Electronic TUBES

5670
TWIN TRIODE
Five-Star Tube
★ ★ ★ ★ ★

FOR GENERAL-PURPOSE APPLICATIONS

MEDIUM MU
9-PIN MINIATURE
SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING
HIGH TRANSCONDUCTANCE

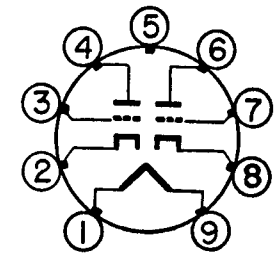
DESCRIPTION AND RATING

The 5670 is a miniature medium-mu twin triode each section of which has a separate cathode connection. The tube is suited for use in a wide-variety of general-purpose amplifier and mixer circuits as well as numerous multivibrator and oscillator applications. The useful operating range extends from low frequencies through the VHF region.

The 5670 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.

Analysis of the electrical characteristics of this tube with those of the 2C51 will indicate that the 5670 is essentially similar.

BASING DIAGRAM

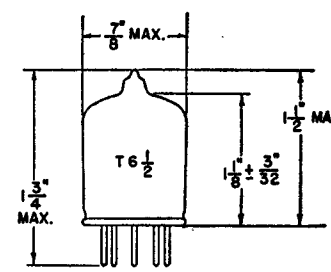


RETMA 8CJ

TERMINAL CONNECTIONS

Pin 1—Heater
Pin 2—Cathode (Section 2)
Pin 3—Grid (Section 2)
Pin 4—Plate (Section 2)
Pin 5—Internal Shield†
Pin 6—Plate (Section 1)
Pin 7—Grid (Section 1)
Pin 8—Cathode (Section 1)
Pin 9—Heater
† It is recommended that Pin 5 be grounded.

PHYSICAL DIMENSIONS



RETMA 6-1

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.35	Amperes
Direct Interelectrode Capacitances*		
Grid to Plate, Each Section	1.1	μμf
Input, Each Section	2.2	μμf
Output, Each Section	1.0	μμf
Grid to Grid	0.0017	μμf
Plate to Plate	0.05	μμf

* Without external shield.

MECHANICAL

Mounting Position—Any
Envelope—T-6½, Glass
Base—E9-1, Small Button 9-Pin

GENERAL ELECTRIC

Supersedes ET-T1083 dated 8-54

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES, EACH SECTION

Plate Voltage	330 Volts
Positive DC Grid Voltage	0 Volts
Negative DC Grid Voltage	−55 Volts
Plate Dissipation	1.35 Watts
DC Grid Current	3.0 Milliamperes
DC Cathode Current	18 Milliamperes
Heater-Cathode Voltage	
Heater Positive with Respect to Cathode	100 Volts
Heater Negative with Respect to Cathode	100 Volts
Grid Circuit Resistance	0.5 Megohms
Bulb Temperature at Hottest Point	165 C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER, EACH SECTION

Plate Voltage	150 Volts
Cathode-Bias Resistor	240 Ohms
Amplification Factor	35
Plate Resistance, approximate	6400 Ohms
Transconductance	5500 Micromhos
Plate Current	8.2 Milliamperes
Grid Voltage, approximate	
Ib = 10 Microamperes	−8 Volts

PUSH-PULL CLASS AB_1 AMPLIFIER

Plate Voltage	300 Volts
Cathode-Bias Resistor	800 Ohms
AF Grid-to-Grid Voltage, RMS	14 Volts
Zero-Signal Plate Current, Each Section	4.9 Milliamperes
Maximum-Signal Plate Current, Each Section	6.3 Milliamperes
Effective Load Impedance, Plate-to-Plate	27,000 Ohms
Total Harmonic Distortion, approximate	10 Percent
Maximum-Signal Power Output	1.0 Watts

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

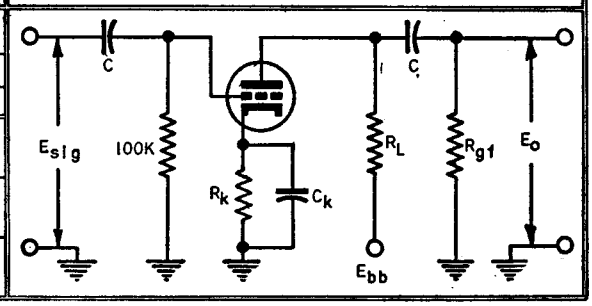
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2000	5.7	20	1200	15	24	900	28	26
0.10	0.24	2400	8.2	21	1500	21	25	1300	37	27
0.24	0.24	4900	7.4	21	3400	18	23	3000	33	25
0.24	0.51	5700	9.7	21	4300	23	24	4200	41	25
0.51	0.51	11000	8.5	20	7800	20	22	7600	36	24
0.51	1.0	13000	10	21	9600	26	23	9200	46	24

