

# GENERAL ELECTRIC

## Transmitting Tube GL-211 - - Instructions

U.S. Army Signal Corps Tube Type VT-4-C

The GL-211 is a general - purpose three-electrode vacuum tube and may be used as a Class A, B, or C amplifier.

### TECHNICAL INFORMATION

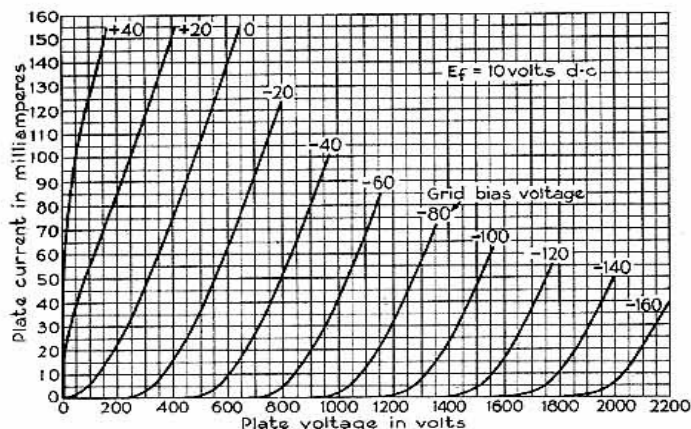
#### GENERAL CHARACTERISTICS:

Filament Voltage, volts	10
Filament Current, amperes	3.25
Amplification Factor	12
Grid-plate Transconductance, mmhos,	
$I_b = 60$ ma	3600
Direct Interelectrode Capacitances, $\mu\mu\text{f}$	
Grid-plate	14.5
Input	6
Output	5.5
Base	Jumbo 4 - Large Pin
Net Weight, oz approx	8
Shipping Weight, lb approx	4

#### MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

	Typical Operation	Max Ratings
<b>CLASS A A-F AMPLIFIER AND MODULATOR:</b>		
D-c Plate Voltage, v	750 1000 1250	1250
Plate Dissipation, w		75
D-c Grid Voltages, v	-46 -61 -75	
Peak Grid Swing, approx volts	41 56 75	
D-c Plate Current, ma	34 53 60	
Plate Resistance, ohms	4400 3800 3600	
Load Resistance, ohms	8800 7600 9200	
Plate Power Output (5% Second Harmonic), w	5.6 12 19.7	
<b>CLASS B A-F POWER AMPLIFIER (TWO TUBES):</b>		
D-c Plate Voltage, v	1000 1250 1250	
Max Signal Plate Current (per tube)§, amp		0.175
D-c Max Signal Plate Input (per tube)§, w		220
Plate Dissipation (per tube)§, w		100
D-c Grid Voltage, v	-72 -95	
Peak A-f Grid Input Voltage, v	380 410	
Zero Signal Plate Current, ma	20 20	
Max Signal Plate Current, ma	320 320	
Max Signal Driving Power, approx w	7.5 8	
Effective Load (plate to plate), ohms	6900 9000	
Max Signal Plate Power Output, watts	200 260	

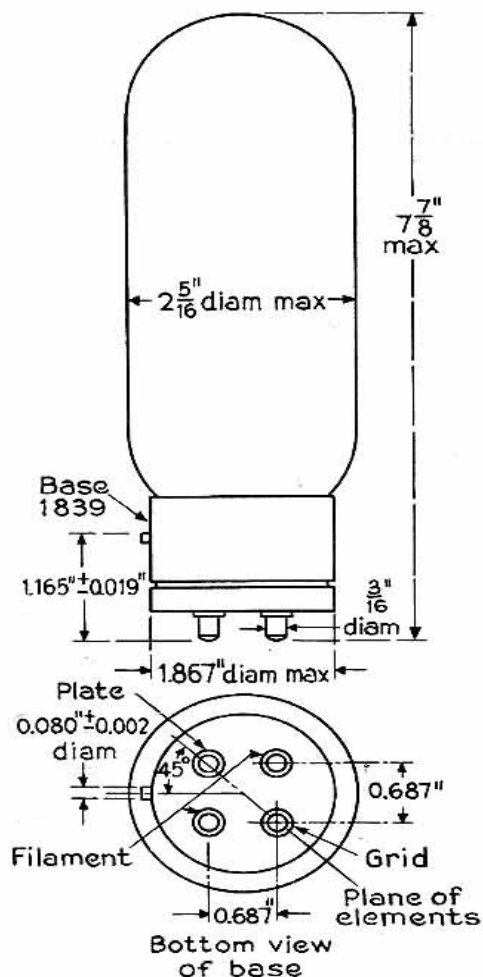
§ Averaged over any audio-frequency cycle



