



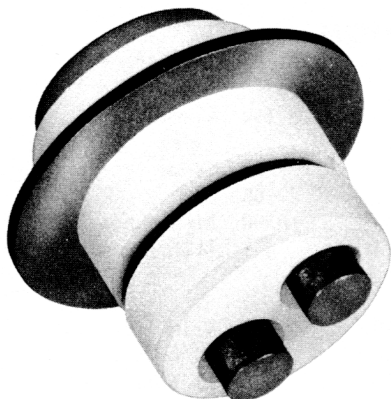
ELECTRONIC  
**INNOVATIONS**  
IN ACTION

**TUBES**

**7486**

**METAL-CERAMIC TRIODE**

**FOR UHF OSCILLATOR AND POWER AMPLIFIER APPLICATIONS**



**DESCRIPTION AND RATING**

The 7486 is a high- $\mu$  triode of ceramic-and-metal planar construction intended for use as an oscillator or radio-frequency power amplifier in the ultra-high-frequency range. The 7486 is especially suited for use where unfavorable conditions of mechanical shock, mechanical vibration, and nuclear radiation are encountered.

**GENERAL**

**ELECTRICAL**

Cathode--Coated Unipotential  
Heater Characteristics and Ratings  
Heater Voltage, AC or DC\* ..... 6.3  $\pm$  0.3 Volts  
Heater Current ..... 0.24 Amperes  
Direct Interelectrode Capacitances†  
Grid to Plate: (g to p) ..... 1.0 pf  
Input: g to (h+k) ..... 1.7 pf  
Output: p to (h+k) ..... 0.01 pf  
Heater to Cathode: (h to k) ..... 1.1 pf

**MECHANICAL**

Mounting Position—Any  
  
See Outline Drawing on page 3 for dimensions and electrical connections

**MAXIMUM RATINGS**

**ABSOLUTE-MAXIMUM VALUES**

Plate Voltage ..... 250 Volts  
Positive DC Grid Voltage ..... 0 Volts  
Negative DC Grid Voltage ..... 50 Volts  
Plate Dissipation ..... 1.0 Watts  
DC Grid Current ..... 2.2 Milliamperes  
DC Cathode Current ..... 11 Milliamperes  
Peak Cathode Current ..... 40 Milliamperes

Heater-Cathode Voltage  
Heater Positive with Respect to  
Cathode ..... 50 Volts  
Heater Negative with Respect to  
Cathode ..... 50 Volts  
Grid Circuit Resistance ..... 10000 Ohms  
Envelope Temperature at Hottest  
Point§ ..... 250 C

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron 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, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or

elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

## CHARACTERISTICS AND TYPICAL OPERATION

### AVERAGE CHARACTERISTICS

Plate Voltage	100	150	Volts
Grid Voltage	0		Volts
Cathode-Bias Resistor		82	Ohms
Amplification Factor		90	
Transconductance	11500	10500	Micromhos
Plate Current	8.0	7.5	Milliamperes

### UHF Oscillator Service

Plate Voltage	150	150	Volts
Grid Resistor	1000	1000	Ohms
Plate Current	8.0	8.0	Milliamperes
Grid Current	2.0	2.0	Milliamperes
Frequency	450	1200	Megacycles
Power Output, approximate	450	300	Milliwatts

### Class C RF Amplifier

Plate Voltage		150	Volts
Grid Resistor		3000	Ohms
Plate Current		5.0	Milliamperes
Grid Current		1.0	Milliamperes
Frequency		450	Megacycles
Power Output, approximate		300	Milliwatts

### FOOTNOTES

\* The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

† Heater current of a bogey tube at  $E_f = 6.3$  volts.

‡ Measured using a grounded adapter that provides shielding between external terminals of tube.

§ Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life. The 7486 is also capable of operation at envelope temperatures much higher than the rated maximum values. For specific recommendations concerning higher temperature operation, contact your General Electric tube sales representative.

