PLIOTRON FP-146

PRELIMINARY TECHNICAL INFORMATION SHEET

GENERAL

Main Use - Class B Power Amplifier		
Number of Electrodes	3	
Filament Voltage	10	Volts
Current	3.25	Amperes
Type - Thoriated Tungsten		
Average Characteristic Calues Calculated at Eb = 1250, Ib = .090 amp., Ef = 10 v. direct		
Grid Voltage	+22	Volts
Amplification Factor	78	
Plate Resistance	20,000	Ohms
Mutual Conductance	3,900	Micromhos
Average Direct Interelectrode Capacitances:		
Plate to Grid	9.2	mmf.
Grid to Filament	7.2	"
Plate to Filament	3.9	"
Maximum Overall Dimensions:		
Length	9-1/2	Inches
Diameter	2-3/4	"
Base Type Numbers	3917 & 4310	
Type of Cooling - Air		

MAXIMUM RATINGS & TYPICAL OPERATING CONDITIONS

Class B Audio Frequency Power Amplifier	Max. Rating	Typical Operation		
Plate Voltage	1500	1250	1000	Volts Direct
Grid "		0	0	" "
Fil. "		10	10	" "
Plate Current - No Signal		.017	.010	Amp. "
" " Max. Signal	.175*	.160	.160	" "
" Input - " "	250*	200	160	Watts
" Dissipation	125*	75	60	"
Output - approx. - Max. Signal	[illegible]	125	100	"
Load Resistance per Tube		2100	1750	Ohms

* Averaged over any audio-frequency cycle

Class B Radio Frequency Power Amplifier (Carrier conditions to which a mod. factor up to 1.0 can be applied)				
Plate Voltage	1500	1250	1000	Volts Direct
Grid "		0	0	" "
Fil. "		10	10	" "
Plate Current	.175	.132	.150	Amp. "
" Input	200	165	150	Watts
" Dissipation	125	110	105	"
Output - approx.		55	45	"

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GENERAL ELECTRIC

General Installation and Operation of Pliotron Tubes

Installation

MECHANICAL

Pliotron mountings must be of good quality and should be so installed as to minimize danger from impact. If the set is subject to vibration, a shock-absorbing suspension must be employed.

COOLING

All apparatus should be arranged to allow free circulation of air around the pliotron. The bulb becomes very hot during operation and, therefore, should neither come in contact with any metallic object nor be subjected to drops or spray of liquid.

Sets using more than one tube should provide adequate spacing between tubes so that adjacent portions of the bulbs do not operate appreciably hotter than the other sections.

ELECTRICAL

To avoid danger of corona discharge, all wires and connections should be made to allow several inches of free space around the pliotron. For tubes using a metal base, the metal shell must not be connected to any part of the circuit.

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 five per cent above rated voltage. The filament transformer shall have good regulation and should be designed for at least thirty per cent above rated filament wattage. During "stand-by" periods, the filament voltage should be maintained at rated voltage. If the "stand-by" periods exceed two hours in duration, the filament current should be shut off.

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.

The grid-circuit and plate-circuit return leads should be connected to the center tap of the filament-transformer secondary. When d-c filament excitation is used, the return leads from the grid and plate circuits should be connected to the negative filament terminal.

To prevent parasitic oscillations when pliotrons are operated in parallel, a noninductive resistance of 10 to 100 ohms should be placed in series with each control-grid lead as near as possible to the grid terminal.

An ammeter in the plate circuit of each tube should be connected so that the direct-plate current may be checked regularly.

The plate circuit should be provided with a protective device such as a fuse or relay in order to prevent overheating caused by improper circuit adjustments or overloading. This device should remove the plate voltage instantly if the direct-plate current reaches a value 50 per cent above ⌀normal.

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

GENERAL

Maximum ratings and typical operating conditions for each recommended class of service are given on the Description and

⌀Note: The ratings and characteristics of a particular pliotron are given on the Description and Rating Sheet for that tube.

*Supersedes GEH-980B

Rating Sheet covering the individual type of pliotron. The typical values given must not be considered as ratings, because the tube may be used at any suitable conditions within the maximum ratings.

CLASS A AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Grid bias for this type of service may be obtained from a separate voltage source or by means of a self-biasing resistor shunted by a filter network to avoid degenerative effects at the low audio-frequencies. When several tubes are operated in parallel, it is necessary to make provision for individual adjustment of grid bias to insure that the plate dissipation of any tube does not exceed the ⌀maximum value. This may be accomplished by means of a tapped "C" battery or, if self bias is used, by means of a variable cathode resistor for each tube. When the self-biasing method is used, separate filament supplies are necessary for each tube.

