ELECTRONICS

6201
TWIN TRIODE

Five-Star Tube

★★★★★

FOR VHF AMPLIFIER AND CONVERTER APPLICATIONS

HIGH-MU
9-PIN MINIATURE
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING
SEPARATE CATHODES

DESCRIPTION AND RATING

The 6201 is a miniature high-mu twin triode each section of which has an individual cathode connection. The tube is especially suited for use as a grounded-grid amplifier or as a frequency converter at frequencies below approximately 300 megacycles.

The 6201 is a special-quality tube intended 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 Characteristics and Ratings

	Parallel*	Series‡	
Heater Voltage, AC or DC. .	6.3±0.6§	12.6±1.3§	Volts
Heater Current	0.3¶	0.15#	Amperes

Direct Interelectrode Capacitances△

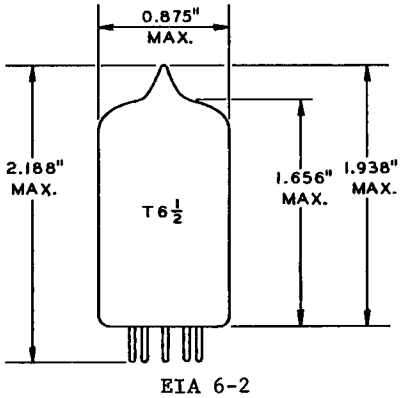
Grid to Plate: (g to p), Each Section.	1.6	pf
Input: g to (h + k), Each Section. . .	2.5	pf
Output: p to (h + k), Section 1 . .	0.45	pf
Output: p to (h + k), Section 2 . .	0.38	pf
Heater to Cathode: (h to k), Each Section.	2.8	pf
Plate to Plate: (p to p).	0.24	pf

MECHANICAL

Operating Position - Any
Envelope - T-6 1/2, Glass
Base - E9-1, Small Button 9-Pin
Outline Drawing - EIA 6-2

Maximum Diameter	0.875	Inches
Maximum Over-all Length . .	2.188	Inches
Maximum Seated Height. . .	1.938	Inches

PHYSICAL DIMENSIONS

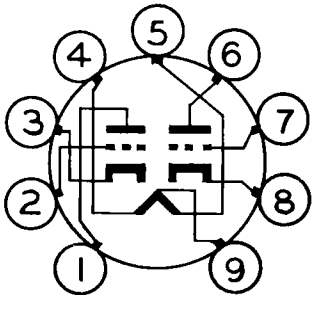


EIA 6-2

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

BASING DIAGRAM



EIA 9A

GENERAL ELECTRIC

Supersedes ET-T1110 dated 8-54

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES, Each Section

DC Plate Voltage	330	Volts
Peak Positive Pulse Plate Voltage	660	Volts
Positive DC Grid Voltage	0	Volts
Negative DC Grid Voltage	55	Volts
Peak Positive Grid Voltage	50	Volts
Peak Negative Grid Voltage	100	Volts
Plate Dissipation	2.7	Watts
Grid Dissipation	0.1	Watts
Peak Cathode Current - See Rating Chart		
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	0.25	Megohms
With Cathode Bias	0.5	Megohms
Bulb Temperature at Hottest Point	165	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.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS, Each Section

Plate Voltage	250	Volts
Cathode-Bias Resistor	200	Ohms
Amplification Factor	60	
Plate Resistance, approximate	10900	Ohms
Transconductance	5500	Micromhos
Plate Current	10	Milliamperes
Grid Voltage, approximate		
Ib = 10 Microamperes	-12	Volts

NOTES

* Operated with the two sections of the heater connected in parallel.

‡ Operated with the two sections of the heater connected in series.

§ 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 Ef = 6.3 volts.

\# Heater current of a bogey tube at Ef = 12.6 volts.

Δ Without external shield.