### INITIAL CHARACTERISTICS LIMITS

	Min.	Bogey	Max.	
Heater Current				
$E_f = 6.3$ volts	222	240	258	Milliamperes
Plate Current				
$E_f = 6.3$ volts, $E_b = 150$ volts, $R_k = 82$ ohms (bypassed)	4.5		11	Milliamperes
Zero-Bias Transconductance				
$E_f = 6.3$ volts, $E_b = 100$ volts, $E_c = 0$ volts	8000	11500		Micromhos
Transconductance Change with Heater Voltage				
Difference between Zero-Bias Transconductance measured at $E_f = 6.3$ volts and $E_f = 6.0$ volts (other conditions the same) expressed as a percentage			20	Percent
Amplification Factor				
$E_f = 6.3$ volts, $E_b = 150$ volts, $R_k = 82$ ohms (bypassed)	65	90	115	
Grid Voltage Cutoff				
$E_f = 6.3$ volts, $E_b = 150$ volts, $I_b = 100 \mu a$		-2.4	-4.5	Volts
Interelectrode Capacitances				
Grid to Plate: (g to p)	0.84	1.00	1.16	Picofarads
Input: g to (h+k)	1.25	1.70	2.15	Picofarads
Output: p to (h+k)	0.004	0.010	0.016	Picofarads
Heater to Cathode: (h to k)	0.80	1.10	1.40	Picofarads

### INITIAL CHARACTERISTICS LIMITS (Continued)

	Min.	Bogey	Max.	
<b>Heater-Cathode Leakage Current</b>				
E <sub>f</sub> = 6.3 volts, E <sub>hk</sub> = 100 volts				
Heater Positive with Respect to Cathode	.....	.....	20	Microamperes
Heater Negative with Respect to Cathode	.....	.....	20	Microamperes
<b>Interelectrode Leakage Resistance</b>				
E <sub>f</sub> = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid to All at 100 volts d-c	100	.....	.....	Megohms
Plate to All at 300 volts d-c	100	.....	.....	Megohms
<b>Grid Emission Current</b>				
E <sub>f</sub> = 7.0 volts, E <sub>b</sub> = 150 volts, E <sub>cc</sub> = -20 volts, R <sub>g</sub> = 0.1 meg	.....	.....	2.0	Microamperes

### SPECIAL PERFORMANCE TESTS

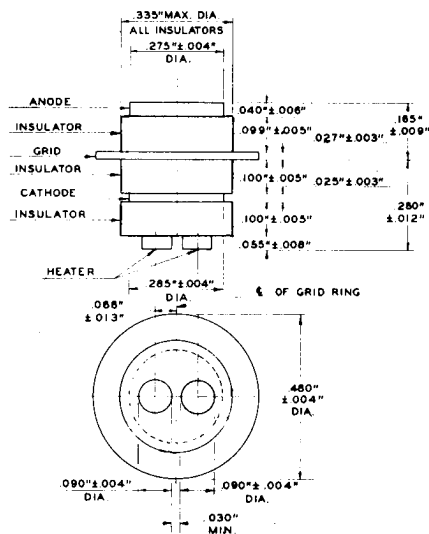
	Min.	Bogey	Max.	
1200 Megacycle Oscillator Power Output	200	.....	.....	Milliwatts
Tubes are tested for power output as an oscillator under the following conditions: F = 1200 mc ± 50 mc, E <sub>f</sub> = 6.3 volts, E <sub>b</sub> = 150 volts, R <sub>g</sub> = 1000 ohms, I <sub>b</sub> = 8.0 ma maximum, I <sub>c</sub> = 1.6 - 2.0 ma				
Pulse Emission	90	.....	.....	Milliamperes
Tubes are tested for pulse emission under the following conditions: E <sub>f</sub> = 6.3 volts, E <sub>b</sub> = 150 volts, E <sub>c</sub> = -10 volts, e <sub>gk</sub> = +7 V, p <sub>rr</sub> = 1000 pps, duty factor = 0.01. Pulse cathode current is measured				
<b>Grid Recovery</b>				
Change in Average Plate Current	.....	.....	0.6	Milliamperes
Peak Plate Current Backswing	.....	.....	1.0	Milliamperes