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	2600	9.2	20	1500	21	23	1100	38	26
0.10	0.24	3200	12	20	2000	29	24	1500	51	26
0.24	0.24	6200	11	20	4100	25	23	3200	45	24
0.24	0.51	7500	14	21	5000	32	23	4300	55	25
0.51	0.51	13000	12	20	8800	28	22	7100	48	24
0.51	1.0	15000	15	20	11000	34	22	9700	59	24

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	Maximum	
Heater Current				
Ef = 6.3 volts	Initial	330	370	Milliamperes
	500 Hr	330	370	Milliamperes
	1000 Hr	330	370	Milliamperes
Plate Current, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed)	Initial	5.9	10.5	Milliamperes
Plate Current Difference between Sections				
Difference between plate currents for each section at Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed)	Initial	....	1.8	Milliamperes
Transconductance (1), Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed)	Initial	4500	6500	Micromhos
Transconductance Change with Heater Voltage, Each Section				
Difference between Transconductance (1), and Transconductance at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Transconductance (1)	Initial	....	15	Percent
	500 Hr	....	15	Percent
Transconductance Change with Operation, Each Section				
Difference between Transconductance (1) initially and after operation expressed as a percentage of initial value	500 Hr	....	20	Percent
	1000 Hr	....	25	Percent
Average Transconductance Change with Operation, Each Section				
Average of values for "Transconductance Change with Operation"	500 Hr	....	15	Percent
Amplification Factor, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed)	Initial	26	44	
Plate Current Cutoff (1), Each Section				
Ef = 6.3 volts, Ebb = 150 volts, Ec = −10 volts, R_L = 0.25 meg	Initial	....	45	Microamperes
Plate Current Cutoff (2), Each Section				
Ef = 6.3 volts, Eb = 150 volts, Ec = 4.0 volts	Initial	5.0	....	Microamperes
Interelectrode Capacitances				
Grid to Plate (g to p), Each Section	Initial	0.8	1.4	μμf
Input (g to k+h), Each Section	Initial	1.7	2.7	μμf
Output (p to k+h), Each Section	Initial	0.7	1.3	μμf
Plate to Plate (p to p)	Initial	....	0.1	μμf
Measured without external shield.				
Negative Grid Current, Each Section				
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 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	....	7.0	Microamperes
	500 Hr	....	7.0	Microamperes
	1000 Hr	....	7.0	Microamperes
Heater Negative with Respect to Cathode	Initial	....	7.0	Microamperes
	500 Hr	....	7.0	Microamperes
	1000 Hr	....	7.0	Microamperes
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 DC	Initial	100	....	Megohms
	500 Hr	50	....	Megohms
Plate (Each Section) to All at 300 Volts DC	Initial	100	....	Megohms
	500 Hr	50	....	Megohms

CHARACTERISTICS LIMITS CONTINUED ON PAGE 4

CHARACTERISTICS LIMITS (Cont'd)

		Minimum	Maximum	
Vibrational Noise Output Voltage, RMS Ef = 6.3 volts, Ebb = 150 volts, Ec = −3.0 volts, R_L = 2000 ohms, vibrational acceleration = 2.5 G at 25 cps. Sections in parallel	Initial	....	100	Millivolts
Grid Emission Current, Each Section Ef = 7.5 volts, Eb = 150 volts, Ecc = −10 volts, Rg = 0.5 meg	Initial	0	0.5	Microamperes

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, Eb = 150 volts, Rk = 240 ohms, Rg = 0.5 meg, Ehk = 135 volts with heater positive with respect to cathode, and bulb temperature = 165 C minimum.

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in transconductance.

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 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—600 G
Statistical sample subjected to five impact accelerations of 600 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.