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

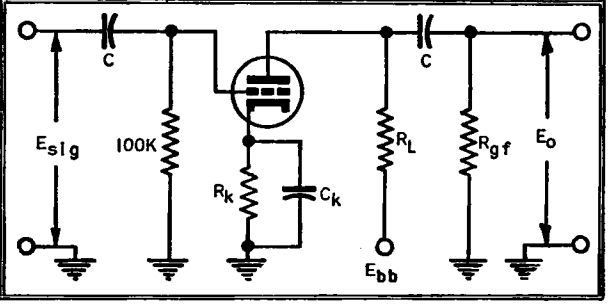
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	1600	5.3	26	1100	12	31	1000	22	32
0.10	0.24	1800	7.8	29	1400	17	33	1200	30	33
0.24	0.24	3800	7.2	28	2800	16	32	2300	28	34
0.24	0.51	4200	9.4	30	3300	20	33	2800	35	33
0.51	0.51	8000	8.3	28	5600	18	31	4900	31	33
0.51	1.0	9600	10	29	6700	23	32	6000	38	33

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2000	9.9	25	1200	17	31	900	35	33
0.10	0.24	2400	13	27	1400	28	33	1200	47	33
0.24	0.24	4700	12	27	2900	25	32	2300	42	34
0.24	0.51	5300	15	28	3600	31	33	2900	52	34
0.51	0.51	9300	13	27	6000	27	31	5000	45	33
0.51	1.0	11000	16	28	7100	33	32	6400	55	34

Notes:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_L and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k should be adequately by-passed.



CHARACTERISTICS LIMITS

		Minimum	Bogey	Maximum	
Heater Current					
Ef = 12.6 volts.	Initial	142	150	158	Milliamperes
	500-Hr	142	---	162	Milliamperes
	1000-Hr	142	---	164	Milliamperes
Plate Current, Each Section					
Ef = 12.6 volts, Eb = 250 volts, Rk = 200 ohms (bypassed).	Initial	7.0	10	14	Milliamperes
Plate Current Difference between Sections					
Difference between plate currents for each section at Ef = 12.6 volts, Eb = 250 volts, Rk = 200 ohms (bypassed)	Initial	---	---	3.2	Milliamperes
Transconductance, Each Section					
Ef = 12.6 volts, Eb = 250 volts, Rk = 200 ohms (bypassed).	Initial	4500	5500	6500	Micromhos
Transconductance Change with Heater Voltage, Each Section					
Difference between transconductance measured at Ef = 12.6 volts and transconductance at Ef = 11.4 volts (other conditions the same) expressed as a percentage of transconductance at Ef = 12.6 volts .	Initial	---	---	15	Percent
	500-Hr	---	---	15	Percent
	1000-Hr	---	---	20	Percent
Transconductance Change with Operation, Each Section					
Difference between transconductance measured initially and after operation expressed as a percentage of the initial value	500-Hr	---	---	20	Percent
	1000-Hr	---	---	25	Percent
Average Transconductance Change with Operation					
Average of values for "Transconductance Change with Operation, Each Section"	500-Hr	---	---	15	Percent

CHARACTERISTICS LIMITS (Cont'd)