An output device such as a choke or transformer should be used to transfer power efficiently from the pliotron to the load.

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.

The input transformer should be designed to give good frequency response when operated into an open circuit, such as that represented by the grid circuit of the Class B stage when the signal amplitude is small. It should be designed also to handle the required input power for maximum signal conditions.

The output transformer should be designed so that the resistance presented by the load is reflected as the proper plate-to-plate loading in the Class B stage. For example, if the load is a modulated Class C amplifier operating at 2000 volts and 500 milliamperes, the ratio of the output transformer to provide a plate-to-plate loading of 10,000 ohms would be $\sqrt{10000 \div 4000}$, or 1.58 to 1, step-down. The transformer should be designed with a core large enough to avoid saturation effects, which would impair the quality of the output. If the secondary is to carry the direct plate current of the modulated amplifier, the core should be made larger and should include an air gap.

CLASS B RADIO-FREQUENCY 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.

Grid bias for Class B a-f. or r-f. service should be obtained from a battery or other d-c source of good regulation. It should not be obtained from a high-resistance supply such as a grid leak.

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 $\frac{m^2P}{2}$, 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.

Grid bias for this service may be obtained from a grid leak or from a combination of grid leak and generator, rectifier, or cathode-bias resistor, suitably by-passed for audio- and radio-frequencies. The combination method is desirable because distortion effects may be minimized.

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

⌀Note: The ratings and characteristics of a particular pliotron are given on the Description and Rating Sheet for that tube.

the modulation is essentially negative, and the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

Grid bias for Class C service may be obtained from a grid leak, from a battery, from a rectifier of good regulation, or from a self-biasing resistor by-passed with a suitable capacitor. With the grid-leak method, the grid excitation must not be removed without also removing the plate voltage. Grid-bias values are not particularly critical, and correct circuit adjustment may be obtained with widely different values.

INSTRUCTIONS

Complete instructions are packed with each shipment of tubes. Additional copies can be secured from the nearest office of the General Electric Company.

General Electric tubes are warranted to be of the kind and quality described in the manufacturer's specifications. Before leaving the factory, each tube is subjected to rigid tests and inspections. Performance will depend, to a large extent, upon the application, and upon the care with which the tubes are handled. In case of doubt as to proper operating conditions, information should be secured from the General Electric Office through which the purchase was made.

To assure satisfactory operation, it is recommended that each tube be tested upon receipt by the customer, in the equipment in which it is to be used. If spare tubes are to be stocked for long periods, a check test should be made every three months. The conditions of test and operation should not be more severe than the conditions described in the specifications.

If any failure of the tubes to comply with the specifications appears during the initial test or subsequently during the life warranty under which the tubes were purchased, the General Electric Office through which the purchase was made will advise the purchaser regarding the correct procedure for returning tubes believed to be defective.

Should the package be received in damaged condition, observance of the procedure described on the tag affixed to the container will enable the General Electric Company to assist the customer in filing a claim for tubes damaged in transit.

Tubes returned for credit adjustment should be packed as carefully as when originally received, for damage sustained in return shipment will make a thorough examination impossible.

LICENSE NOTICE

In connection with this device, the General Electric Company has rights under patents having claims (a) on the device itself and (b) on combinations of the device with other devices or elements, as for example in various circuits and hook-ups.

The sale does not carry a license under the patent claims of (b) except for installation and legitimate renewals and repairs in apparatus and systems already licensed for use under such patent claims on combinations.

Service Report Form

This service sheet is furnished for the convenience of the customer in applying for adjustment if the quality of the tube does not meet the specification and warranty under which the tube was sold. It is essential that the customer, in making application for adjustment, fill out this sheet and return it, with the tube, to the commercial agency from which the tube was purchased.

In returning a vacuum tube for test and examination, the customer gives permission to the General Electric Company to break the glass bulb and to dissect the structure of the tube, in case such procedure is considered necessary for a complete examination of the tube, to determine whether or not the failure was caused by a manufacturing defect.

Type of Tube.....Serial Number.....Date Tested.....Date Put In Service.....Result of Initial Test (Good) (Defective).....

Manufacturer of Equipment in Which Tube Was Used
(Include Manufacturer's Designation or Catalog No.) .....

Service, with Cathode Operating, Hours ..... Service, with Anode Operating, Hours .....

Hours Service Per Day .....Hours Service Per Week .....Date Rejected .....

Reason Rejected .....

Description of Equipment .....

Remarks (Include Service Conditions) .....

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Conditions of Operation
(Voltages, Currents, Temperatures, Circuits, etc.) .....

.....

Signature .....Date .....

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

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