubes or pentodes may be used as class AB<sub>2</sub> modulators in this circuit. Both transmitting tubes and receiving tubes are included in the table. Beam tubes with an external connection for the beam-forming plates should be used with the beam-forming plates tied to the center tap of the filament transformer. Tubes with cathodes should have the cathode grounded, and pentodes should have their suppressor grid grounded unless the table indicates otherwise.

It is necessary to use a well-regulated source of voltage for the screen-grid supply (+SG). For this reason a separate power supply is recommended. It is possible to use a voltage divider circuit, but the screen current varies so much in operation that the divider must draw a current equal to the screen-grid current. The divider is thus not economical.

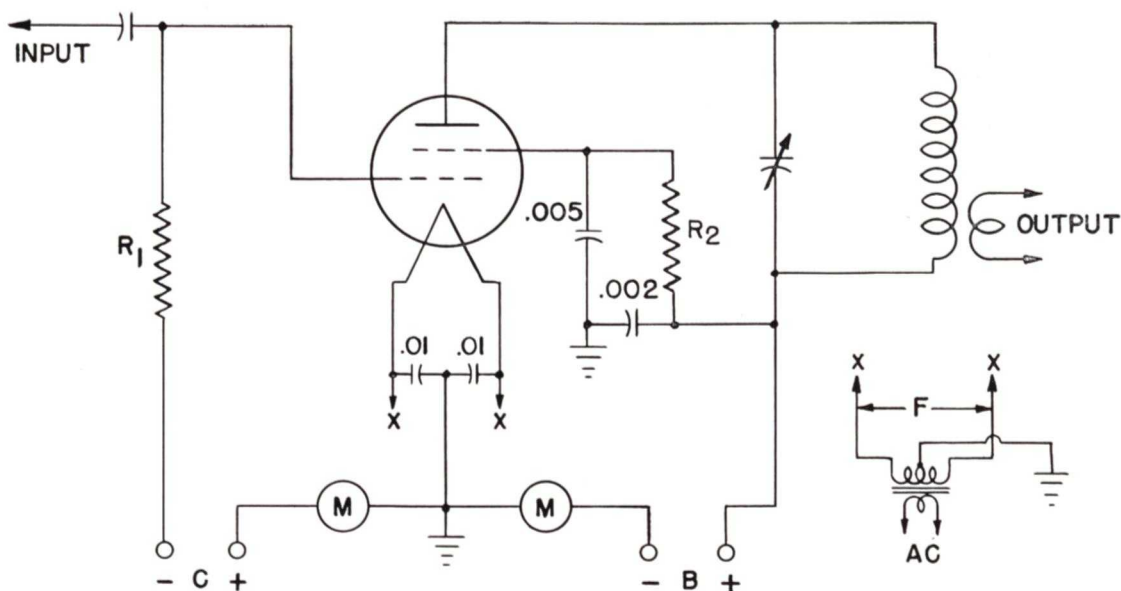
## TRIODE BUFFER OR FINAL



CIRCUIT A

Tube Type	Input Watts		B		C		$I_g$ ma		R ohms	F volts	Airgap (inches)	
	CW	PH	CW	PH	CW	PH	CW	PH			CW	PH
GL-35T	250	168	2000	2000	45	105	45	23	2,000	5.0	.100	.250
GL-100TH	495	366	3000	3000	75	215	51	26	2,500	5.0	.200	.500
GL-203A	188	150	1250	1000	80	45	25	50	1,800	10.0	.070	.100
GL-211	188	150	1250	1000	135	90	18	35	5,000	10.0	.070	.100
GL-592	600	395	2600	2500	90	200	45	45	3,500	10.0	.175	.375
GL-805	300	200	1500	1250	45	70	40	60	1,500	10.0	.078	.144
GL-806	990	585	3300	3000	250	440	40	27	8,750	5.0	.250	.500
GL-810	620	450	2250	1800	45	45	40	50	3,000	10.0	.150	.225
GL-811	225	156	1500	1250	45	25	35	50	2,000	6.3	.078	.144
GL-812	225	156	1500	1250	95	45	25	25	3,200	6.3	.078	.144
GL-838	188	150	1250	1000	45	45	30	60	1,500	10.0	.070	.100
GL-1623	100	75	1000	750	45	75	20	20	2,500	6.3	.070	.084
GL-8000	750	500	2500	2000	135	275	40	37	2,500	10.0	.175	.250
GL-8005	300	238	1500	1250	90	160	32	28	1,250	10.0	.078	.144