		Minimum	Bogey	Maximum	
Amplification Factor, Each Section					
Ef = 12.6 volts, Eb = 250 volts,					
Rk = 200 ohms (bypassed).	Initial	50	60	70	
Plate Current Cutoff (1), Each Section					
Ef = 12.6 volts, Ebb = 250 volts,					
Ec = -20 volts, R_L = 0.1 meg	Initial	---	---	100	Microamperes
Plate Current Cutoff (2), Each Section					
Ef = 12.6 volts, Ebb = 250 volts, Ec =					
-7.0 volts, R_L = 0.1 meg.	Initial	5	---	---	Microamperes
Pulse Cathode Current, Each Section					
Ef = 12.6 volts, Eb = 250 volts, Ec = -30 volts,					
Rk = 1.0 ohms, egk = +30 volts, tp = 10 μsec, prr =					
1000 pps, tr = 1.0 μsec, tf = 1.0 μsec	Initial	300	---	---	Milliamperes
	500-Hr	290	---	---	Milliamperes
	1000-Hr	280	---	---	Milliamperes
Pulse Cathode Current at Reduced Heater Voltage, Each Section					
Ef = 11.4 volts, Eb = 250 volts, Ec = -30 volts,					
Rk = 1.0 ohms, egk = +30 volts, tp = 10 μsec, prr =					
1000 pps, tr = 1.0 μsec, tf = 1.0 μsec	Initial	260	---	---	Milliamperes
Interelectrode Capacitances					
Grid to Plate: (g to p), Each Section	Initial	1.3	1.6	1.9	Picofarads
Input: g to (h + k), Each Section.	Initial	2.0	2.5	3.0	Picofarads
Output: p to (h + k), Section 1	Initial	0.20	0.45	0.70	Picofarads
Output: p to (h + k), Section 2	Initial	0.16	0.38	0.60	Picofarads
Heater to Cathode: (h to k), Each Section	Initial	2.1	2.8	3.5	Picofarads
Plate to Plate: (p to p).	Initial	0.15	0.24	0.33	Picofarads
Measured without external shield.					
Negative Grid Current, Each Section					
Ef = 12.6 volts, Eb = 250 volts, Rk = 200 ohms					
(bypassed), Rg = 0.5 meg.	Initial	---	---	0.7	Microamperes
	500-Hr	---	---	0.7	Microamperes
	1000-Hr	---	---	0.7	Microamperes
Pulse Life Test Sample:	500-Hr	---	---	1.4	Microamperes
	1000-Hr	---	---	1.4	Microamperes
Heater-Cathode Leakage Current, Each Section					
Ef = 12.6 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
Interelectrode Leakage Resistance, Each Section					
Ef = 12.6 volts. Polarity of applied d-c					
interelectrode voltage is such that no cathode					
emission results.					
Grid to All at 100 volts DC.	Initial	500	---	---	Megohms
	500-Hr	250	---	---	Megohms
	1000-Hr	100	---	---	Megohms
Plate to All at 300 volts DC	Initial	500	---	---	Megohms
	500-Hr	250	---	---	Megohms
	1000-Hr	100	---	---	Megohms
Grid Emission Current, Each Section					
Ef = 15.0 volts, Eb = 250 volts,					
Ec = -20 volts, Rg = 0.5 meg	Initial	---	---	1.5	Microamperes

SPECIAL PERFORMANCE TESTS

	Minimum	Bogey	Maximum	
Low Frequency Vibrational Output	---	---	100	Millivolts, RMS

Statistical sample is subjected to vibration in each of two planes at 40 cps, with peak acceleration 10G. Tube is operated with Ef = 12.6 volts, Ebb = 250 volts, Ec = -3.0 volts, R_L = 2000 ohms, sections in parallel.

Low Pressure Voltage Breakdown Test

Statistical sample tested for voltage breakdown at a pressure of 21 millimeters Hg, to simulate an altitude of 80000 feet. Tubes shall not give visual evidence of flashover or corona when 500 volts RMS, 60 cps, is applied between the plate pins and adjacent pins.

DEGRADATION RATE TESTS

Fatigue

Statistical sample vibrated for a total of 96 hours, 32 hours in each of 3 planes, at a peak acceleration of 2.5 G. Frequency is 25 cps. Tubes are operated during the stest with Ef = 12.6 volts (no other voltages applied). Following the test, tubes are evaluated for low-frequency vibrational output, heater-cathode leakage, grid current, and transconductance.

Shock

Statistical sample subjected to 5 impact accelerations of approximately 600 G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 42° hammer angle. Tubes are operated during the test with Ef = 12.6 volts, Eb = 250 volts, Ehk = +100 volts, Rk = 200 ohms, and Rg = 0.1 megohms. Following the test, tubes are evaluated for low-frequency vibrational output, heater-cathode leakage, grid current, and transconductance.

Stability Life Test

Statistical sample operated under the following conditions: Ef = 12.6 volts (cycled - on 1 3/4 hours, off 1/4 hour), Eb = 250 volts, Rk = 200 ohms, Rg = 0.5 megohms, Ehk = 135 volts with heater positive with respect to cathode, and temperature = room temperature. Tubes are evaluated, following 2 hours and 20 hours of life test, for percent change in transconductance of individual tubes.