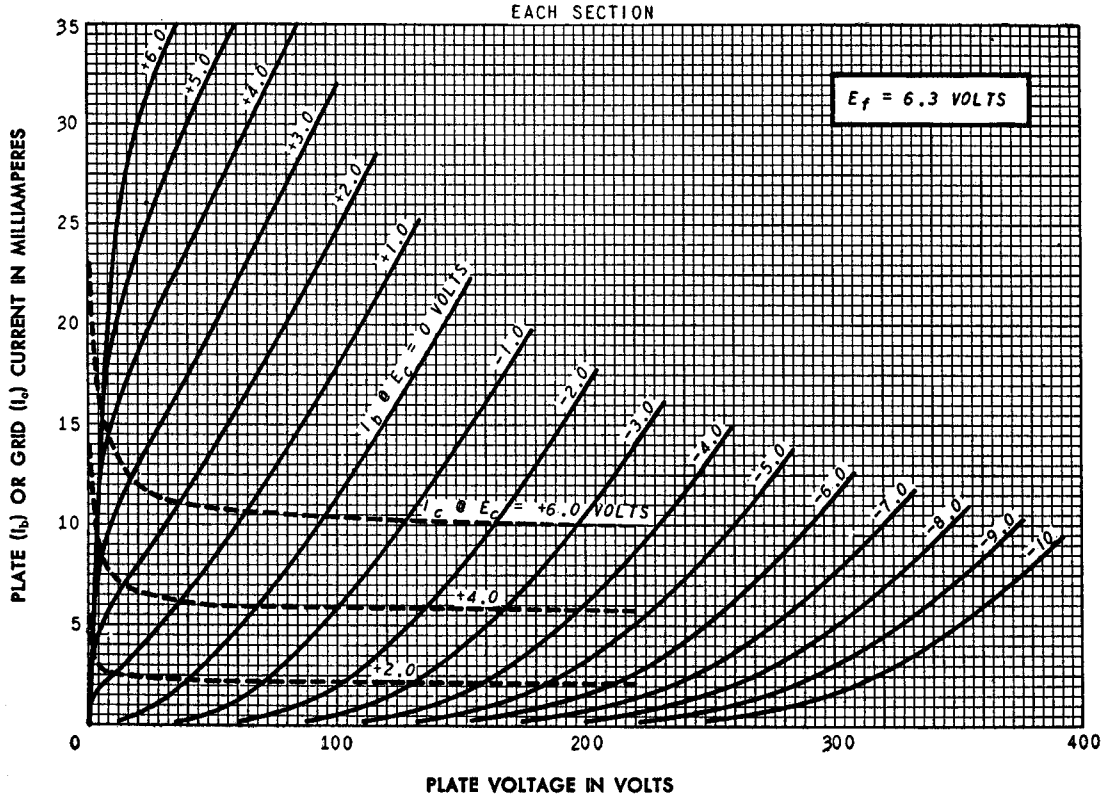
Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

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-1C specification.