Tubes with poor grid recovery affect circuit operation, when the grid is driven positive by a pulse of signal or noise, somewhat as if a parallel RC circuit were in series with the grid. This effect may occur in tubes of any type, but is unimportant in many applications. In the majority of 7486 tubes the effect is negligible, but to eliminate the few in which it may be excessive, tubes are tested under the following conditions: E<sub>f</sub> = 6.3 volts, E<sub>bb</sub> = 250 volts, R<sub>L</sub> = 0.01 meg. E<sub>c</sub> is

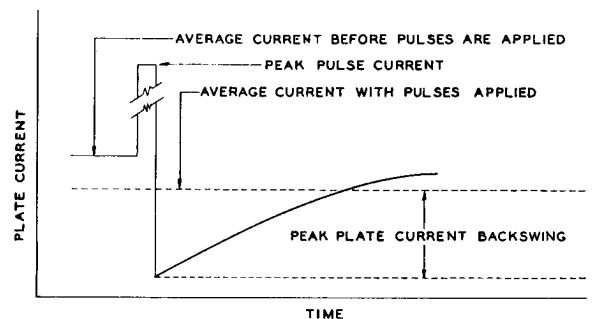
adjusted for I<sub>b</sub> = 3.0 ma.

Upon application to the grid of a 5-volt positive pulse (p<sub>rr</sub> = 60 pps, duty factor = 0.0012) the change in average plate current is noted, and the peak plate current backswing is measured. The following diagram shows qualitatively the plate current-time relationship for a tube (with poor grid recovery) subjected to this test.

### OUTLINE DRAWING



### PLATE CURRENT VS TIME— GRID RECOVERY TEST



- 1—Maximum eccentricity of anode, grid, and cathode 0.005" from center line.
- 2—Maximum eccentricity of insulators 0.010" from center line.
- 3—Center line of grid ring used as reference line for horizontal tolerances.
- 4—Bottom surface of grid ring used as reference line for vertical tolerances.

## SPECIAL PERFORMANCE TESTS (Continued)

	Min.	Bogey	Max.
Low Frequency Vibrational Output .....			10 Millivolts RMS
Statistical sample is subjected to vibration in each of two planes at 40 cps, with peak acceleration 15G. Tube is			operated with $E_f = 6.3$ volts, $E_{bb} = 150$ volts, $R_k = 82$ ohms (bypassed), $R_{L_1} = 10000$ ohms.
Variable Frequency Vibrational Output			
The tube is designed to be free of vibrational outputs in excess of 15 mv RMS at any frequency within the range 100-2000 cps, when vibrated in either of two planes at 10G			peak acceleration. Electrical conditions for this test are the same as for Low Frequency Vibrational Output.
Low Pressure Voltage Breakdown Test			
Statistical sample tested for voltage breakdown at a pressure of 8 mm Hg, to simulate an altitude of 100,000 feet. Tubes shall not give visual evidence of flashover or corona			when 300 volts RMS, 60 cps, is applied between the plate and grid terminals.

## DEGRADATION RATE TESTS

### Fatigue

Statistical sample vibrated for a total of six hours, three hours in each of two planes, at a peak acceleration of 10G. Frequency is continuously varied from 30 cps to 2000 cps and back to 30 cps, with a period of ten minutes. Tubes are operated during the test with  $E_f = 6.3$  volts,  $E_b = 150$  volts, and  $R_k = 82$  ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, and heater current.

### Shock

Statistical sample subjected to 5 impact accelerations of approximately 450G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 30° hammer angle. Tubes are operated during the test with  $E_f = 6.3$  volts,  $E_b = 150$  volts,  $E_{hk} = +100$  volts, and  $R_k = 82$  ohms. Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, and heater current.

### Stability Life Test

The statistical sample subjected to the Dynamic Life Test is evaluated for percent change in zero-bias transconductance of individual tubes, from the initial reading to readings following 2 hours and 20 hours of the life test.

### Survival Rate Life Test

The combined statistical samples subjected to the Dynamic and Pulse Life Tests are evaluated for shorted and open elements following approximately 100 hours of life test.

### Dynamic Life Test

Statistical sample operated, with a 60 cps grid signal, at maximum rated DC grid current and cathode current for a period of 1000 hours. Heater voltage is cycled (on  $1\frac{3}{4}$  hours, off  $\frac{1}{4}$  hour). Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, oscillator power output, zero-bias transconductance, heater-cathode leakage, and interelectrode leakage resistance.

