

FOR AF POWER AMPLIFIER APPLICATIONS

8-LEAD SUBMINIATURE
POWER OUTPUT—1 WATT

SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING

DESCRIPTION AND RATING

The 5902 is a subminiature beam power pentode for use as an audio-frequency power amplifier. In this application the tube is capable of delivering an output of approximately one watt.

The 5902 is a special-quality tube for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC.....6.3 $\pm$ 5% Volts

Heater Current.....0.45 Amperes

Direct Interelectrode Capacitances

	With Shield*	Without Shield
Grid-Number 1 to Plate.....	0.11	0.15 μ f
Input.....	6.5	6.5 μ f
Output.....	7.5	4.5 μ f

*With external shield of 0.405-inch inside diameter connected to cathode.

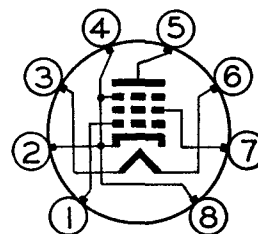
MECHANICAL

Mounting Position—Any

Envelope—T-3, Glass

Base—E8-10, Subminiature Button 8-Lead

BASING DIAGRAM

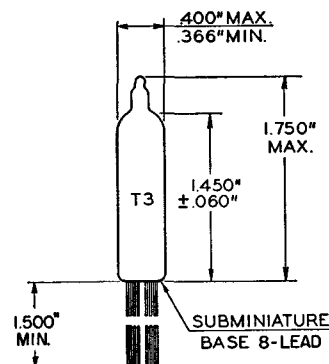


RETMA 8DL

TERMINAL CONNECTIONS

- Lead 1—Grid Number 1
- Lead 2—Cathode and Beam Plates
- Lead 3—Heater
- Lead 4—Cathode and Beam Plates
- Lead 5—Plate
- Lead 6—Heater
- Lead 7—Grid Number 2 (Screen)
- Lead 8—Cathode and Beam Plates

PHYSICAL DIMENSIONS



RETMA 3-3

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES

Plate Voltage	165 Volts
Screen Voltage	155 Volts
Positive DC Grid-Number 1 Voltage	0 Volts
Negative DC Grid-Number 1 Voltage	55 Volts
Plate Dissipation	3.7 Watts
Screen Dissipation	0.4 Watts
DC Cathode Current	50 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	200 Volts
Heater Negative with Respect to Cathode	200 Volts
Bulb Temperature at Hottest Point	220 C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A₁ AMPLIFIER

Plate Voltage	110 Volts
Screen Voltage	110 Volts
Cathode-Bias Resistor	270 Ohms
Peak AF Grid-Number 1 Voltage, RMS	6.4 Volts
Plate Resistance, approximate	15,000 Ohms
Transconductance	4200 Micromhos
Zero-Signal Plate Current	30 Milliamperes
Maximum-Signal Plate Current, approximate	29 Milliamperes
Zero-Signal Screen Current	2.2 Milliamperes
Maximum-Signal Screen Current	5.5 Milliamperes
Load Resistance	3000 Ohms
Total Harmonic Distortion, approximate	10 Percent
Maximum-Signal Power Output	1.0 Watts
Grid-Number 1 Voltage, approximate	
I _b = 10 Microamperes	-40 Volts

CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
E _f = 6.3 volts	Initial	420	480	Milliamperes
	500-Hr	414	492	Milliamperes
Plate Current				
E _f = 6.3 volts, E _b = 110 volts, E _{c2} = 110 volts, R _k = 270 ohms (by-passed)	Initial	23.0	37.0	Milliamperes
Screen Current				
E _f = 6.3 volts, E _b = 110 volts, E _{c2} = 110 volts, R _k = 270 ohms (by-passed)	Initial	0	4.0	Milliamperes
Transconductance				
E _f = 6.3 volts, E _b = 110 volts, E _{c2} = 110 volts, R _k = 270 ohms (by-passed)	Initial	3500	4900	Micromhos
Plate Resistance				
E _f = 6.3 volts, E _b = 110 volts, E _{c2} = 110 volts, R _k = 270 ohms (by-passed)	Initial	0.01	....	Megohms
Power Output (1)				
E _f = 6.3 volts, E _b = 110 volts, E _{c2} = 110 volts, R _k = 270 ohms (by-passed), R _L = 3000 ohms, E _{sig} = 6.4 volts RMS	Initial	0.75	....	Watts
Power Output Change with Heater Voltage				
Difference between Power Output (1) and Power Output at E _f = 5.7 volts (other conditions the same) expressed as a percentage of Power Out- put (1)	Initial	....	15	Percent
	500-Hr	....	15	Percent
Power Output Change with Operation				
Difference between Power Output (1) initially and after operation ex- pressed as a percentage of initial value	500-Hr	....	20	Percent