AVERAGE PLATE CHARACTERISTICS

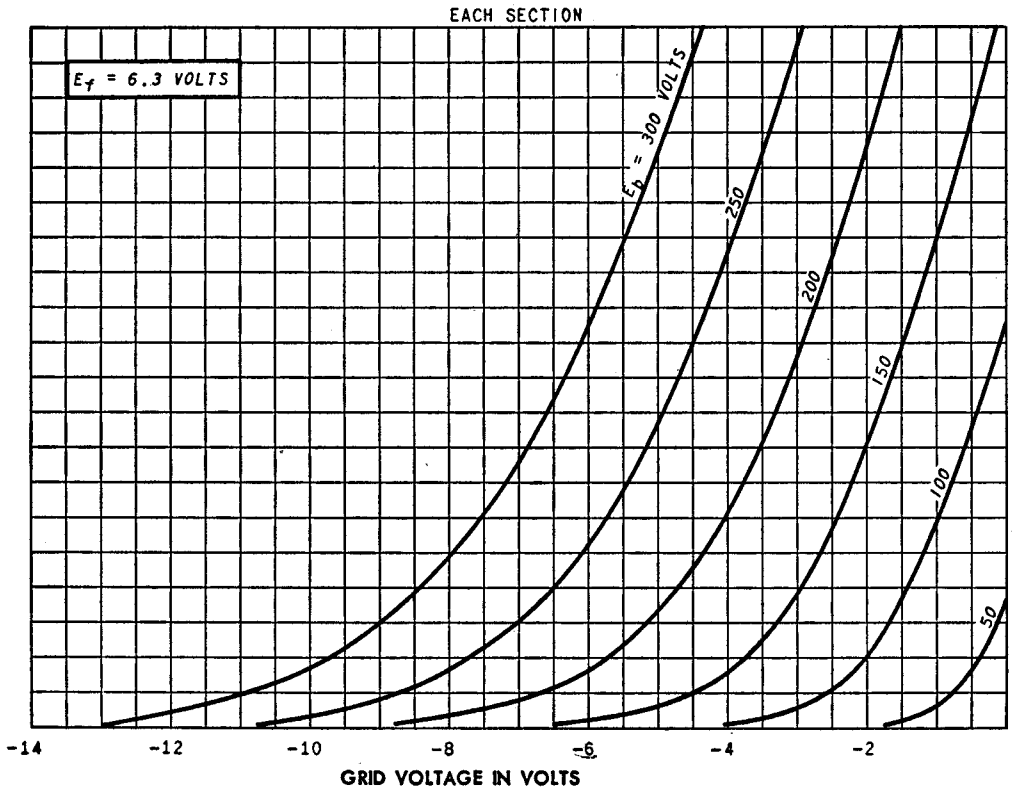
EACH SECTION



APRIL 10, 1953

AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



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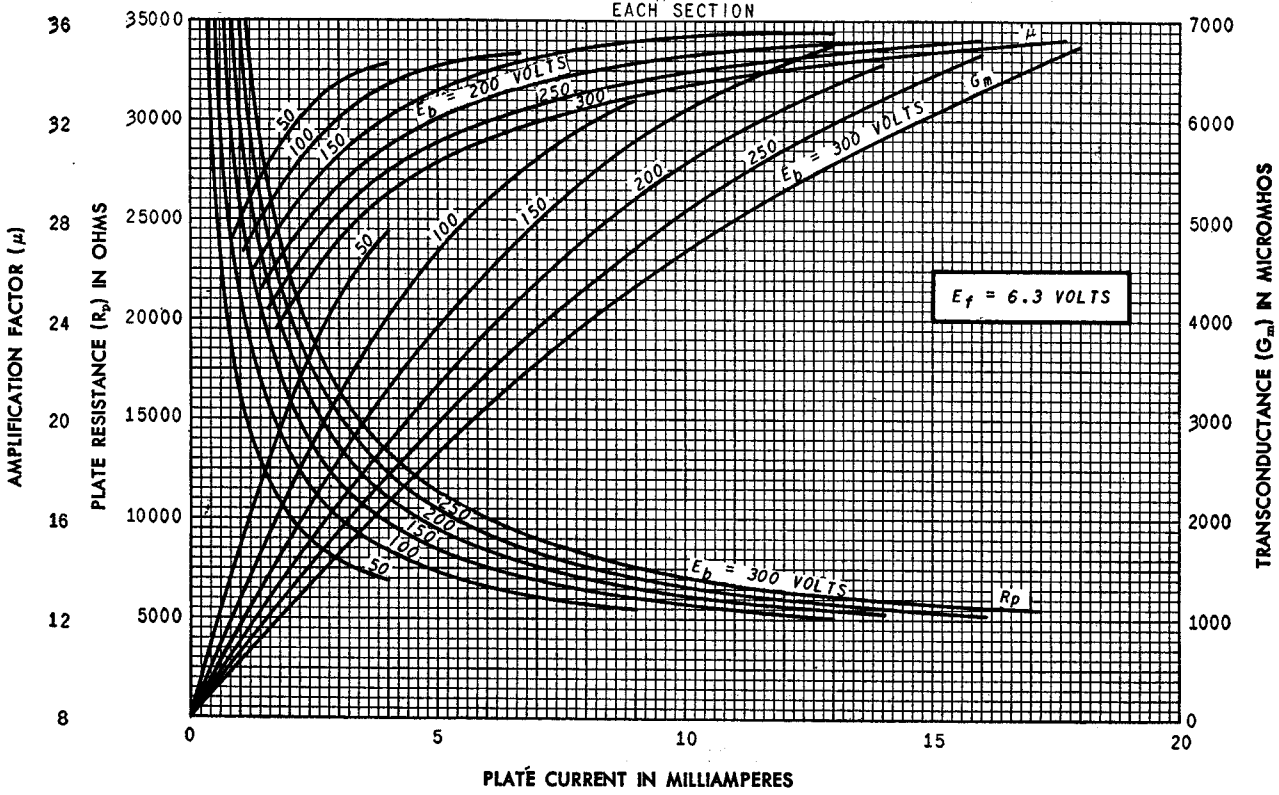
AVERAGE CHARACTERISTICS

EACH SECTION



OCTOBER 9, 1953

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.