### Pulse Life Test

Statistical sample operated with 120 ma peak cathode current, 0.01 duty factor, for 1000 hours. Heater voltage is cycled (on  $1\frac{3}{4}$  hours, off  $\frac{1}{4}$  hour). Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, pulse cathode current, heater-cathode leakage, and interelectrode leakage resistance.

### Interface Life Test

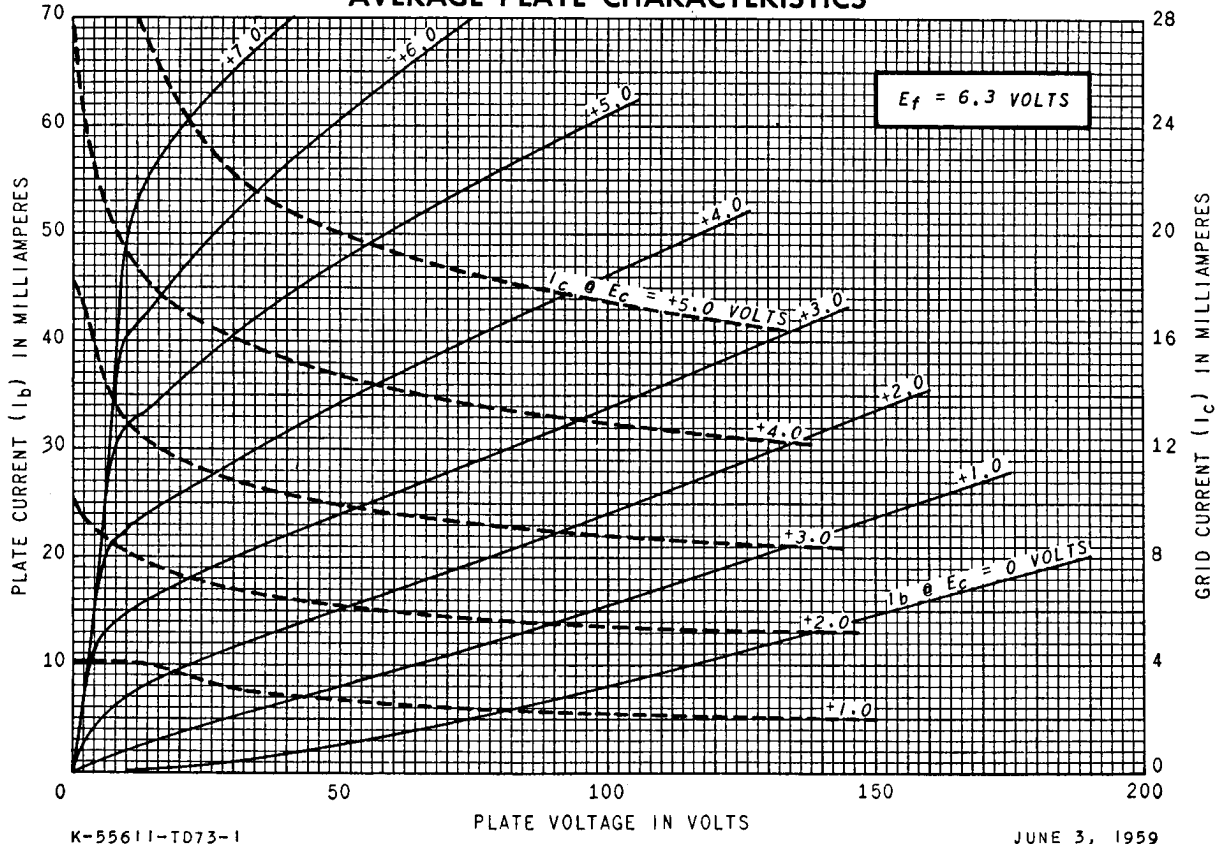
Statistical sample operated for 1000 hours with  $E_f = 6.6$  volts, no other voltages applied, and evaluated for cathode interface resistance following the life test.

### Heater-Cycling Life Test

Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include  $E_f = 7.0$  volts cycled for one minute on and one minute off,  $E_b = E_c = 0$  volts, and  $E_{hk} = 70$  volts with heater positive with respect to cathode. Following this test, tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage current.

**Note:** The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

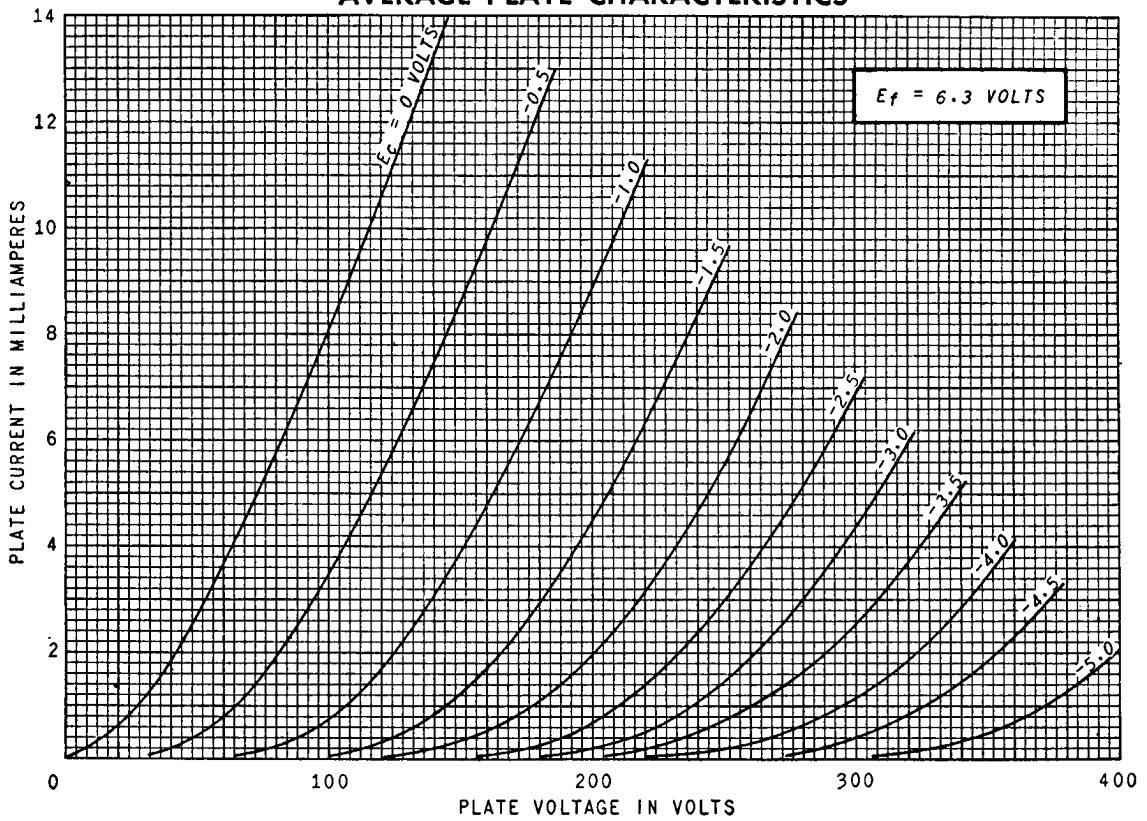
AVERAGE PLATE CHARACTERISTICS



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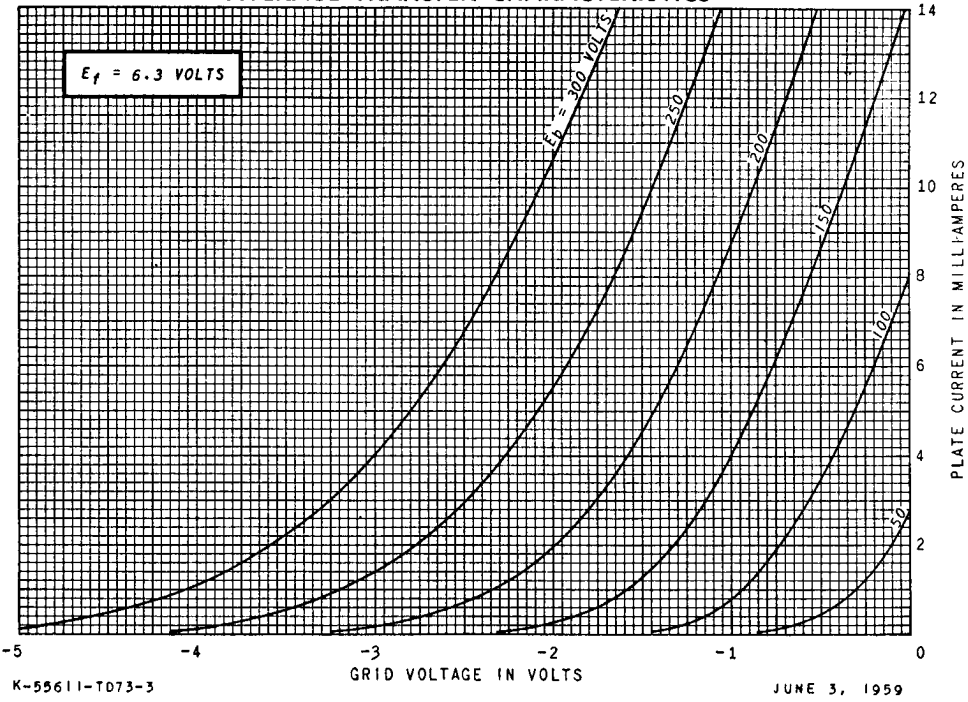
AVERAGE PLATE CHARACTERISTICS



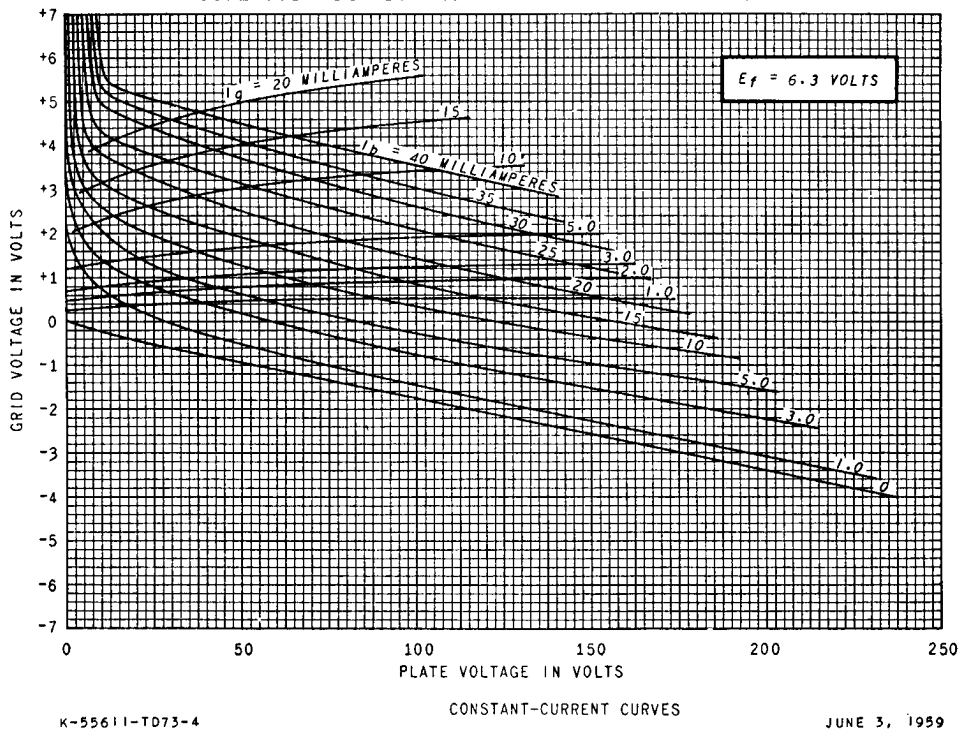
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JUNE 3, 1959

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE CONSTANT-CURRENT CHARACTERISTICS



RECEIVING TUBE DEPARTMENT



Owensboro, Kentucky