Electronic TUBES

6829
TWIN TRIODE
Five-Star Tube
★★★★★
FOR COMPUTER APPLICATIONS

6829GE00

HIGH PERVEANCE
SHARP CUTOFF
MEDIUM MU

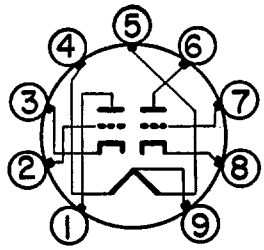
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING
PROTOTYPE—5965

DESCRIPTION AND RATING

The 6829 is a miniature, medium-mu twin triode designed especially for service in computer applications. The electrical characteristics of the 6829 are equivalent to those of the 5965; and, like the 5965, the tube features a high zero-bias plate current together with a sharp cutoff characteristic.

Intended for use in critical industrial and military applications in which operational dependability is of primary importance, the 6829 exhibits a high degree of mechanical strength and incorporates 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.

BASING DIAGRAM



RETMA 9A

TERMINAL CONNECTIONS

Pin 1—Plate (Section 2)
Pin 2—Grid (Section 2)
Pin 3—Cathode (Section 2)
Pin 4—Heater
Pin 5—Heater
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater Center Tap

GENERAL

ELECTRICAL

	Series	Parallel	
Cathode—Coated Unipotential			
Heater Voltage, AC or DC	12.6 ± 5%	6.3 ± 5%	Volts
Heater Current	0.225	0.45	Amperes

Direct Interelectrode Capacitances*

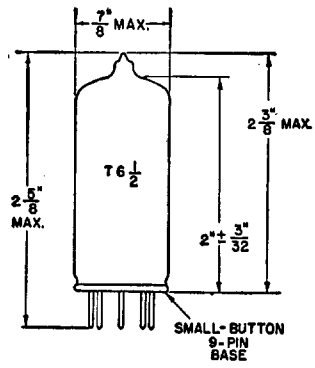
Grid to Plate, Each Section	3.0 μμf
Input, Each Section	4.0 μμf
Output, Section 1	0.5 μμf
Output, Section 2	0.38 μμf
Heater to Cathode, Each Section	4.0 μμf
Grid to Grid, maximum	0.03 μμf
Plate to Plate, maximum	0.9 μμf

* Without external shield.

MECHANICAL

Mounting Position
  Preferred Orientation—Upright or with Plate Majors in Vertical Position
  Permissible Orientation—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

PHYSICAL DIMENSIONS



RETMA 6-3

GENERAL ELECTRIC

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES, EACH SECTION†

DC Plate Voltage	275	Volts
Peak Positive Pulse Plate Voltage	550	Volts
Positive DC Grid Voltage	1.0	Volts
Negative DC Grid Voltage	50	Volts
Peak Positive Grid Voltage‡	10	Volts
Peak Negative Grid Voltage	100	Volts
Plate Dissipation, Each Plate	2.2	Watts
Total Plate Dissipation, Both Plates	4.0	Watts
DC Grid Current	1.0	Milliamperes
Peak Grid Current‡	50	Milliamperes
DC Cathode Current	20	Milliamperes
Peak Cathode Current‡	160	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode§	100	Volts
Heater Negative with Respect to Cathode§	100	Volts
Grid Circuit Resistance		
With Fixed Bias	0.1	Megohms
With Cathode Bias	0.5	Megohms
Bulb Temperature at Hottest Point	140	C

† Design-Maximum Ratings are the limiting values expressed with respect to bogie tubes at which satisfactory tube life can be expected to occur for the types of service for which the tube is rated. Therefore, the equipment designer must establish the circuit design so that initially and throughout equipment life no design-maximum value is exceeded with a bogie tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, and environmental conditions.

‡ Rating based on a pulse of 10 microsecond duration, 1 percent duty cycle, and 1000 pps repetition rate.

§ For pulse voltages of less than 1 percent duty cycle, the peak voltage may be 150 volts maximum.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage	100	150	150	Volts
Grid Voltage	π	−4.8	....	Volts
Cathode-Bias Resistor	...	...	220	Ohms
Amplification Factor	...	...	47	
Plate Resistance, approximate	...	...	7000	Ohms
Transconductance	...	...	6700	Micromhos
Plate Current	17	0.15	8.5	Milliamperes

π With grid current adjusted for approximately 200 microamperes.

CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current				
Ef = 6.3 volts	Initial	420	480	Milliamperes
	500-Hr	420	485	Milliamperes
	1000-Hr	420	490	Milliamperes
Zero-Bias Plate Current (1), Each Section				
Ef = 6.3 volts, Eb = 100 volts, Ic = 200 μa (Rg = 0.5 meg to +100 volts)	Initial	12.0	22.0	Milliamperes
Zero-Bias Plate Current Change with Heater Voltage, Each Section				
Difference between Zero-Bias Plate Current (1) and Zero-Bias Plate Current at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Zero-Bias Plate Current (1)	Initial	....	15	Percent
	500-Hr	....	15	Percent
Zero-Bias Plate Current Change with Operation, Each Section				
Difference between Zero-Bias Plate Current (1) initially and after operation expressed as a percentage of initial value	500-Hr	....	20	Percent
	1000-Hr	....	25	Percent
Plate Current, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 220 ohms (bypassed)	Initial	6.3	10.7	Milliamperes
Transconductance, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 220 ohms (bypassed)	Initial	5300	8100	Micromhos
Amplification Factor, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 220 ohms (bypassed)	Initial	39	55	
Grid Voltage Cutoff (1), Each Section				
Ef = 6.3 volts, Eb = 150 volts, Ib = 150 μa	Initial	....	−7.5	Volts
Grid Voltage Cutoff Difference between Sections				
Difference between cutoff voltages for each section at Ef = 6.3 volts, Eb = 150 volts, Ib = 150 μa	Initial	....	1.5	Volts
Interelectrode Capacitances				
Grid to Plate (g to p), Each Section	Initial	2.4	3.6	μμf
Input (g to k+h), Each Section	Initial	3.0	5.0	μμf
Output (p to k+h), Section 1	Initial	0.37	0.57	μμf
Output (p to k+h), Section 2	Initial	0.30	0.46	μμf
Heater to Cathode (h to k), Each Section	Initial	3.0	5.0	μμf
Grid to Grid (g to g)	Initial	....	0.03	μμf
Plate to Plate (p to p)	Initial	....	0.9	μμf
Measured without external shield				
Negative Grid Current, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 220 ohms (bypassed), Rg = 0.5 meg	Initial	0	0.3	Microamperes
	500-Hr	0	0.3	Microamperes
	1000-Hr	0	0.3	Microamperes
Heater-Cathode Leakage Current, Each Section				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	Initial	....	7	Microamperes
	500 Hr	....	7	Microamperes
	1000-Hr	....	7	Microamperes
Heater Negative with Respect to Cathode	Initial	....	7	Microamperes
	500-Hr	....	7	Microamperes
	1000-Hr	....	7	Microamperes

CHARACTERISTICS LIMITS CONTINUED ON PAGE 4

CHARACTERISTICS LIMITS (Cont'd)

Interelectrode Leakage Resistance				
Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results.				
Grid (Each Section) to All at 100 volts d-c	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Plate (Each Section) to All at 300 volts d-c	Initial	100	....	Megohms
	500-Hr	50	....	Megohms
Vibrational Noise Output Voltage, RMS, Each Section				
Ef = 6.3 volts, Ebb = 150 volts, Rk = 220 ohms (bypassed), R_L = 2000 ohms, Vibrational acceleration = 2.5 G at 25 cps	Initial	....	300	Millivolts
Grid Emission Current, Each Section				
Ef = 6.7 volts, Eb = 150 volts, Ecc = −30 volts, Rg = 0.5 meg	Initial	0	0.5	Microamperes
Pulse Cathode Current				
Ef = 6.3 volts, Eb = 150 volts, Ecc = −20 volts. Grid is driven 10 volts positive with a pulse of 1% duty cycle and 1000 pps repetition rate. Pulse cathode current is measured for each section with both sections operating under pulse conditions	Initial	160	....	Milliamperes
	500-Hrϕ	150	....	Milliamperes

Unless otherwise specified, the indicated 500-hour and 1000-hour values are life-test end points for the following conditions of operation for each section: Ef = 6.3 volts, Ebb = 180 volts, R_L = 3900 ohms, Ic = 46 μa (Rg = 3.9 meg to 180 volts), Ehk = 135 volts with heater positive with respect to cathode, and bulb temperature = 140 C minimum.

ϕ Conditions of life-test operation for each section are Ef = 6.3 volts, Ebb = 180 volts, Ecc = −20 volts, R_L = 200 ohms, and Rg = 50 ohms. Grid is driven with a 11.5-volt positive-going pulse (measured on driver side of Rg) of 1% duty cycle and 1000 pps repetition rate.

SPECIAL TESTS AND RATINGS

Stability Life Test

Statistical sample operated for one hour to evaluate and control initial variations in zero-bias plate current.

Survival Rate Life Test

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

Heater-Cycling Life Test

Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.5 volts (parallel-heater connection) cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 135 volts with heater positive with respect to cathode.

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 2.5 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.

Cathode-Interface Impedance Life Test

Statistical sample operated without cathode current conduction to evaluate and control the development of cathode interface impedance.

Altitude Rating—60,000 Feet

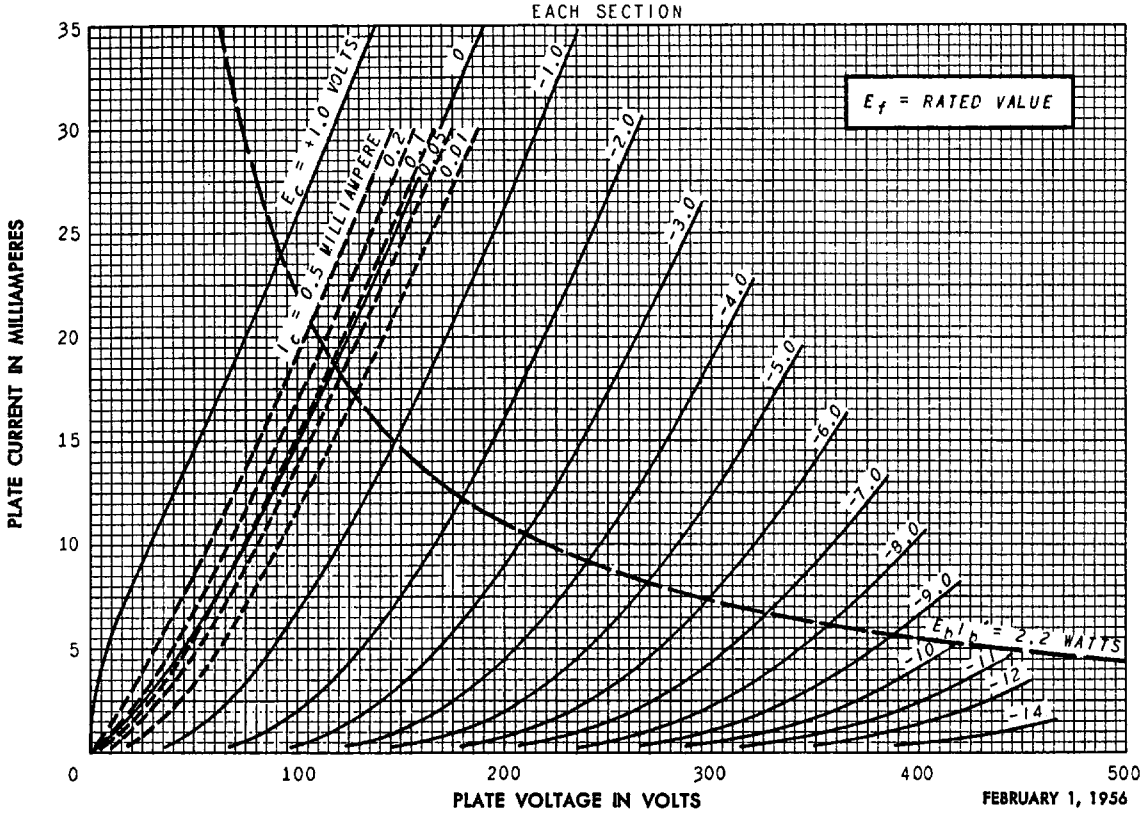
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

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.

△Supersedes page 4, dated 1-56

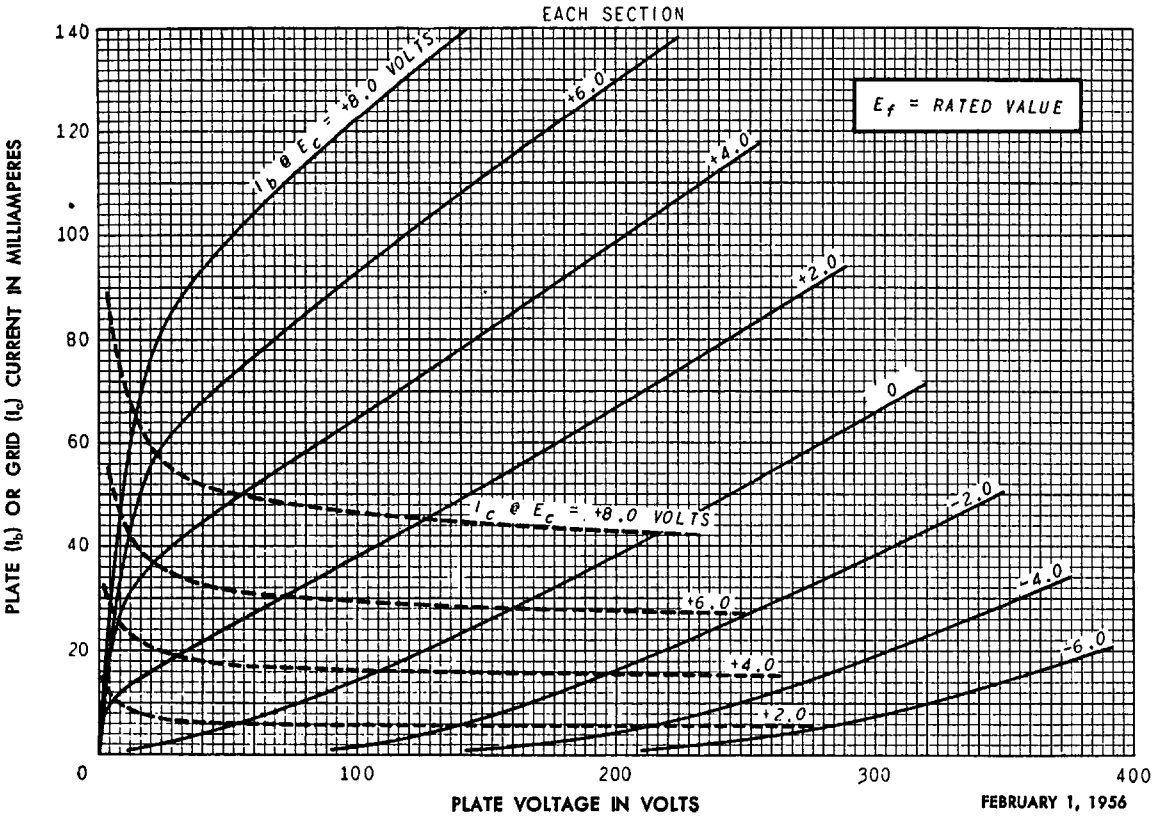
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



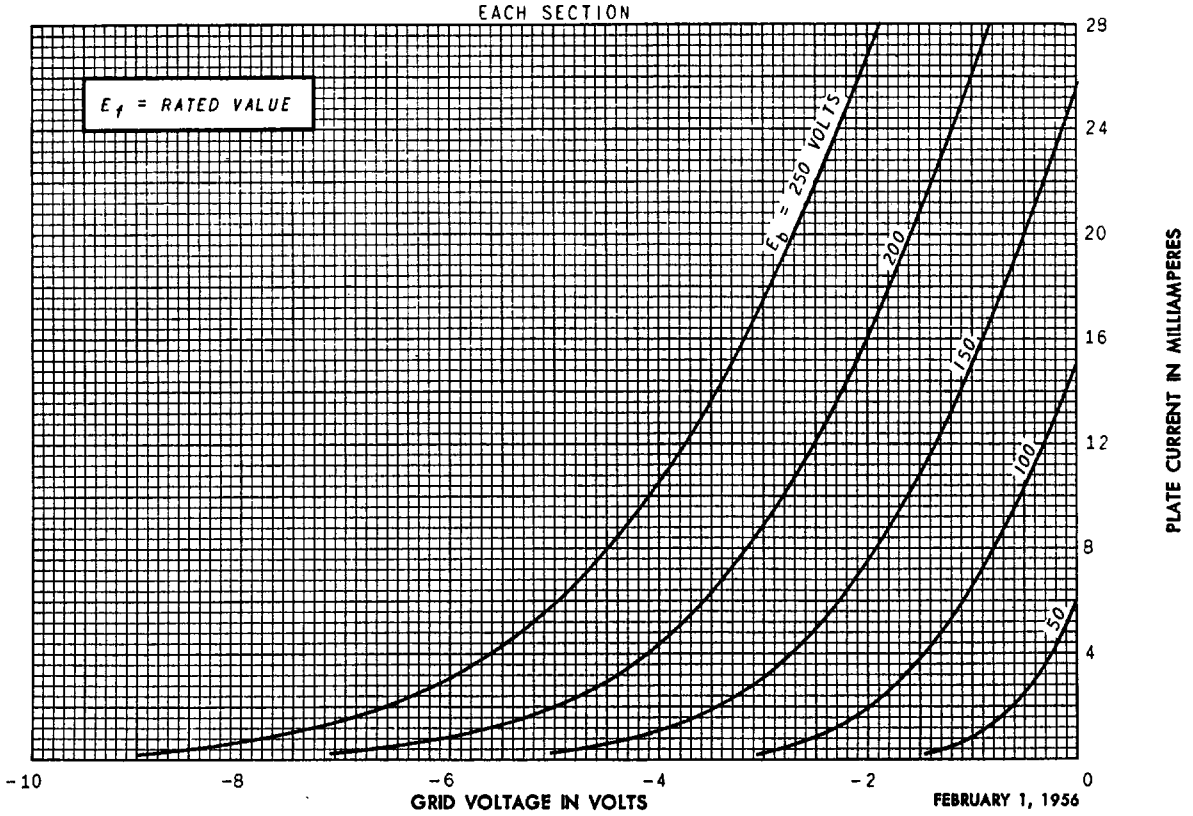
AVERAGE PLATE CHARACTERISTICS

EACH SECTION



AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



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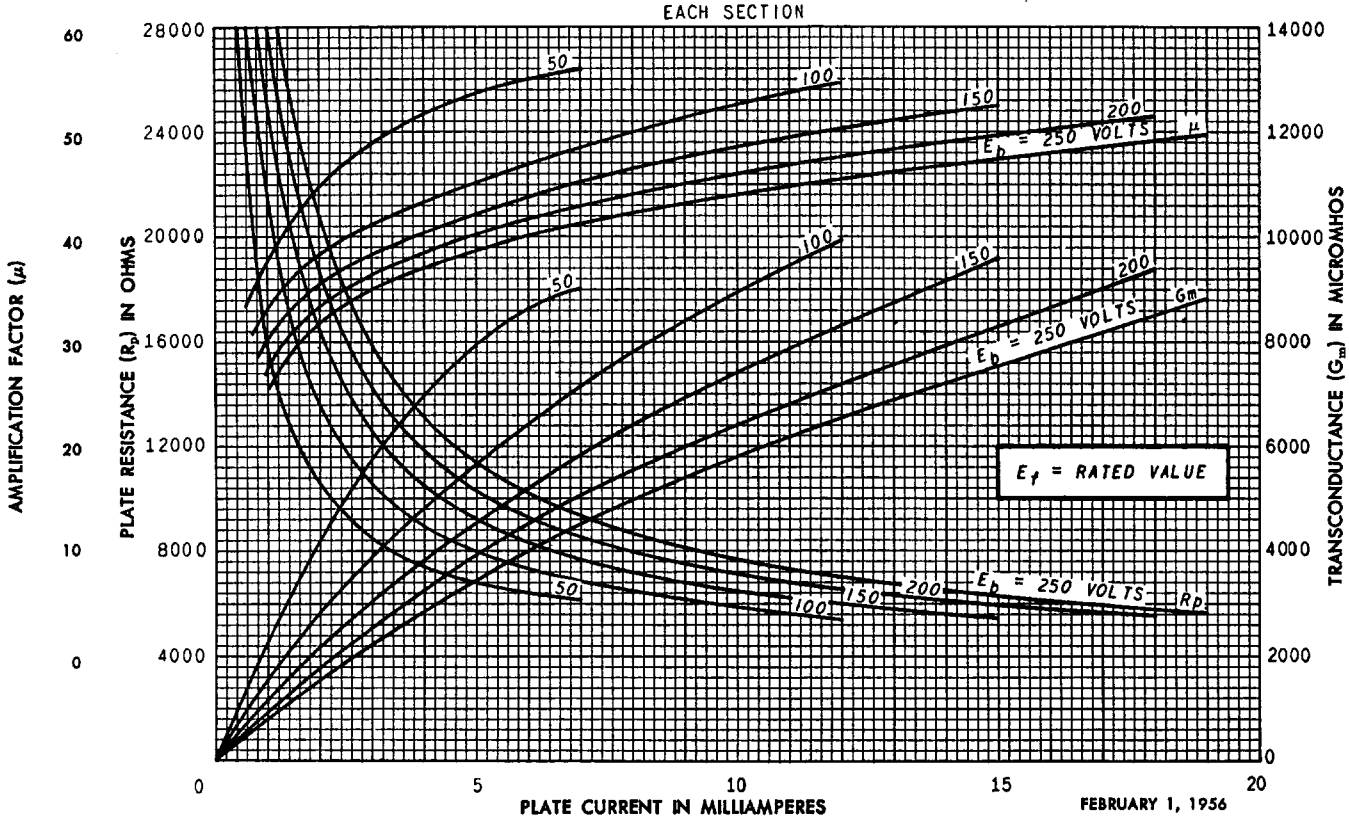
AVERAGE CHARACTERISTICS

EACH SECTION



FEBRUARY 1, 1956

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.