Survival Rate Life Test

Statistical sample operated under Stability Life Test conditions is evaluated for shorted and open elements and transconductance following approximately 100 hours of life test.

Intermittent Life Test

Statistical sample operated for 1000 hours under the following conditions: Ef = 12.6 volts (cycled - on 1 3/4 hours, off 1/4 hour), Eb = 250 volts, Rk = 200 ohms, Rg = 0.5 megohms, Ehk = 135 volts with heater positive with respect to cathode, and bulb temperature = 165C minimum. Tubes are evaluated, following 500 and 1000 hours of the life test, for shorted or open elements, heater current, transconductance, negative grid current, heater-cathode leakage, and interelectrode leakage resistance. Life test end points are given in "Characteristics Limits" section.

Interface Life Test

Statistical sample operated for 500 hours with Ef = 6.9 volts (parallel heaters), no other voltages applied, and evaluated for cathode interface resistance following the life test.

Heater-Cycling Life Test

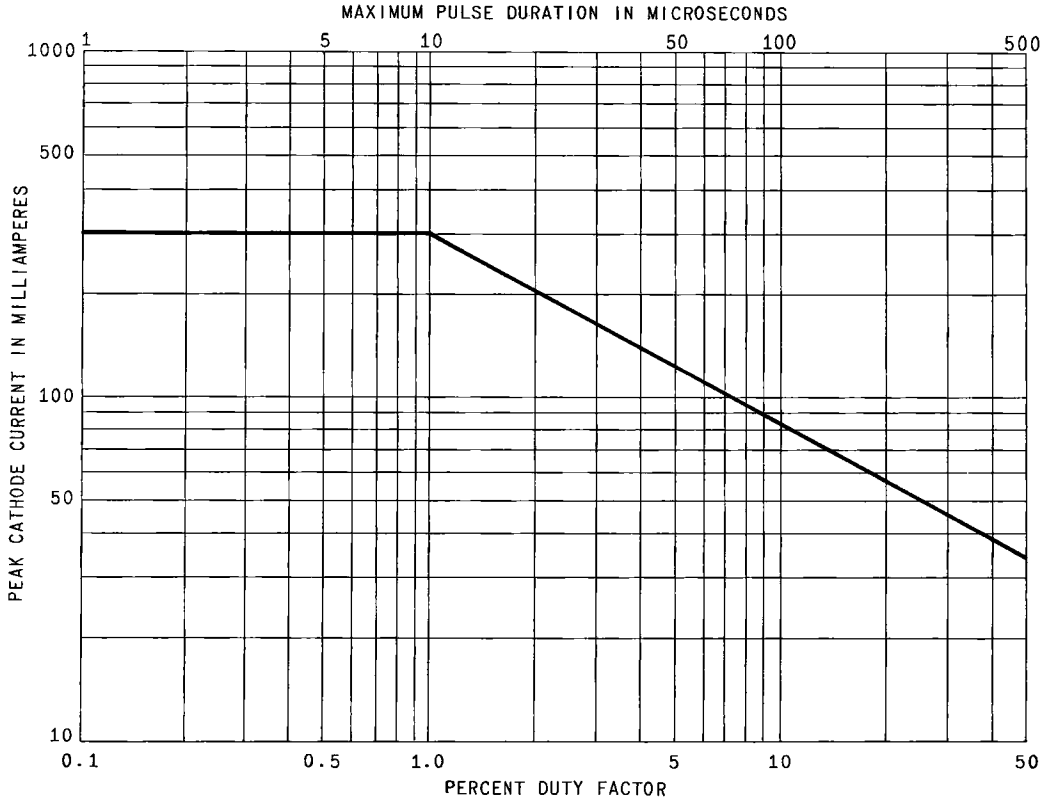
Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.5 volts (paralled heaters; cycled - on 1 minute, off 1 minute), Eb = Ec = 0 volts, and Ehk = +135 volts. Following this test, tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage current.