CHARACTERISTICS LIMITS (Cont'd)

	Minimum Maximum		
Average Power Output Change with Operation			
Average of values for "Power Output Change with Operation" 500-Hr	....	15	Percent
Plate Current Cutoff			
E _f = 6.3 volts, E _{bb} = 110 volts, E _{c2} = 110 volts, E _{c1} = -40 volts Initial	....	100	Microamperes
Interelectrode Capacitances			
Grid-Number 1 to Plate (g ₁ to p) Initial	....	0.20	μμf
Input (g ₁ to h, k, g ₂) Initial	5.5	7.5	μμf
Output (p to h, k, g ₂) Initial	6.5	8.5	μμf
Measured with external shield of 0.405-inch inside diameter connected to cathode.			
Negative Grid-Number 1 Current			
E _f = 6.3 volts, E _b = 110 volts, E _{c2} = 110 volts, R _{g1} = 1.0 meg, R _k = 270 ohms Initial	....	1.0	Microamperes
	500-Hr	2.0	Microamperes
Heater-Cathode Leakage Current			
E _f = 6.3 volts, E _{hk} = 100 volts			
Heater Positive with Respect to Cathode Initial	....	15	Microamperes
	500-Hr	60	Microamperes
Heater Negative with Respect to Cathode Initial	....	15	Microamperes
	500-Hr	60	Microamperes
Interelectrode Leakage Resistance			
E _f = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results			
Grid-Number 1 to All at 100 Volts DC Initial	50	....	Megohms
	500-Hr	25	Megohms
Plate to All at 300 Volts DC Initial	50	....	Megohms
	500-Hr	25	Megohms
Vibrational Noise Output Voltage, RMS			
E _f = 6.3 volts, E _{bb} = 110 volts, E _{c2} = 110 volts, R _k = 270 ohms (by-passed), R _L = 2000 ohms, Vibrational acceleration = 15 G at 40 cps Initial	....	100	Millivolts
Grid-Number 1 Emission Current			
E _f = 7.5 volts, E _b = 110 volts, E _{c2} = 110 volts, E _{c1} = -40 volts, R _{g1} = 1.0 meg Initial	....	2.0	Microamperes

The indicated 500-hour values are life-test end points for the following conditions of operation: E_f = 6.3 volts, E_b = 100 volts, E_{c2} = 100 volts, R_k = 220 ohms, R_{g1} = 0.47 meg, E_{hk} = 200 volts with heater positive with respect to cathode, and bulb temperature = 220 C minimum.

SPECIAL TESTS AND RATINGS

Stability Life Test

Statistical sample operated for one hour to evaluate and control initial variations in power output.

Survival Rate Life Test

Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical in-operatives.

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 four minutes off, $E_b = E_{c2} = E_{c1} = 0$ volts, and $E_{hk} = 140$ volts RMS.