## TETRODE, PENTODE & BEAM POWER BUFFER OR FINAL



CIRCUIT B

Tube Type	Input watts		B		C		$I_g$ ma		$R_1$ ohms	$R_2$ ohms PH*	$E_{sg}$ volts		Airgap (inches)	
	CW	PH	CW	PH	CW	PH	CW	PH			CW	PH	CW	PH
GL-2E24	40	27	600	500	20	15	3	3	10,000	40,000	195	180	.050	.070
GL-2E26	40	27	600	500	15	20	3	3	10,000	35,000	185	180	.050	.070
GL-4D21	500	375	3000	2500	90	150	9	9	7,000	71,500	350	350	.200	.375
GL-802**	33	20	600	500	45	0	2	2	27,000	17,000	250	245	.050	.070
GL-803†	320	240	2000	1600	45	0	12	20	37,500	20,000	500	500	.100	.200
GL-807	75	60	750	600	20	60	4	4	7,000	50,000	250	275	.050	.070
GL-813	360	240	2000	1600	45	70	3	4	15,000	60,000	400	400	.100	.200
GL-814	225	180	1500	1250	45	60	10	10	4,500	43,000	300	300	.078	.144
GL-828‡	270	200	1500	1250	45	85	12	12	4,500	30,000	400	400	.078	.144
GL-837**	30	18	500	400	45	0	4	5	7,500	13,000	200	140	.050	.050
GL-1613	18	12	350	275	0	0	4	4	10,000	7,500	200	200	.030	.030
GL-1614	30	23	375	325	0	0	2	2	20,000	10,000	250	245	.030	.030
GL-1619	30	20	400	325	0	20	5	3	11,000	5,000	300	285	.030	.030
GL-1624	54	38	600	500	45	45	5	3	3,000	25,000	300	275	.050	.070
GL-1625	75	60	750	600	20	60	4	4	7,000	50,000	250	275	.050	.070

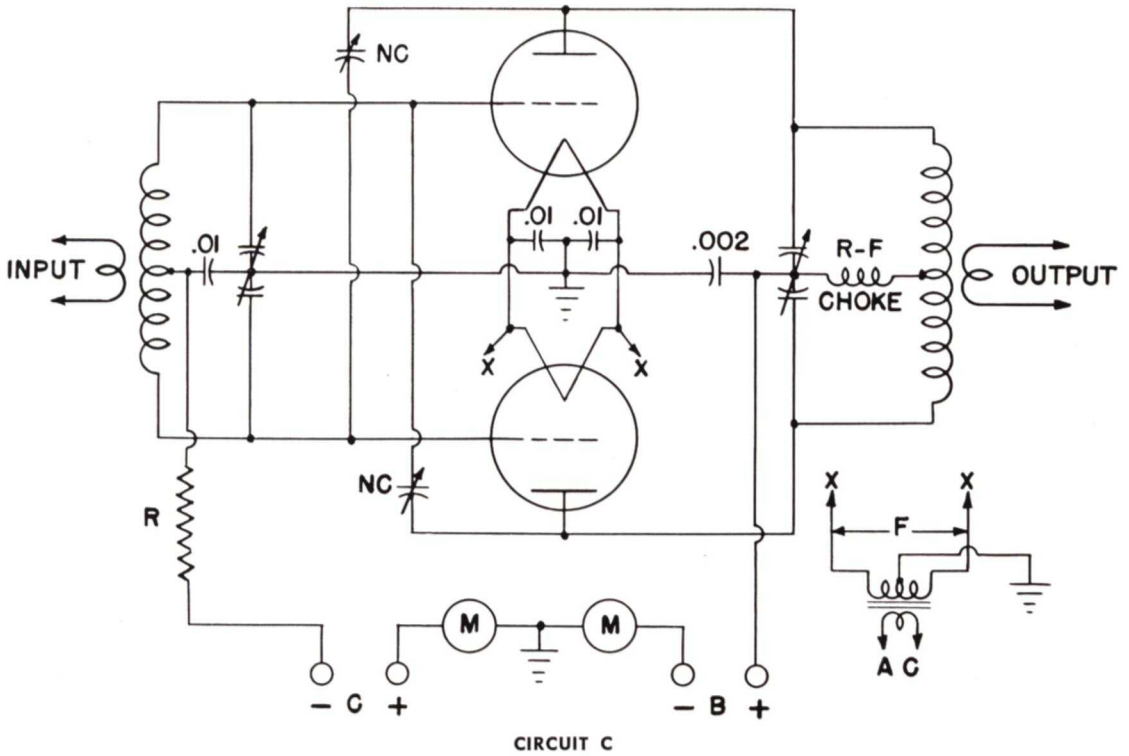
\*Phone only; see text.

\*\*Suppressor grid voltage = +40 volts.

†Suppressor voltage of +40 for CW and +100 for phone.

‡Suppressor voltage = +75 volts.

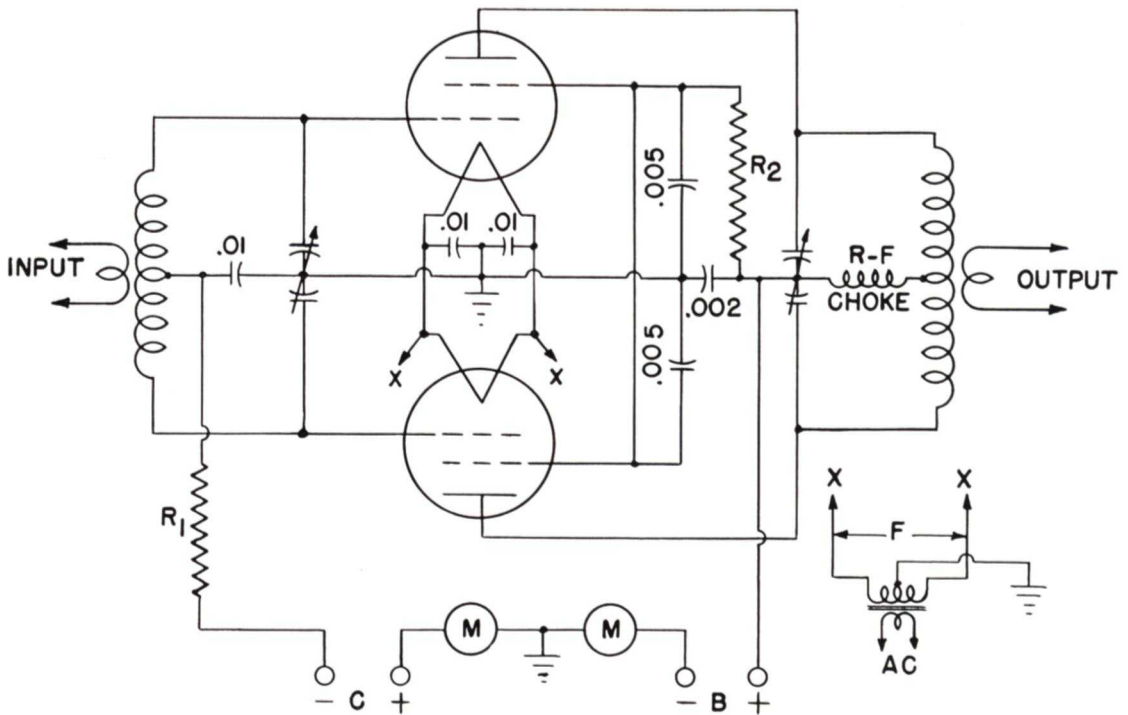
## PUSH-PULL TRIODE BUFFER OR FINAL



Tube Type	Input watts		B		C		$I_{c2}$ ma		R ohms	F volts	Airgap (inches)	
	CW	P.H	CW	PH	CW	PH	CW	PH			CW	PH
GL-35T	500	336	2000	2000	45	105	90	46	1,000	5.0	.100	.250
GL-100TH	990	732	3000	3000	75	215	102	52	1,250	5.0	.200	.500
GL-203A	376	300	1250	1000	80	45	50	100	900	10.0	.070	.100
GL-211	376	300	1250	1000	135	90	36	70	2,500	10.0	.070	.100
GL-592	1000	790	2500	2500	80	200	90	90	1,750	10.0	.175	.375
GL-805	600	400	1500	1250	45	70	80	120	750	10.0	.078	.144
GL-806	1000	1000	2500	2500	250	200	50	80	5,000	5.0	.175	.375
GL-810	1000	900	2000	1800	45	45	80	100	1,500	10.0	.100	.225
GL-811	450	312	1500	1250	45	25	70	100	1,000	6.3	.078	.144
GL-812	450	312	1500	1250	95	45	50	50	1,500	6.3	.078	.144
GL-826	250	150	1000	800	35	65	70	70	500	7.5	.070	.084
GL-838	376	300	1250	1000	45	45	60	120	750	10.0	.070	.100
GL-1623	200	150	1000	750	45	75	40	40	1,250	6.3	.070	.084
GL-8000	1000	1000	2000	2000	135	275	50	75	1,250	10.0	.100	.250
GL-8005	600	476	1500	1250	90	160	64	56	625	10.0	.078	.144

All values are for two tubes.

## PUSH-PULL TETRODE, PENTODE & BEAM POWER BUFFER OR FINAL



CIRCUIT D

Tube Type	Input watts		B		C		I <sub>g</sub> ma		R <sub>1</sub> ohms	R <sub>2</sub> ohms PH*	E <sub>sig</sub> volts		Airgap (inches)	
	CW	PH	CW	PH	CW	PH	CW	PH			CW	PH	CW	PH
GL-2E24	80	54	600	500	20	15	6	6	5,000	20,000	195	180	.050	.070
GL-2E26	80	54	600	500	15	20	6	6	5,000	17,500	185	180	.050	.070
GL-4D21	1000	750	3000	2500	90	150	18	18	3,500	35,500	350	350	.200	.375
GL-802**	66	40	600	500	45	0	4	4	13,500	8,500	250	245	.050	.070
GL-803†	640	480	2000	1600	45	0	24	40	19,000	10,000	500	500	.100	.200
GL-807	150	120	750	600	20	60	8	8	3,500	25,000	250	275	.050	.070
GL-813	720	480	2000	1600	45	70	6	8	7,500	30,000	400	400	.100	.200
GL-814	450	360	1500	1250	45	60	20	20	2,250	21,500	300	300	.078	.144
GL-815‡	75	60	500	400	20	20	3	3	8,000	15,000	200	175	.050	.050
GL-828●	540	400	1500	1250	45	85	24	24	2,250	15,000	400	400	.078	.144
GL-829B‡	120	90	750	600	20	35	12	12	3,000	13,000	200	200	.050	.070
GL-832A‡	36	21	750	600	45	45	3	3	6,750	25,000	200	200	.050	.070
GL-837**	60	36	500	400	45	0	9	10	3,750	6,500	200	140	.050	.050
GL-1613	36	24	350	275	0	0	8	8	5,000	3,750	200	200	.030	.030
GL-1614	60	46	375	325	0	0	4	4	10,000	5,000	250	245	.030	.030
GL-1619	60	40	400	325	0	20	10	6	5,500	2,500	300	285	.030	.030
GL-1624	108	76	600	500	45	45	10	6	1,500	12,500	300	275	.050	.070
GL-1625	150	120	750	600	20	60	8	8	3,500	25,000	250	275	.050	.070

\*Phone only; see text.

\*\*Suppressor grid voltage = +40 volts.

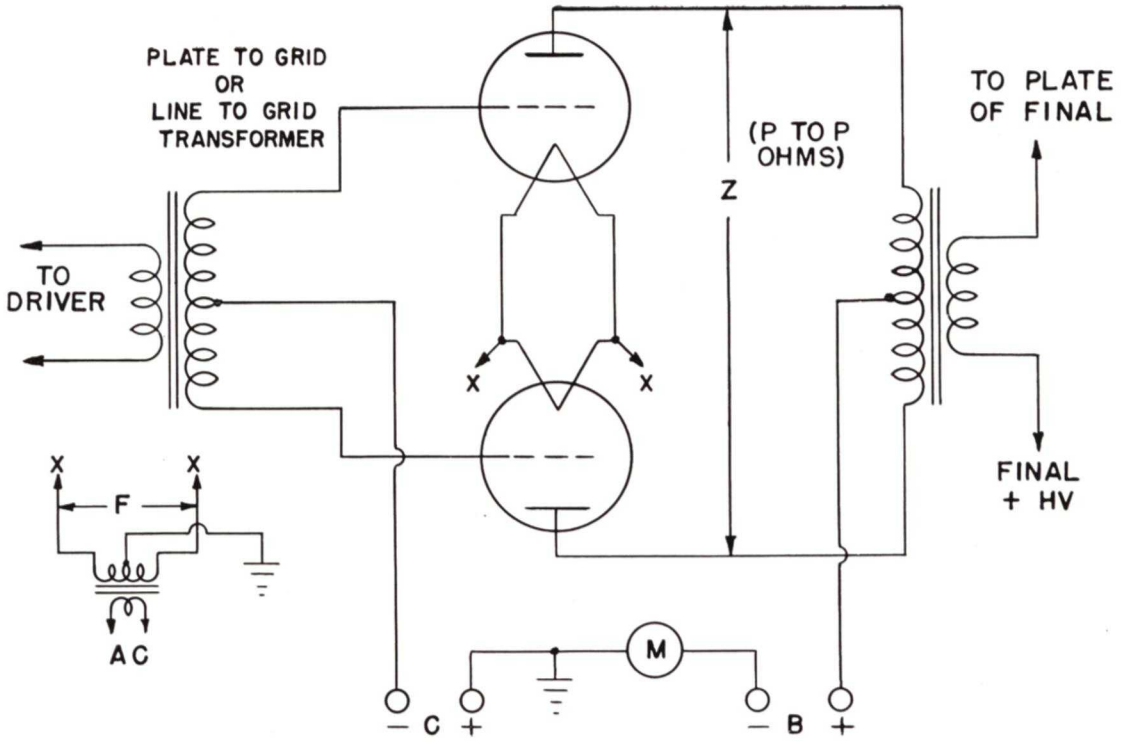
†Suppressor voltage of +40 for CW & +100 for phone.

‡Single tube operation.

●Suppressor voltage = +75 volts.

All values are for two tubes.

## CLASS B MODULATORS



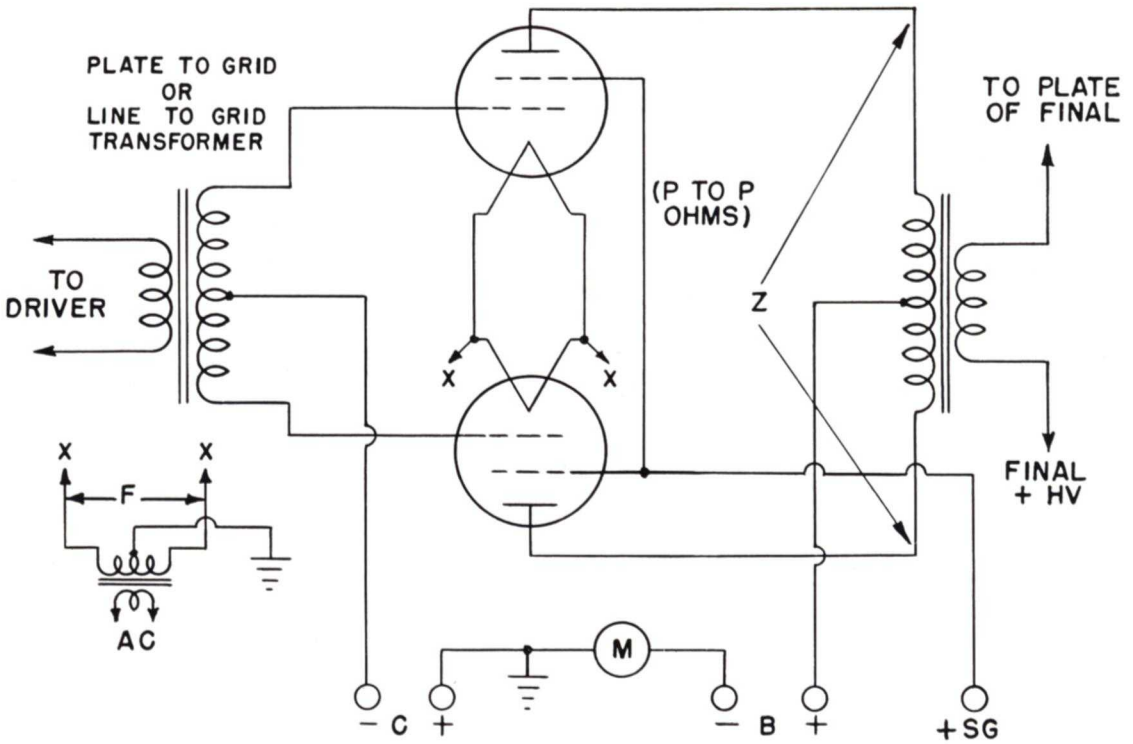
Tube Type	F volts	Audio output watts	Driving power watts*	B	C	Zero signal $I_p$ ma	Max. signal $I_p$ ma	Z ohms
GL-35T	5.0	235	4	2000	40	34	167	27,500
GL-100TH	5.0	650	5	3000	65	40	215	31,000
GL-203A	10.0	260	11	1250	40	26	320	9,000
GL-211	10.0	260	8	1250	95	20	320	9,000
GL-805	10.0	370	7	1500	16	84	400	8,200
GL-806	5.0	535	19	2000	140	80	390	18,000
GL-810	10.0	590	10	2000	50	60	420	11,000
GL-811	6.3	225	4	1500	0	20	200	18,000
GL-812	6.3	225	5	1500	46	42	200	18,000
GL-838	10.0	260	8	1250	0	148	320	9,000
GL-1623	6.3	145	4	1000	40	30	200	12,000
GL-8000	10.0	600	7	2000	120	60	425	10,800
GL-8005	10.0	300	4	1500	70	40	310	10,000

\*Approximate.  
All values are for two tubes.

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## CLASS AB<sub>2</sub> MODULATORS



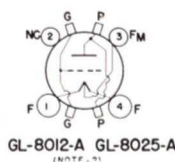
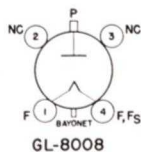
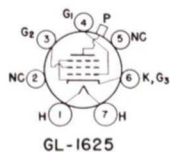
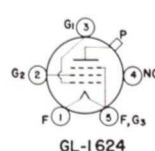
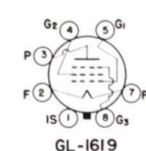
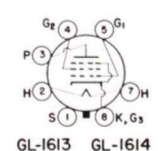
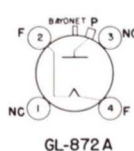
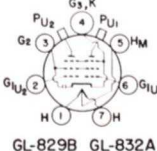
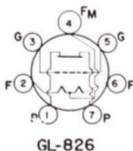
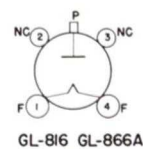
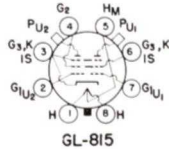
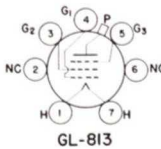
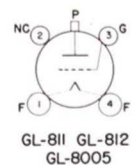
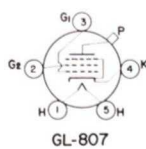
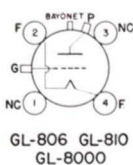
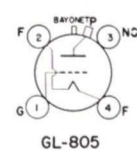
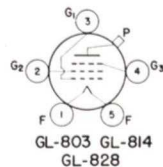
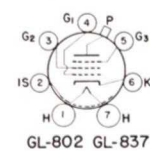
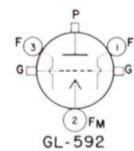
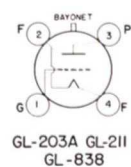
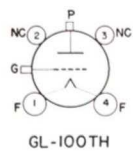
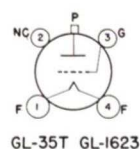
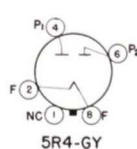
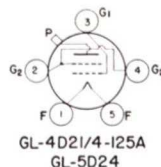
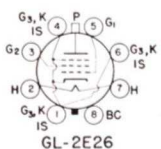
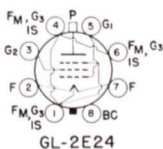
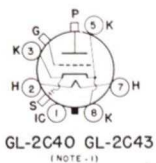
CIRCUIT F

Tube Type	F volts	Audio output watts	Peak grid power watts	B	C	SG	Max. sig. $I_p$ ma	Max. sig. $I_{sg}$ ma	Z ohms
GL-2E26	6.3	54	0.36	500	15	125	150	32	8,000
GL-4D21	5.0	520	2.5	3000	51	350	260	3.5	27,700
GL-807*	6.3	120	0.5	750	32	300	240	10	6,960
GL-813	10.0	515	0.1	2250	90	750	315	58	18,500
GL-815†	6.3	54	0.36	500	15	125	150	32	8,000
GL-828‡	10.0	385	....	2000	120	750	270	60	18,500
GL-1619	2.5	36	0.4	400	16	300	150	11.5	6,000
GL-1624	2.5	72	1.2	600	25	300	180	15	7,500
GL-1625	12.6	120	0.5	750	32	300	240	10	6,960
2A5	2.5	18.5	....	375	26	250	82	19.5	10,000
42	6.3	18.5	....	375	26	250	82	19.5	10,000
6F6	6.3	18.5	....	375	26	250	82	19.5	10,000
6L6	6.3	31	....	360	18	225	142	11	6,000
6V6*	6.3	10	....	250	15	250	79	13	10,000

\*Class AB<sub>1</sub> †Single tube operation.  
‡Suppressor voltage = +60 volts.  
All values are for two tubes.

# SOCKET CONNECTIONS

## (Bottom View)



Key: BC—Base Sleeve; F—Filament; F<sub>m</sub>—Filament center-tap; G—Grid; H—Heater; H<sub>m</sub>—Heater center-tap; IC—Internal connection (do not use); IS—Internal shield; K—Cathode; NC—No connection; P—Plate; S—Shell; U—Unit.

Note 1: Shell is cathode r-f terminal.

Note 2: Plate caps are those farthest from base.

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