Pulse Life Test

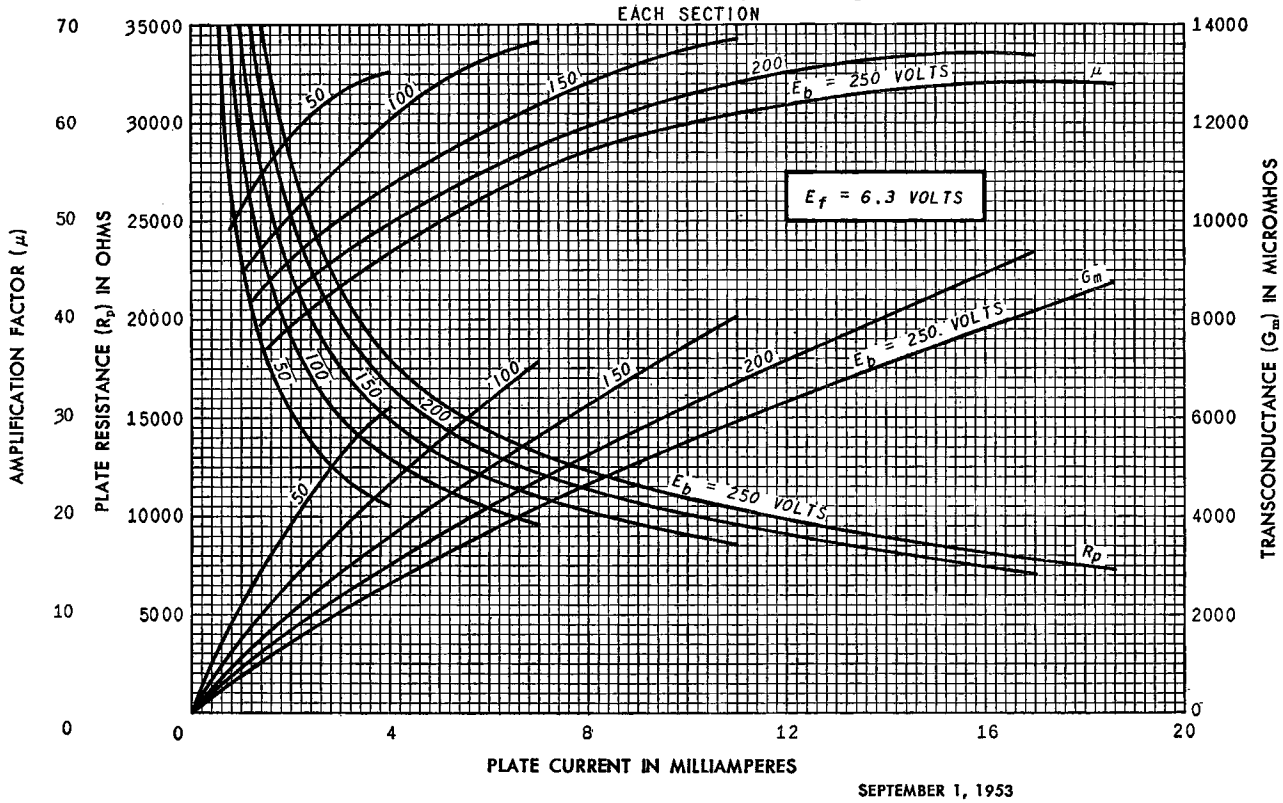
Statistical sample operated for 1000 hours under the following conditions: Ef = 12.6 volts (cycled - on 1 3/4 hours, off 1/4 hour), Ebb = 300 volts, Ec = -30 volts, egk = +30 volts, tp = 10 μsec, prr = 1000 pps, tr = 1.5 μsec, tf = 1.5 μsec, R_L = 150 ohms, and Rg = 22 ohms. Tubes are evaluated, following 500 and 1000 hours of life test, for shorted and open elements, negative grid current, and pulse cathode current. Life test end points are given in "Characteristics Limits" section.

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.