Shock Rating—450 G

Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating—2.5 G

Statistical sample subjected to vibrational acceleration of 25 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

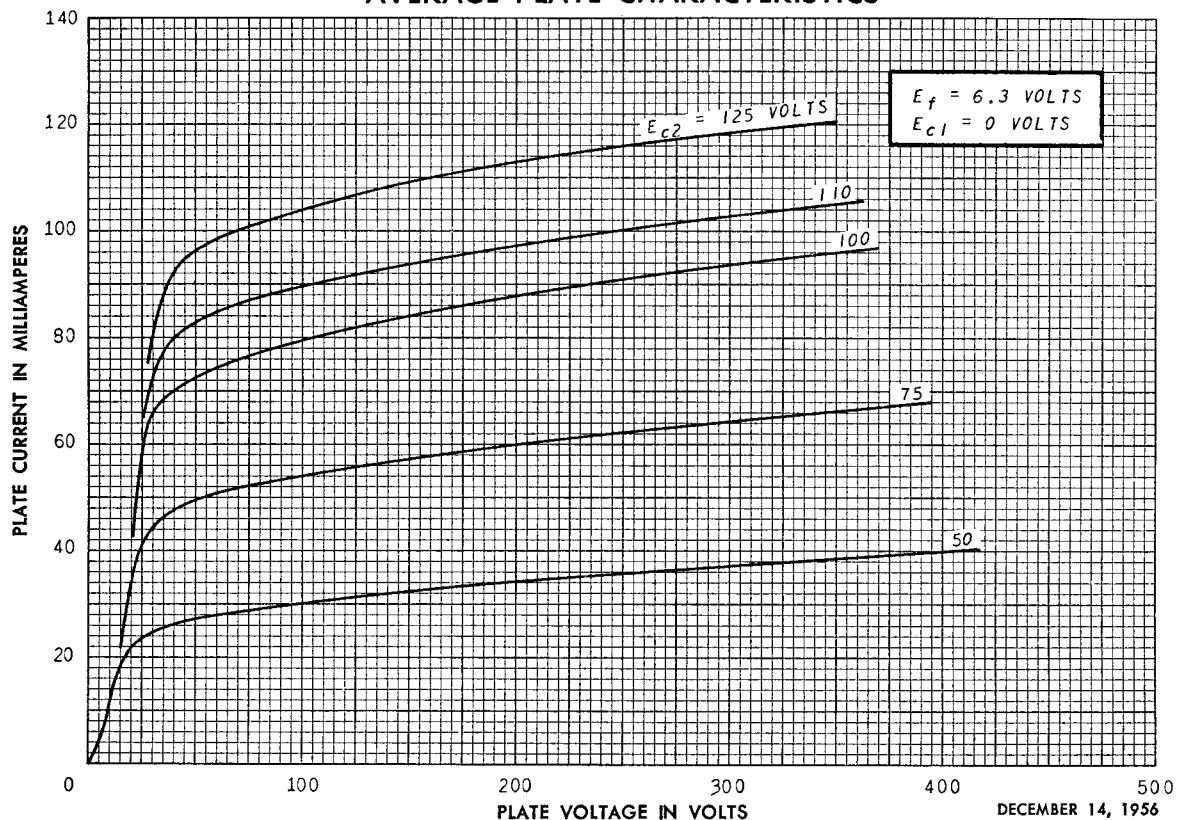
Altitude Rating—60,000 Feet

Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

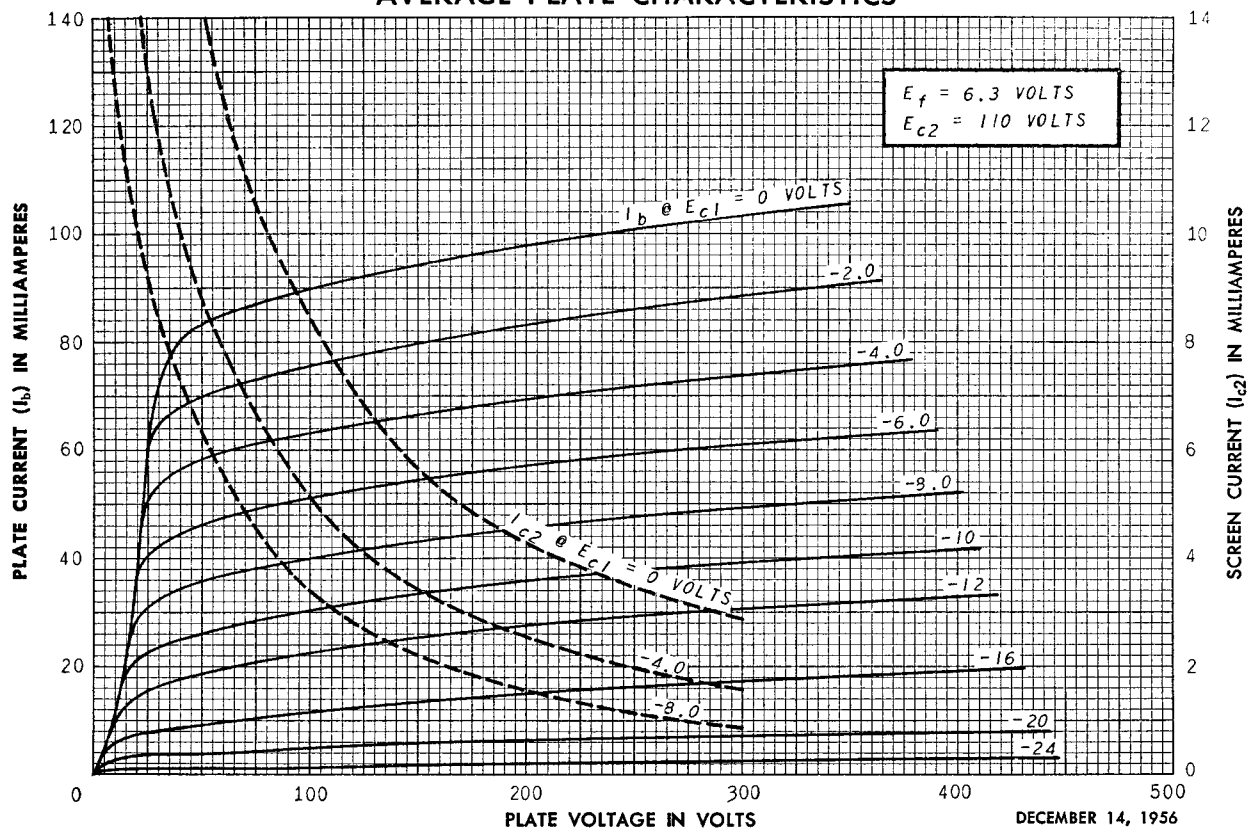
Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1 specification.