Average Plate Characteristics

K-6917423

9-20-39



K-4909036

9-20-39

	Typical Operation		Max Rat- ings
<b>CLASS B R-F POWER AMPLIFIER:</b>			
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)			
D-c Plate Voltage, v	1000	1250	1250
D-c Grid Voltage, v	-72	-95	
D-c Plate Current, amp	0.130	0.106	0.150
Plate Input, w			150
Plate Dissipation, w			100
Peak R-f Grid Input Voltage, volts	125	125	
D-c Grid Current, approx ma	5	1	
Driving Power†, approx w	10	7.5	
Plate Power Output, w	40	42.5	

† At crest of audio-frequency cycle.

<b>CLASS C R-F POWER AMPLIFIER AND OSCILLATOR, PLATE MODULATED:</b>			
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)			
D-c Plate Voltage, v	750	1000	1000
D-c Grid Voltage, v	-200	-260	-400
D-c Plate Current, amp	0.150	0.150	0.175
D-c Grid Current, approx amp	0.035	0.035	0.050
Plate Input, watts			175
Plate Dissipation, w			67
Peak R-f Grid Input Voltage, approx v	350	410	
Driving Power, approx w	12	14	
Plate Power Output	65	100	

<b>CLASS C R-F POWER AMPLIFIER AND OSCILLATOR:</b>				
(Key down conditions per tube without modulation)†				
D-c Plate Voltage, v	750	1000	1250	1250
D-c Grid Voltage, v	-135	-175	-225	-400
D-c Plate Current, amp	0.150	0.150	0.150	0.175
D-c Grid Current, approx amp	0.018	0.018	0.018	0.050

	Typical Operation		Max Rat- ings
Plate Input, w			220
Plate Dissipation, watts			100
Peak R-f Grid Input Voltage, approx v	275	315	375
Driving Power, approx w	5	6	7
Plate Power Output, watts	65	100	130

‡ Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

The tube should be mounted so as to operate in a vertical position with the base end down.

The normal value of grid leak, when the tube is used as an oscillator or r-f power amplifier (Class C), is in the neighborhood of 5000 ohms, although this may be replaced by a suitable fixed bias. If self-bias is used the cathode resistor should be approximately 1000 ohms.

The maximum ratings apply only at frequencies below 15 megacycles. For operation at higher frequencies adequate ventilation and normal ambient temperatures must be maintained, and the plate voltage must be reduced as indicated.

Frequency, megacycles	15	30	80
Percentage of Maximum )			
Rated Plate Voltage )	100	75	50
and Plate Input )			

The resonant frequency of the grid-plate circuit is approximately 100 megacycles.

## INSTALLATION

The filament is of the thoriated-tungsten type, and should be operated preferably from an a-c source, although a d-c supply may be used. A voltmeter should be connected permanently across the filament circuit at the socket terminals so that the filament voltage can be maintained at the rated value. The filament supply should be designed to allow operation at rated filament voltage. Unless otherwise specified by the manufacturer, any variations which may occur should permit operation of the filament at voltages within the range; namely, rated voltage to 5 per cent above rated voltage. The filament transformer shall have good regulation and should be designed for at least 30 per cent above rated filament wattage. If the average number of daily interruptions of the transmitter is greater than 100 per day, the filament voltage should be maintained at 80 per cent of normal during the stand-by periods. If the number of interruptions is less than 100 per day, the filament power may be removed during stand-by periods.

Overheating by severe overload may decrease filament emission. Unless the overload has liberated a large amount of gas, the activity of the filament usually can be restored by operating the filament at rated voltage for ten minutes or more with no voltage on the plate or grid. This process may be accelerated by increasing the filament voltage to 20 per cent above the normal value (not higher) for a few minutes.

In rating pliotrons, certain values are given as maximum; that is, the values beyond which it is unsafe to go from the viewpoint of life and performance. In order not to exceed the maximum ratings, changes in plate and filament voltage caused by line-voltage fluctuation, load variation, and manufacturing variation of the associated apparatus must be determined. Then, an average value of plate voltage should be chosen so that under the usual operating conditions the maximum ratings will not be exceeded.

IN TRYING OUT A NEW CIRCUIT OR WHEN ADJUSTMENTS ARE BEING MADE, THE PLATE VOLTAGE SHOULD BE REDUCED IN ORDER TO PREVENT DAMAGE TO THE PLIOTRON OR ASSOCIATED APPARATUS IN CASE THE ADJUSTMENTS ARE INCORRECT.

## OPERATION

Maximum ratings and typical operating conditions for each recommended class of service are given under the Description and Rating. The typical values given must not be considered as ratings, because the tube may be used at any suitable conditions within the maximum ratings.

∅ Note: See Description and Rating on pages one and two.

## CLASS B AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

In this type of service two tubes are used in a "balanced" circuit, each tube conducting only half the time. The plate loss becomes maximum at a signal slightly less than 1, depending on the circuit conditions, and therefore the plate dissipation must be limited so that at this value of sustained signal, the plate loss will not exceed the maximum rating.

## CLASS B RADIO-FREQUENCY POWER AMPLIFIER

In Class B radio-frequency service, the plate is supplied with unmodulated direct voltage, and the grid is excited by modulated r-f voltage. It is important to note that in this service the plate dissipation is greatest when the carrier is unmodulated. Therefore, the circuit should be adjusted so that, without modulation, the plate loss will not exceed the maximum rating.

## CLASS C RADIO-FREQUENCY POWER AMPLIFIER -- PLATE MODULATED

In this type of service, the plate supply voltage is modulated so that the tube output is modulated radio frequency. Assuming a value, P, of plate input to be modulated, the amount of audio-frequency power to be supplied is equal to  $\frac{m^2 P}{2}$ , where m is the modulation factor.

The maximum ratings and typical operating conditions given in the Technical Information are such that a modulation factor up to 1.0 may be used. When a lower value of modulation is used, the plate dissipation allowed may be increased, but should be limited so that with the modulation sustained at its peak value, m, the plate loss will not exceed a value  $\frac{3}{2+m^2}$  times the plate dissipation rating.

## CLASS C RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR

In telegraph service, the plate input power is keyed, i.e., is on and off alternately in accordance with the characters of some code. During the "key-down" periods, the tube functions as an unmodulated radio-frequency power amplifier. The tube may be used also as an amplifier or oscillator without keying. In both types of service, the ratings given are for "key-down" conditions.

Certain methods of modulation may be applied to this class of service provided the modulation is essentially negative and the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

	Typical Operation	Typical Operation	Max Rat- ings
<b>CLASS B R-F POWER AMPLIFIER:</b>			
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)			
D-c Plate Voltage, v	1000	1250	1250
D-c Grid Voltage, v	-72	-95	
D-c Plate Current, amp	0.130	0.106	0.150
Plate Input, w			150
Plate Dissipation, w			100
Peak R-f Grid Input Voltage, volts	125	125	
D-c Grid Current, approx ma	5	1	
Driving Power†, approx w	10	7.5	
Plate Power Output, w	40	42.5	

† At crest of audio-frequency cycle.

	Typical Operation	Typical Operation	Max Rat- ings
<b>CLASS C R-F POWER AMPLIFIER AND OSCILLATOR, PLATE MODULATED:</b>			
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)			
D-c Plate Voltage, v	750	1000	1000
D-c Grid Voltage, v	-200	-260	-400
D-c Plate Current, amp	0.150	0.150	0.175
D-c Grid Current, approx amp	0.035	0.035	0.050
Plate Input, watts			175
Plate Dissipation, w			67
Peak R-f Grid Input Voltage, approx v	350	410	
Driving Power, approx w	12	14	
Plate Power Output	65	100	

	Typical Operation	Typical Operation	Typical Operation	Max Rat- ings
<b>CLASS C R-F POWER AMPLIFIER AND OSCILLATOR:</b>				
(Key down conditions per tube without modulation)‡				
D-c Plate Voltage, v	750	1000	1250	1250
D-c Grid Voltage, v	-135	-175	-225	-400
D-c Plate Current, amp	0.150	0.150	0.150	0.175
D-c Grid Current, approx amp	0.018	0.018	0.018	0.050

	Typical Operation	Typical Operation	Typical Operation	Max Rat- ings
Plate Input, w				220
Plate Dissipation, watts				100
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Driving Power, approx w	5	6	7	
Plate Power Output, watts	65	100	130	

‡ Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

The tube should be mounted so as to operate in a vertical position with the base end down.

The normal value of grid leak, when the tube is used as an oscillator or r-f power amplifier (Class C), is in the neighborhood of 5000 ohms, although this may be replaced by a suitable fixed bias. If self-bias is used the cathode resistor should be approximately 1000 ohms.

The maximum ratings apply only at frequencies below 15 megacycles. For operation at higher frequencies adequate ventilation and normal ambient temperatures must be maintained, and the plate voltage must be reduced as indicated.

Frequency, megacycles	15	30	80
Percentage of Maximum )			
Rated Plate Voltage )	100	75	50
and Plate Input )			

The resonant frequency of the grid-plate circuit is approximately 100 megacycles.