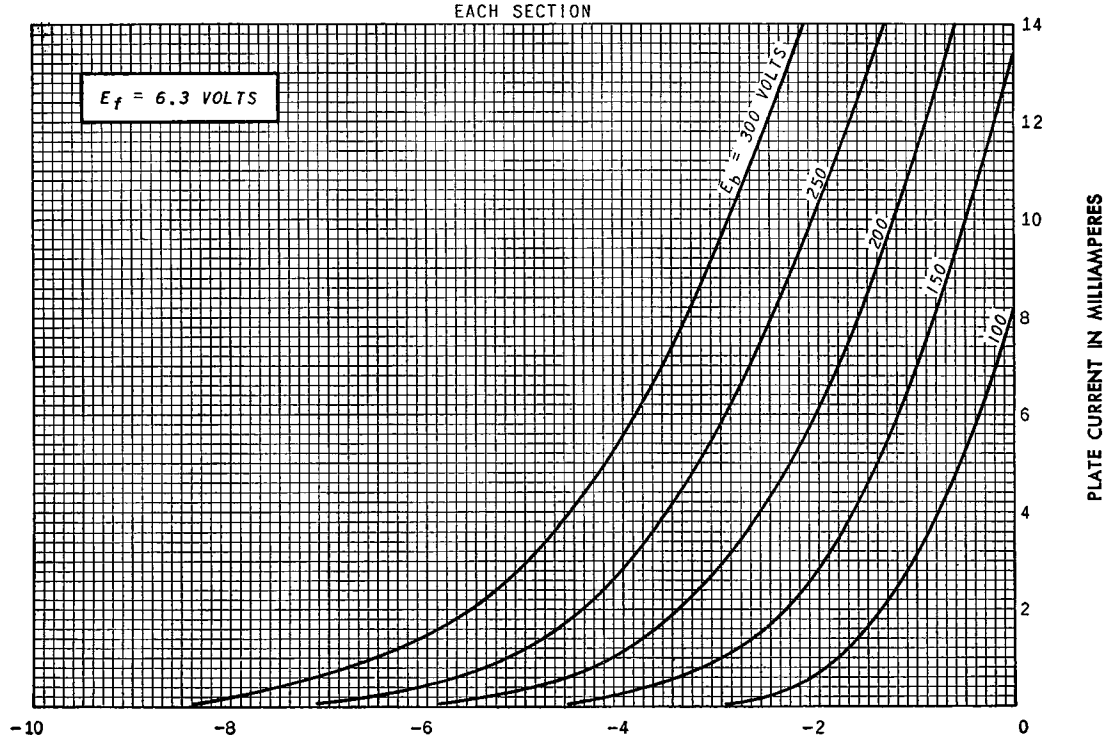
AVERAGE CHARACTERISTICS



SEPTEMBER 1, 1953

AVERAGE TRANSFER CHARACTERISTICS

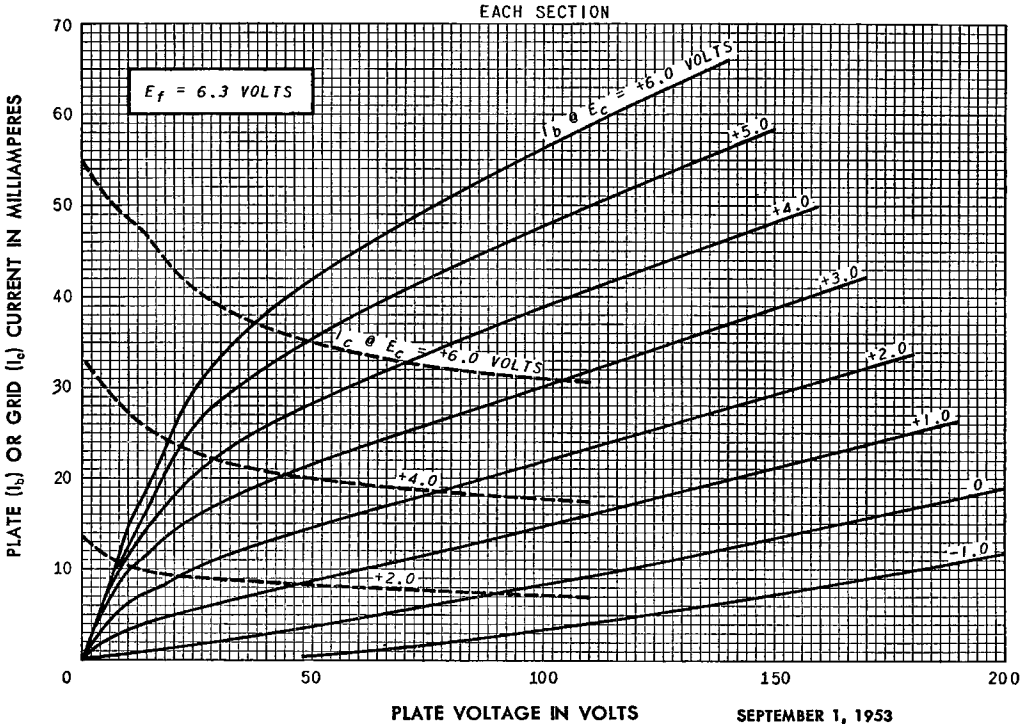
EACH SECTION



SEPTEMBER 1, 1953

AVERAGE PLATE CHARACTERISTICS