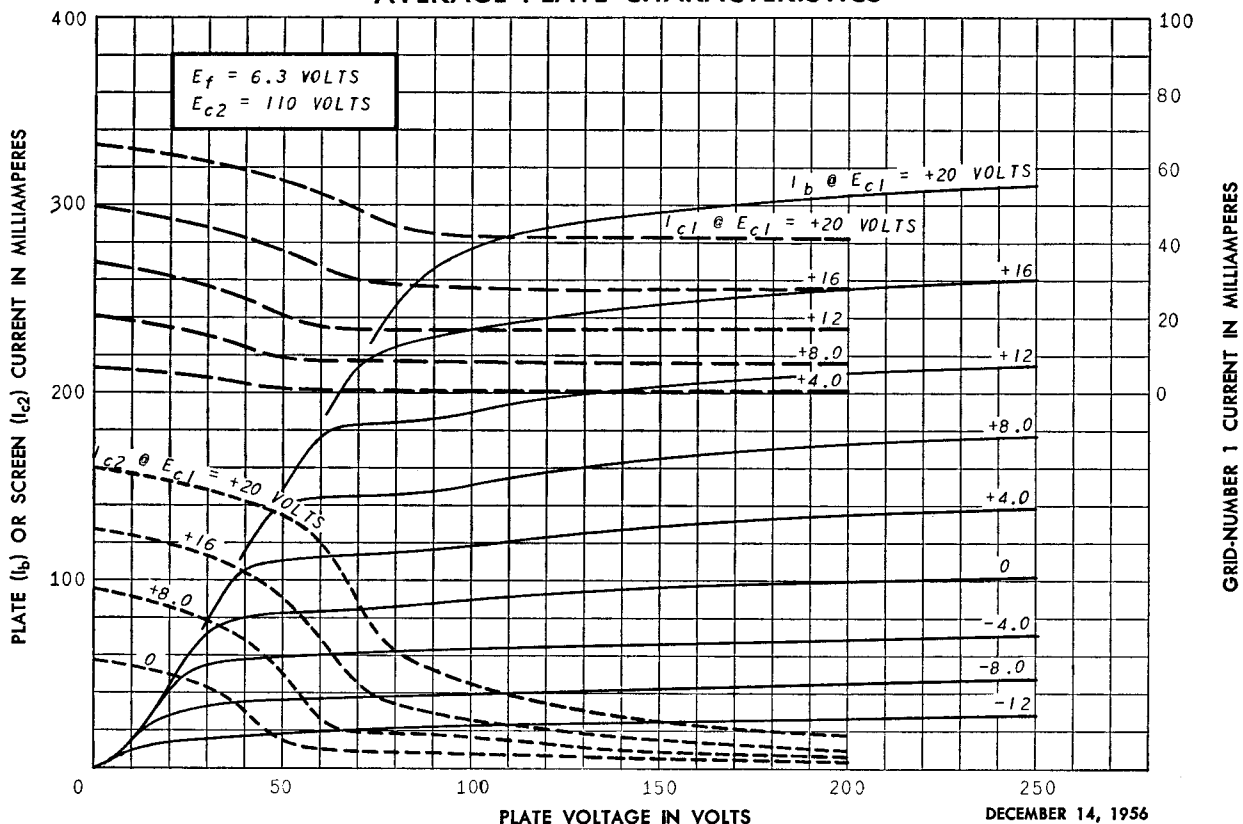
AVERAGE PLATE CHARACTERISTICS



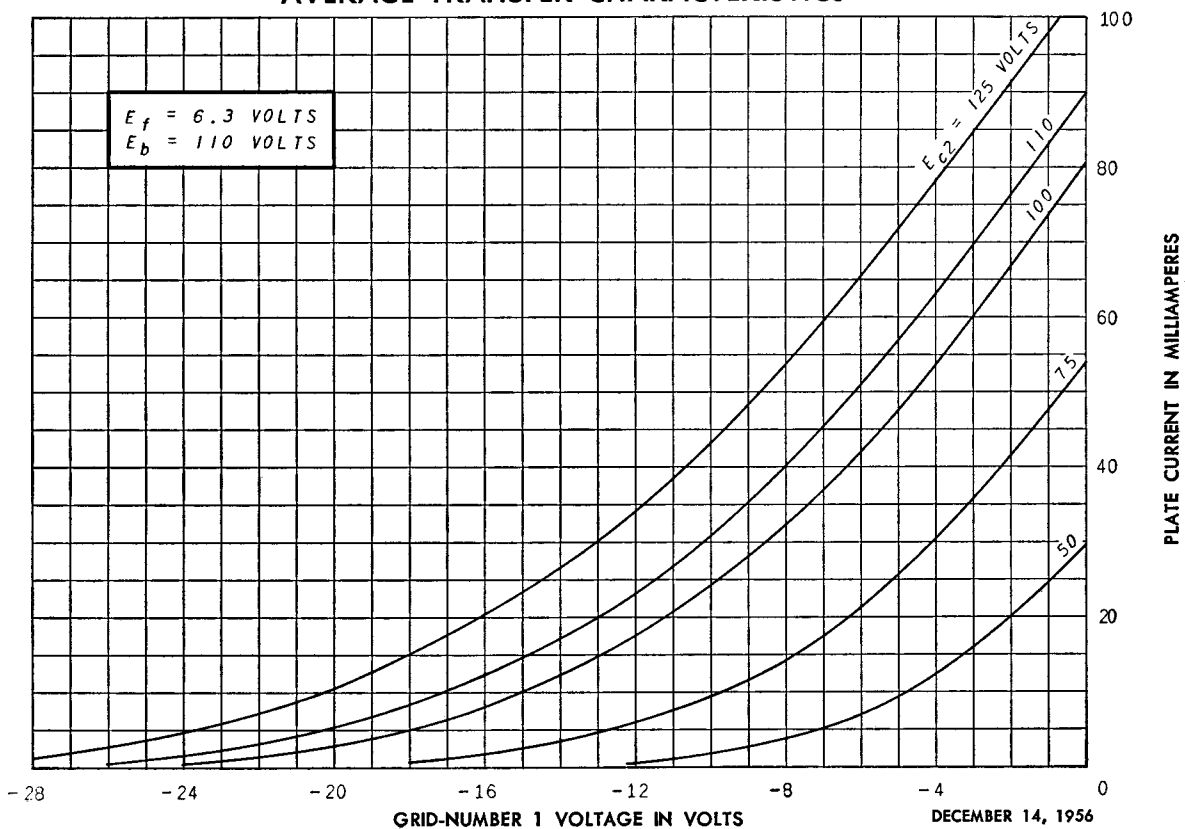
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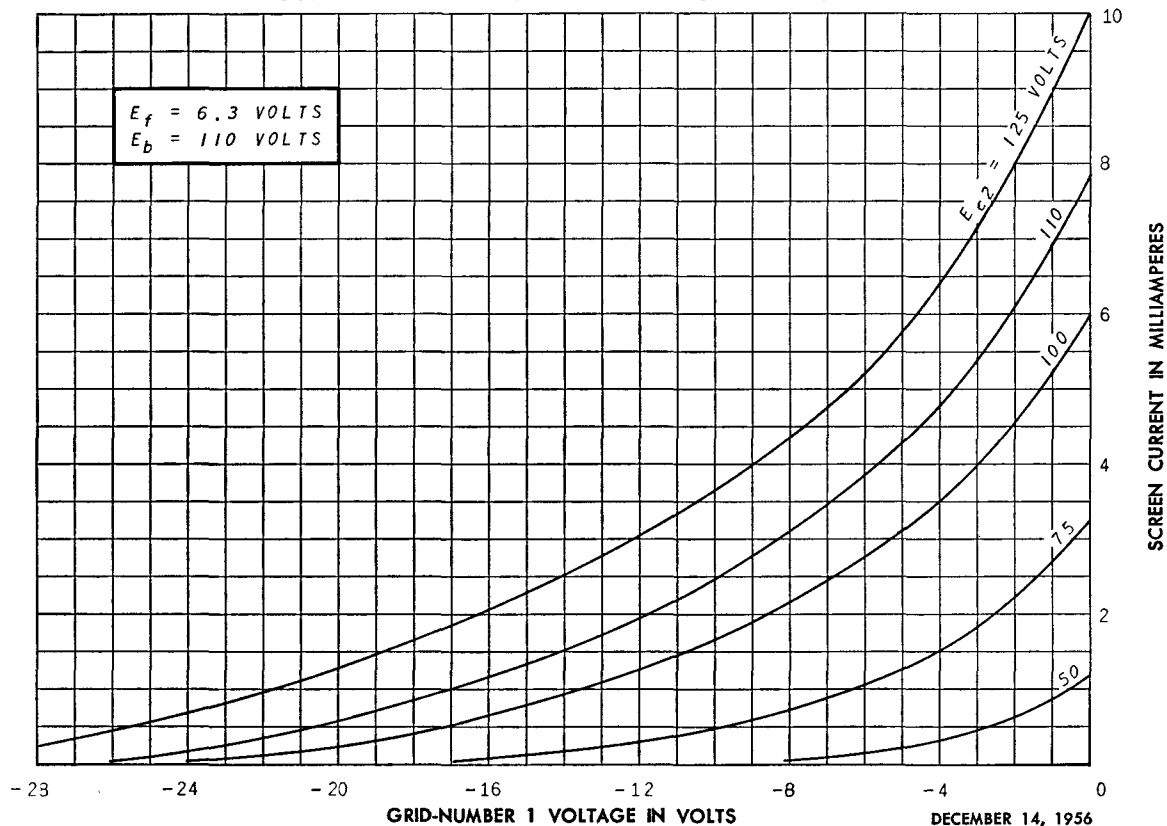
AVERAGE PLATE CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS



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