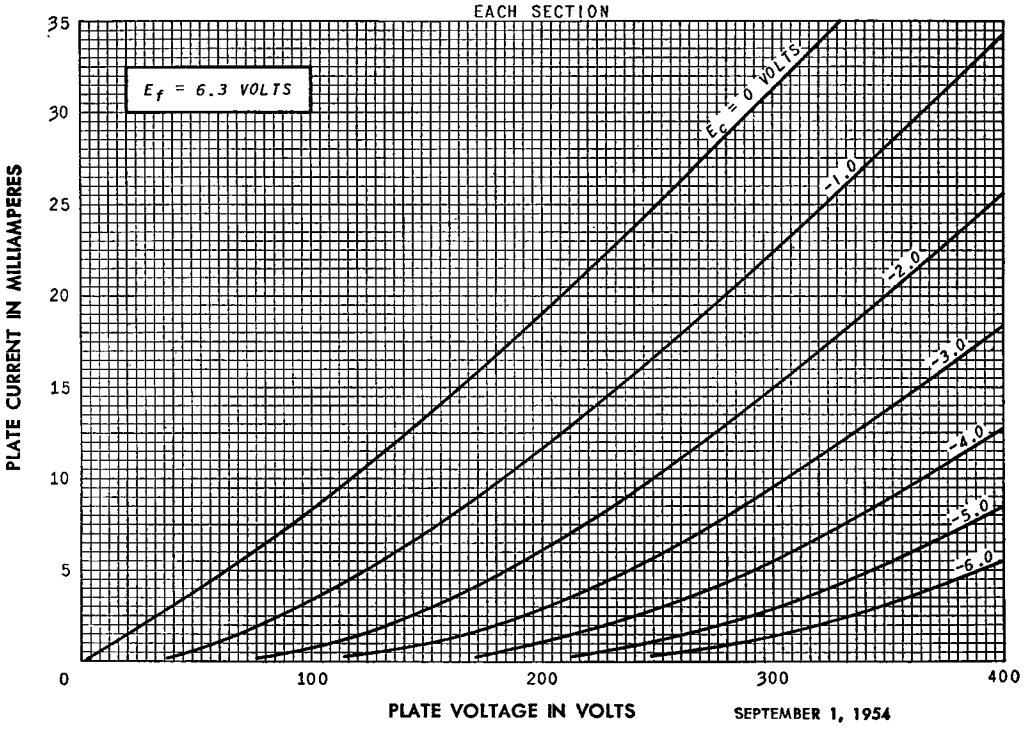
EACH SECTION



SEPTEMBER 1, 1953

AVERAGE PLATE CHARACTERISTICS

EACH SECTION



SEPTEMBER 1, 1954

TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky