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Perkins Electro-Acoustic Research Lab, Inc. ❦ Engineering and Intuition Serving the Soul of Music

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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.

GENERAL

ELECTRICAL

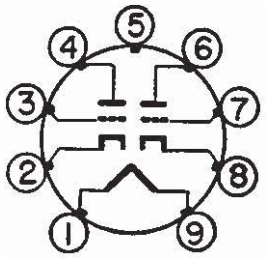
Cathode—Coated Unipotential		
Heater Voltage, AC or DC	6.3 ± 10%	Volts
Heater Current	0.35	Amperes
Direct Interelectrode Capacitances*		
Grid to Plate, Each Section	1.1	μμf
Input, Each Section	2.2	μμf
Output, Each Section	1.0	μμf
Grid to Grid	0.0017	μμf
Plate to Plate	0.05	μμf

* Without external shield.

MECHANICAL

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

BASING DIAGRAM

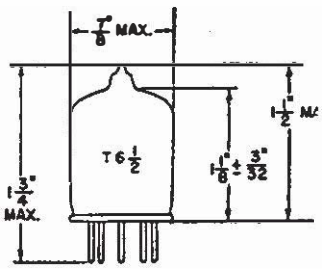


RETMA 8CJ

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 Pi 5 be grounded.

PHYSICAL DIMENSIONS



RETMA 6-1

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)

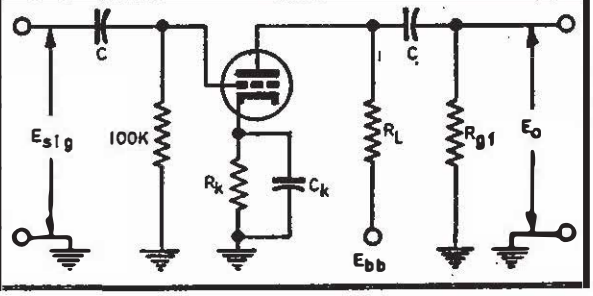
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2000	5.7	20	1200	15	24	900	28	26
0.10	0.24	2400	8.2	21	1500	21	25	1300	37	27
0.24	0.24	4900	7.4	21	3400	18	23	3000	33	25
0.24	0.51	5700	9.7	21	4300	23	24	4200	41	25
0.51	0.51	11000	8.5	20	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	Initiol	....	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), Eoch Section	Initial	1.7	2.7	μμf
Output (p to k+h), Eoch 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.

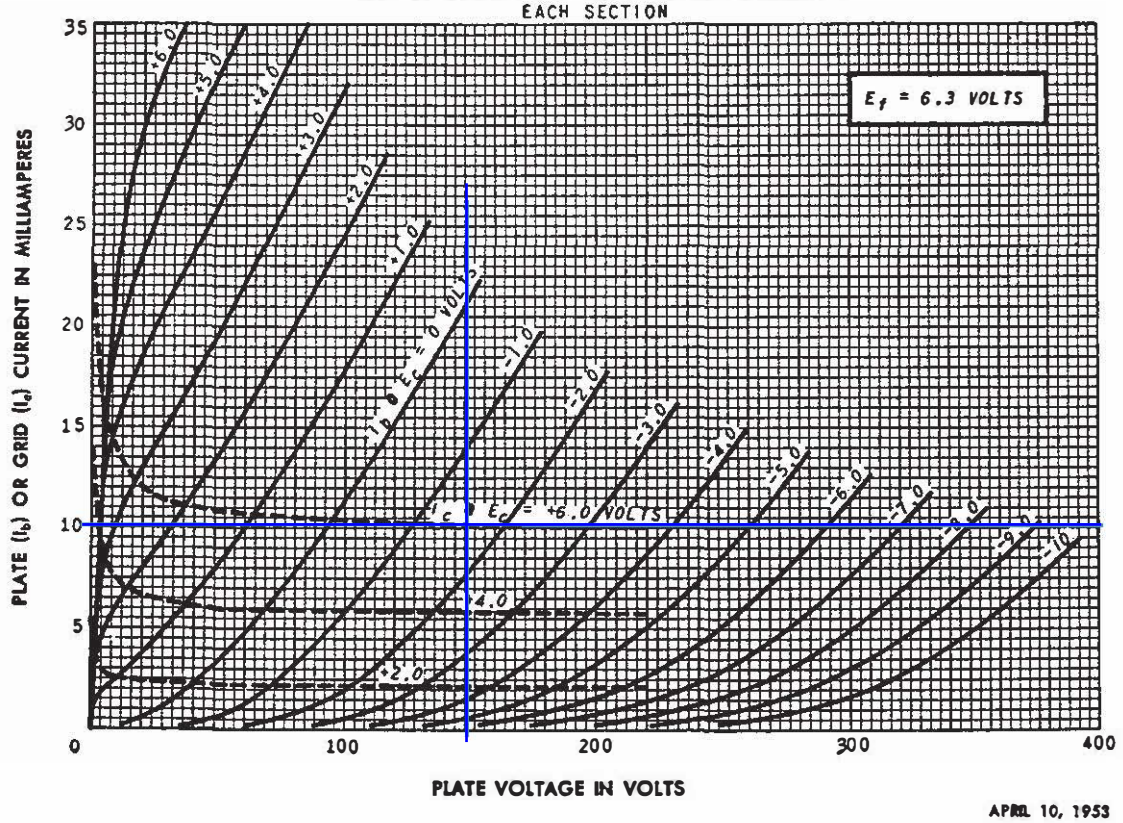
Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

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

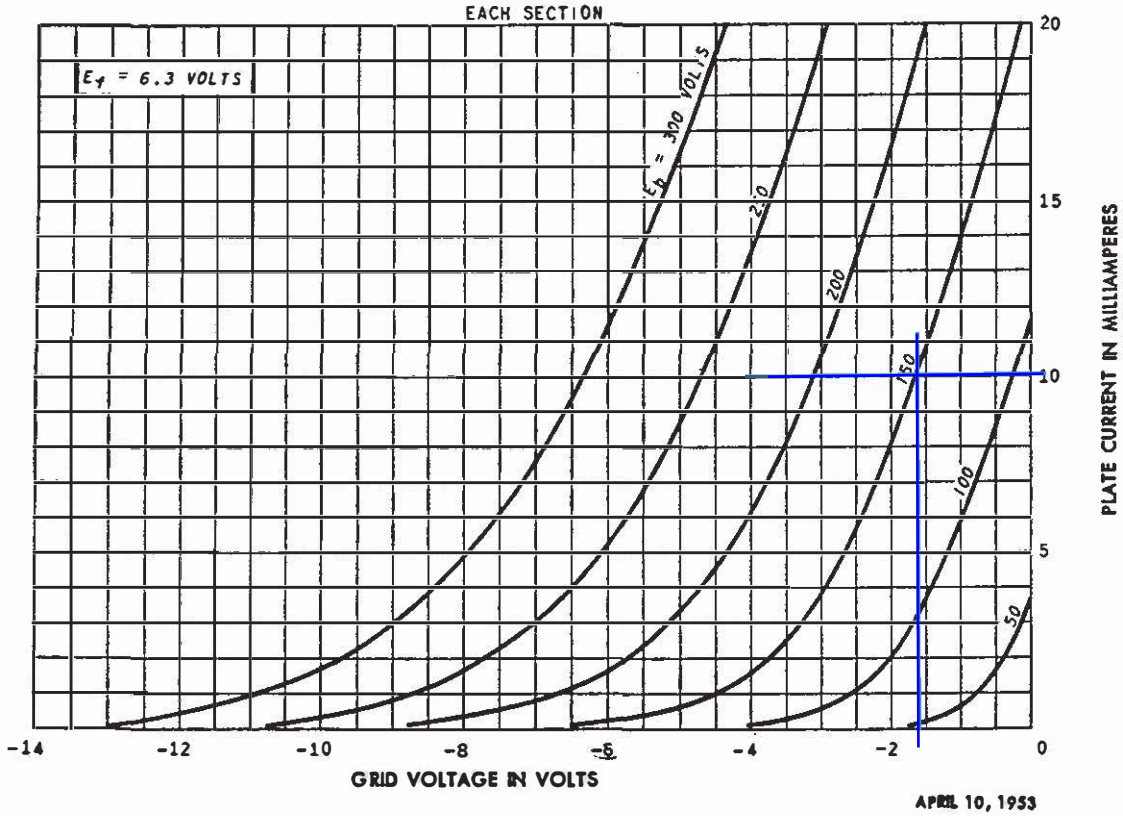
EACH SECTION



APRIL 10, 1953

AVERAGE TRANSFER CHARACTERISTICS

EACH SECTION



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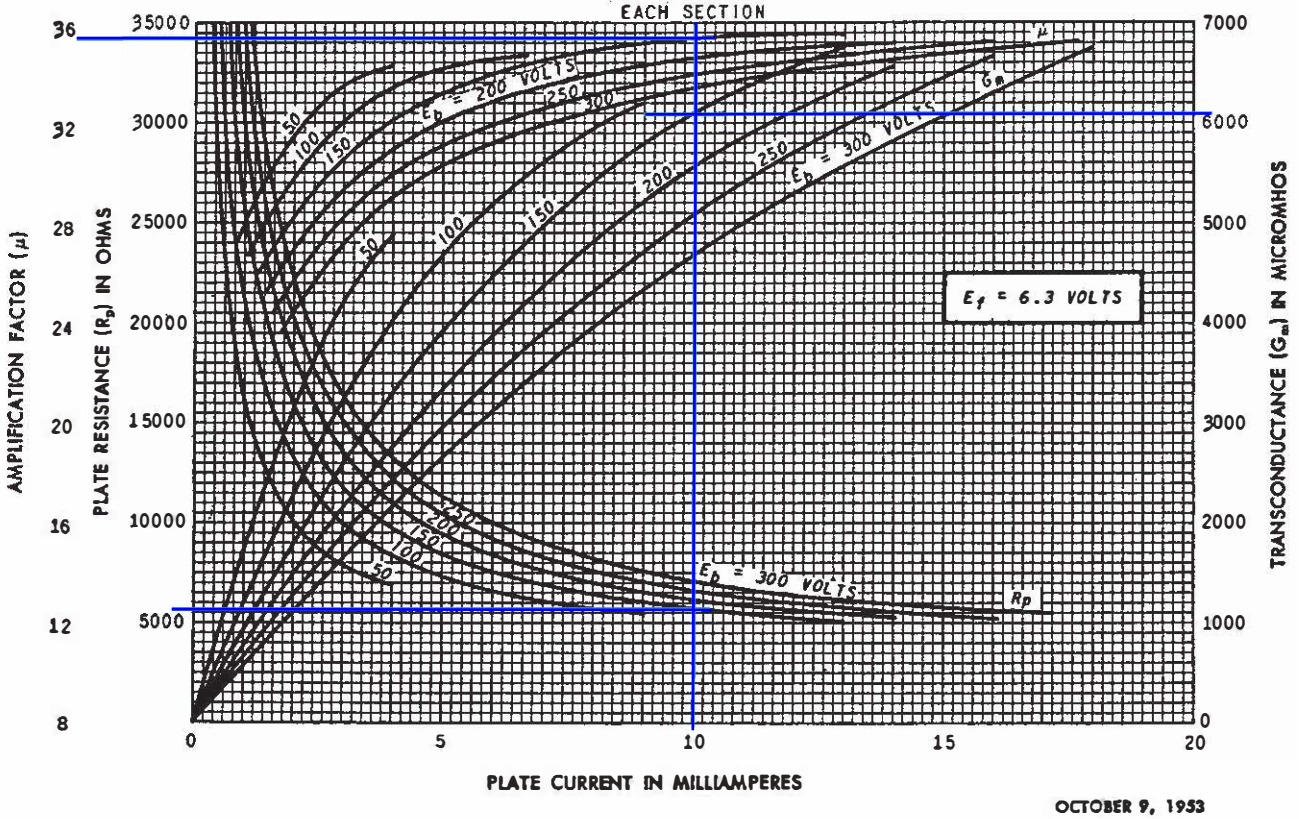
AVERAGE CHARACTERISTICS

EACH SECTION



OCTOBER 9, 1953

ELECTRONIC COMPONENTS DIVISION

GENERAL ELECTRIC

Schenectady 5, N. Y.

★ ★ ★ ★ ★

GL-5670

DESCRIPTION AND RATING

ETX-233A

PAGE 1

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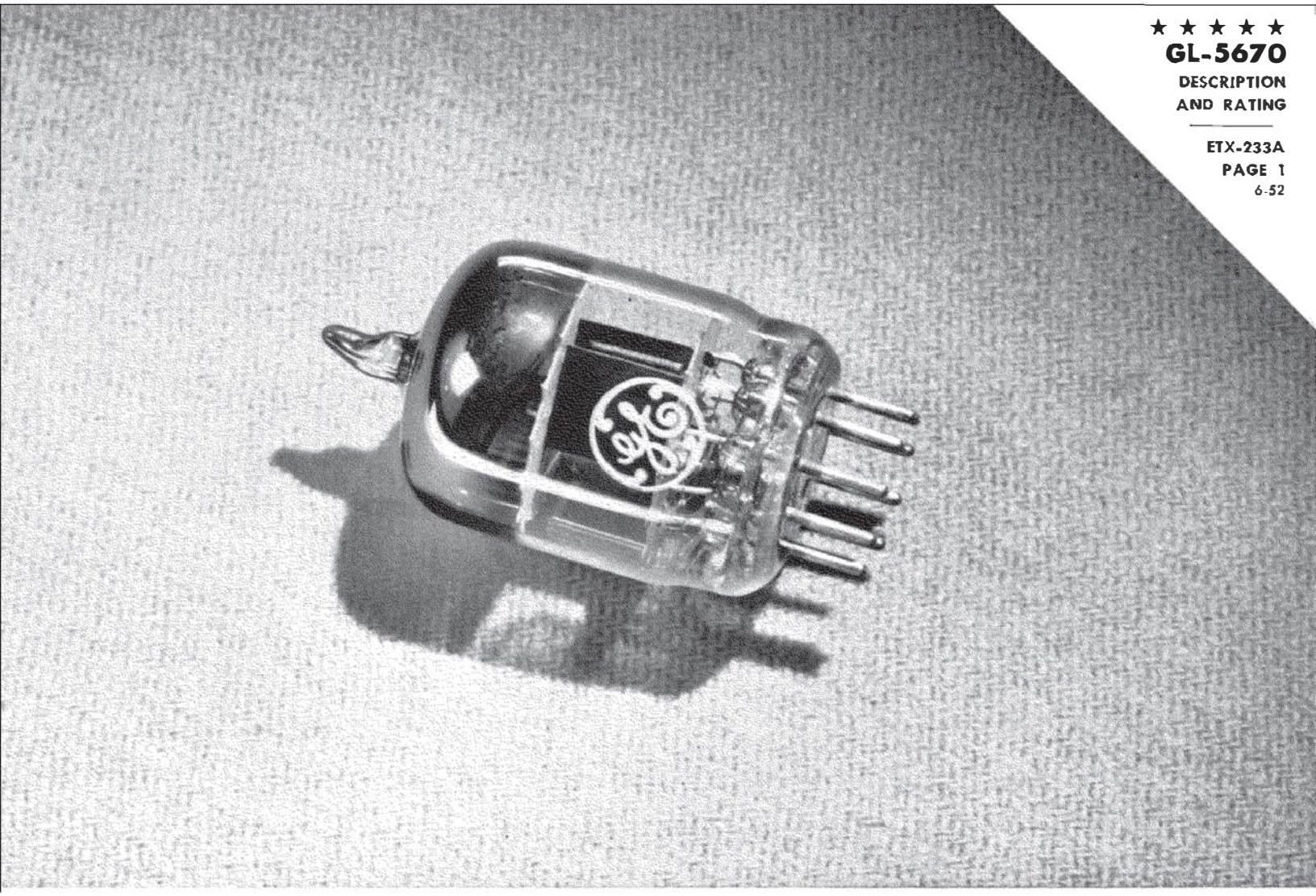


TWIN TRIODE

DESCRIPTION

The GL-5670 is a 9-pin miniature, high-frequency twin triode designed for reliable life under conditions of intermittent operation.

GENERAL

Electrical Data

Cathode—Coated Unipotential

Heater Voltage, a-c or d-c	6.3	Volts
Heater Current	0.350	Ampere

Mechanical Data

Envelope	T-6½	Glass
Base	E9-1 Glass Button	9-pin
Maximum Diameter	⅞	Inch
Maximum Seated Height	1½	Inches
Maximum Over-all Length	1¾	Inches

Mounting Position—Any

Direct Interelectrode Capacitances

Without External Shield

Plate to Grid, Each Section*	1.3	uuf
Plate to Cathode, Each Section*	1.0	uuf
Grid to Cathode, Each Section*	2.2	uuf
Plate to Plate, Nominal	0.05	uuf
Plate to Plate, Maximum	0.10	uuf

* Internal shield and heater connected to cathode.

GE Electronic TUBE

GENERAL ELECTRIC

Supersedes ETX-233 dated 9-49

TECHNICAL INFORMATION (CONT'D)

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Design Center

Each Triode Section

Plate Voltage	300	Volts
Plate Dissipation	1.5	Watts
Plate Current	18	Milliamperes
Heater-Cathode Voltage	90	Volts

Typical Operation

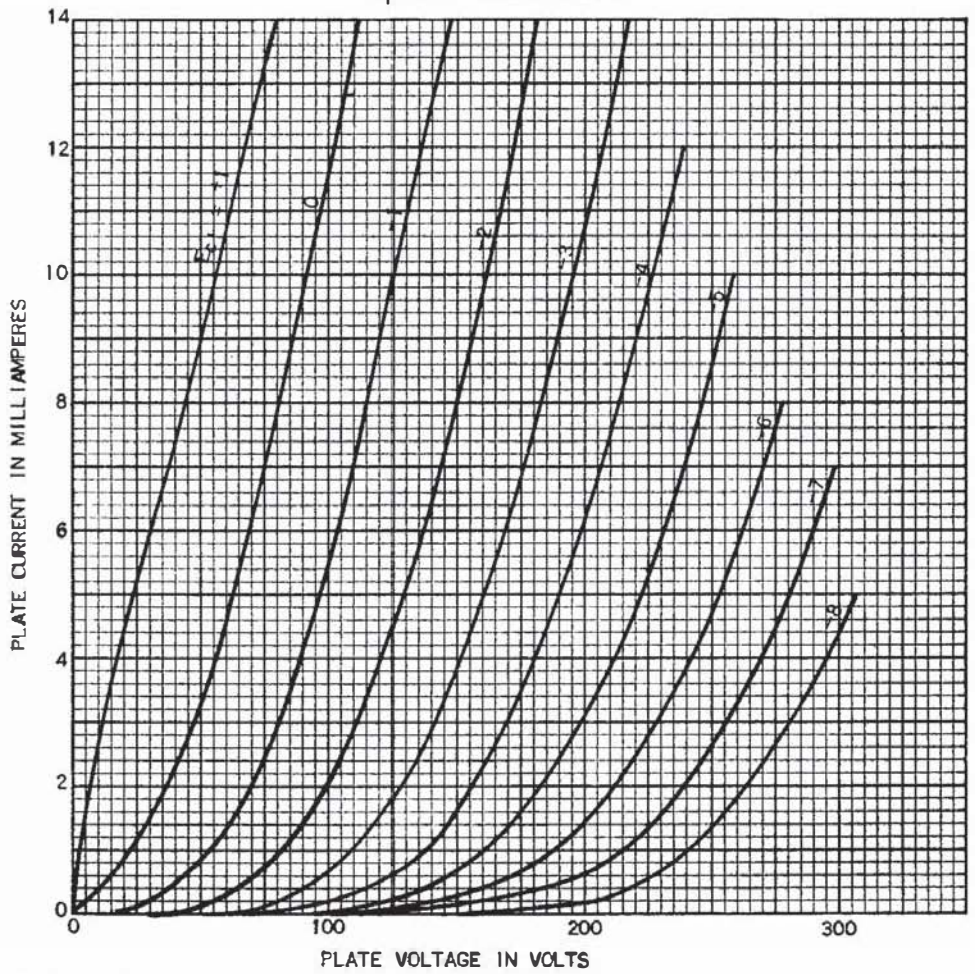
Class A_1 Operation

Plate Voltage	150	Volts
Cathode Resistor, Per Section	240	Ohms
Plate Current, Per Section	8.2	Milliamperes
Transconductance, Per Section	5500	Micromhos
Amplification Factor	35	
Cut-off Grid Voltage, Ib = 75ua approx.	−10	Volts

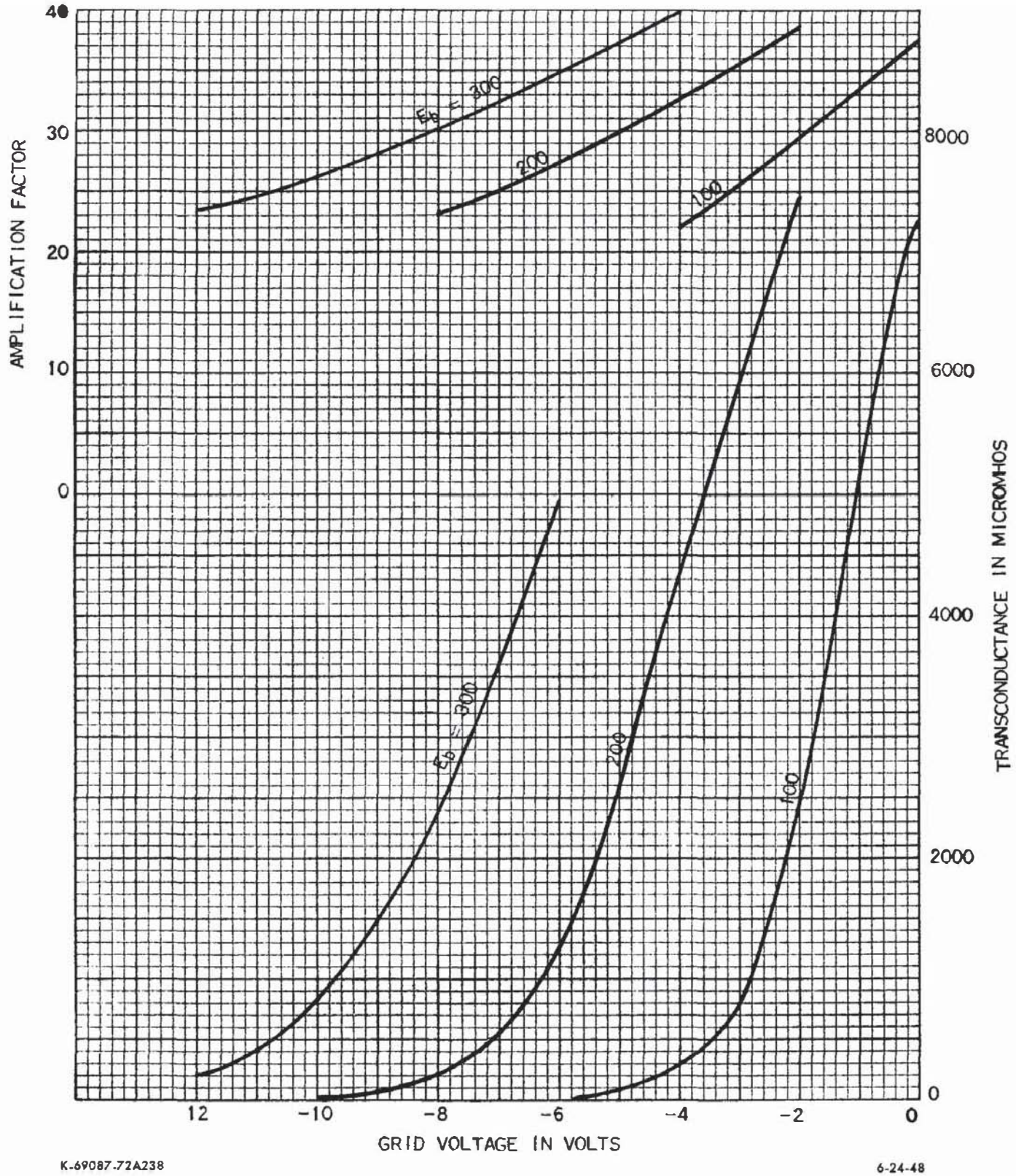
Class AB_1 Operation

Plate Voltage	300	Volts
Cathode Resistor	800	Ohms
A-F Grid-to-Grid Voltage, RMS	14	Volts
Zero-Signal Plate Current, Per Section	4.9	Milliamperes
Maximum-Signal Plate Current, Per Section	6.3	Milliamperes
Load Impedance, Plate-to-Plate	27000	Ohms
Total Harmonic Distortion	10	Per Cent
Maximum-Signal Power Output	1.0	Watt

GL-5670
AVERAGE PLATE CHARACTERISTICS
$E_f = 6.3$ VOLTS A-C



GL-5670
AVERAGE CHARACTERISTICS
$E_f = 6.3$ VOLTS A-C



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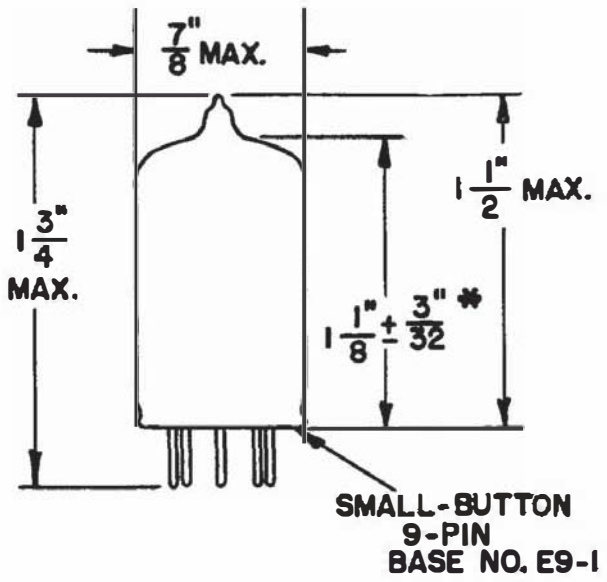
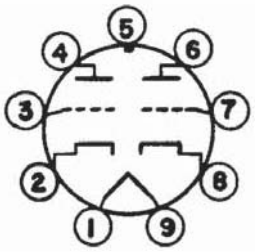
GL-5670 OUTLINE



* MEASURED FROM BASE SEAT TO BULB TOP LINE AS OETERMINED BY RING GAGE OF 7/16" I.D.

BASING DIAGRAM



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

N-15122AZ

6-18-43

Tube Department
GENERAL ELECTRIC
Schenectady, N. Y.

RAYTHEON

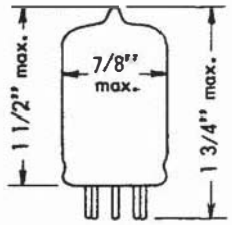
TECHNICAL INFORMATION

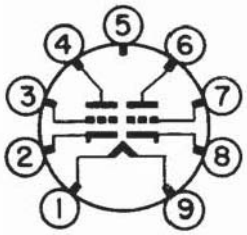
RELIABLE DOUBLE TRIODE

Excellence in Electronics

TYPE CK5670WA

The CK5670WA is a heater-cathode type, double triode of miniature construction, suitable for high frequency and general purpose amplifier service. It is designed for dependable operation under conditions of shock and vibration usually found in mobile and aircraft applications.





MECHANICAL DATA

ENVELOPE: T-6 1/2 Glass

BASE: Miniature Button 9-Pin

TERMINAL CONNECTIONS:

Pin 1 Heater	Pin 6 Plate, Unit #1
Pin 2 Cathode, Unit #2	Pin 7 Grid, Unit #1
Pin 3 Grid, Unit #2	Pin 8 Cathode, Unit #1
Pin 4 Plate, Unit #2	Pin 9 Heater
Pin 5 Internal Shield	

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock-Test-Note 3)	630G
Maximum Vibrational Acceleration (100 hour Fatigue Test-Note 4)	2.5G
Maximum Bulb Temperature	165°C

MOUNTING POSITION: Any

ELECTRICAL DATA

Caution---- To Electron Equipment Design Engineers. Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeapardized if filament voltage ratings are exceeded. Life and reliability of performance are directly related to the degree that regulation of the heater voltage is maintained at its center rated value.

Ratings and Normal Operation:	MIL-E-1B Symbol	Absolute Minimum	Normal Test Conditions (Note 6)	Normal Operation (Note 5)		Absolute Maximum	MIL-E-1B Units
Heater Voltage (Note 7)	Ef:	5.7	6.3	6.3	6.3	6.9	V
Plate Voltage	Eb:		150	150	300	330	Vdc
Grid Voltage	Ec1:		0	0	0		Vdc
Plate Dissipation (per plate)	Pp/p:			1.23	1.4	1.65	W
Heater-Cathode Voltage	Ehk:	-100				+100	Vdc
Plate Current (Note 9) per Plate	Ib/p:			8.2	4.9	18.0	mAdc
Cathode Resistance (per Cathode)	Rk/k:		240	240	800		ohms

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)

In the following tests each unit is tested separately.

Test	Conditions	AQL %	MIL-E-1B Symbol	Min.	LAL	Bogie	UAL	Max.	ALD	MIL-E-1B Units
Acceptance Tests-Group C										
Continuity and Short:		0.4								
Acceptance Tests-Group D	**Combined AQL = 1.0%**									
Heater Current:		0.65	If:	330		350		370		mA

Tentative Data

Printed in U.S.A.

RAYTHEON MANUFACTURING COMPANY
RECEIVING AND CATHODE RAY TUBE OPERATIONS
NEWTON 58, MASS.

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)

In the following tests each unit is tested separately

Test	Conditions	AQL %	MIL-E-1B Symbol	Min.	LAL	Bogie	UAL	Max.	ALD	MIL-E-1B Units
Heater-Cathode Leakage:	Ehk=100 Vdc Heater Positive	0.65	Ihk:					10		μAdc
	Ehk=-100 Vdc Heater Negative		Ihk:					10		μAdc
	Units Connected in parallel									
Grid Current (1):	Rp=0.5 Meg.	0.65	Ic (1):					-0.3		μAdc
Plate Current (1):		0.65	Ib (1):	5.9	7.3	8.2	9.1	10.5	2.0	mAdc
Plate Current (2):	Ec=-10Vdc; Rp=0.25 Meg: Rk=0	0.65	Ib (2):					45		μAdc
Transconductance (1):		0.65	Sm(1):	4500	5125	5500	5875	6500	850	μmhos
Acceptance Tests-Group E										
Insulation of Electrodes:	Ef=6.3V									
	Eg-all=-100 Vdc	2.5	Rg-all:	100						Meg.
	Ep-all=-300 Vdc		Rp-all:	100						Meg.
Plate Current (1) difference between Sections:		2.5	Δlb (1):					2.0		mAdc
Transconductance (2):	Ef=5.7V (Note 8)	2.5	ΔSm(2):					15		%
Rf Noise:	Eb=250Vdc; Ecol=1.1 mVac; Ck=0.2 uf. Units Connected in parallel; Rk=240 ohms:	2.5						3.0		mW
Noise and Microphonics:	Ef=6.3 Vac; Eb=250 Vdc; Rp=10,000 ohms, Units connected in parallel; Rk=240 ohms.	2.5	Ep:					200		mVac
Grid Current (2):	After 5 minutes at Ef=7.0V; measure grid current at Ef=7.0V; 3 min. test not permitted.	2.5	Ic (2):					-0.5		μAdc
Acceptance Tests-Group F										
Vibration (2):	F=25 cps; G=2.5; Ec=-3Vdc; Rk=0; Rp=2000 ohms; Units connected in parallel	6.5	Ep:					100		mVac
Amplification Factor:		6.5	Mu:	26	30	35	40	44	11.0	
Capacitance:			Cgp:	0.8				1.4		μμf
Capacitance:	Note 2	6.5	Cin:	1.7				2.7		μμf
Capacitance:			Cout:	0.7				1.3		μμf
Capacitance:			Cp-p:					0.10		μμf
Low Pressure Voltage Breakdown:		6.5		500						Vac
Acceptance Tests-Group A										
Shock:	Hammer Angle=42°; Note 3									
Fatigue:	96 Hours; Note 4	6.5								
Post Shock and Fatigue Test End Points:										
Vibration (2):	F=25 cps; G=2.5; Rp=2000 ohms units connected in parallel.		Ep:					300		mVac
Heater-Cathode Leakage:	Ehk=+100 Vdc		Ihk:					30		μAdc
	Ehk=-100 Vdc		Ihk:					30		μAdc
	Units connected in parallel.									
Transconductance (1):			Sm(1):	3850						μmhos
Grid Current (1):			Ic (1):					-0.6		μAdc

RELIABLE DOUBLE TRIODE

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)

In the following tests each unit is tested separately.

Test	Conditions	AQL %	MIL-E-1B Symbol	Min.	Max.	MIL-E-1B Units
Acceptance Tests - Group B						
Glass Strain:	(thermal shock)	2.5				
Acceptance Life Tests						
Heater Cycling:	Ef=7.5 V: Ehk=135 Voc; Eb=Ec=0 Vdc; 1 min. on, 1 min. off			2000		cycles
Heater Cycling Life Test End Point:						
Heater-Cathode Leakage:	Heater Positive		Ihk:		20	μAdc
	Heater Negative		Ihk:		20	μAdc
1 Hour Stability Life Test:	TA=Room; Ehk=+135 Vdc; Rg1=0.5 meg.					
1 Hour Stability Life Test End Points:						
Transconductance (1) Change of Individual Tubes from initial:	(Typical sample size=50 tubes)	1.0	ΔSm(1):		10	%
100 Hour Survival Rate Life Test:	TA=Room; Ehk=+135 Vdc; Rg1=0.5 Meg.					
100 Hour Survival Rate Life Test end points:						
Inoperative:	(Typical Sample Size=200 tubes)	0.65				
500 and 1000 Hour Intermittent High Temperature Life Test:	T Bulb=165°C; Ehk=+135 Vdc; Rg1=0.5 Meg.					

Test	Conditions	AQL %	MIL-E-1B Symbol	Min.	Max.	MIL-E-1B Units	Max. defects per Characteristic 1st Sample	Max. defects per Characteristic Combined Sample
500 Hour Intermittent High Temperature Life Test End Points:	(Typical sample sizes=20 tubes 1st sample, 40 tubes 2nd sample) (Total allowable combined defects=4 tubes 1st sample; 8 tubes 1st and 2nd samples)							
Inoperatives:							1	3
Heater Current:			If:	330	370	mA	1	3
Heater-Cathode Leakage:			Ihk:		10	μAdc	1	3
Grid Current (1):			Ic(1):		-0.3	μAdc	1	3
Transconductance (1):			Sm(1):	3850	6500	μmhos	1	3
Transconductance (1) Average change (Note 10):		Avg.	ΔSm(1):		15	%		
Electrode Insulation: (g-all)			Rg-all:	50		Meg	2	5
(p-all)			Rp-all:	50		Meg.		
Transconductance (2) (Note 8):			ΔSm(2)		15	%		
1000 Hour Intermittent High Temperature Life Test End Points:	(Typical Sample Size= 20 tubes 1st sample 40 tubes 2nd sample)							
Inoperatives							2	5
Heater Current			If:	330	370	mA	2	5
Heater-Cathode Leakage			Ihk:		10	μAdc	2	5
Grid Current (1)			Ic(1):		-0.3	μAdc	2	5
Transconductance (1)			Sm(1):	3550	6500	μmhos	2	5

NOTES

Note 1: Characteristics, Quality Control Test Procedures, and Inspection Levels are made according to the appropriate paragraphs of MIL-E-1B "Inspection Instructions for Electron Tubes", and MIL-STD-105A.

RAYTHEON

RELIABLE DOUBLE TRIODE

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)

In the following tests each unit is tested separately.

NOTES (cont'd)

Note 2: Without Shield

Note 3: Test conditions and acceptance criteria per Shock Test procedures of MIL-E-1B basic specifications.

Note 4: Test Conditions and acceptance criteria per Fatigue Test procedures of MIL-E-1B basic specifications.

Note 5: These normal values represent conditions at which control of reliability may be expected.

Note 6: These normal test conditions are used for all characteristics unless otherwise stated under the individual test item.

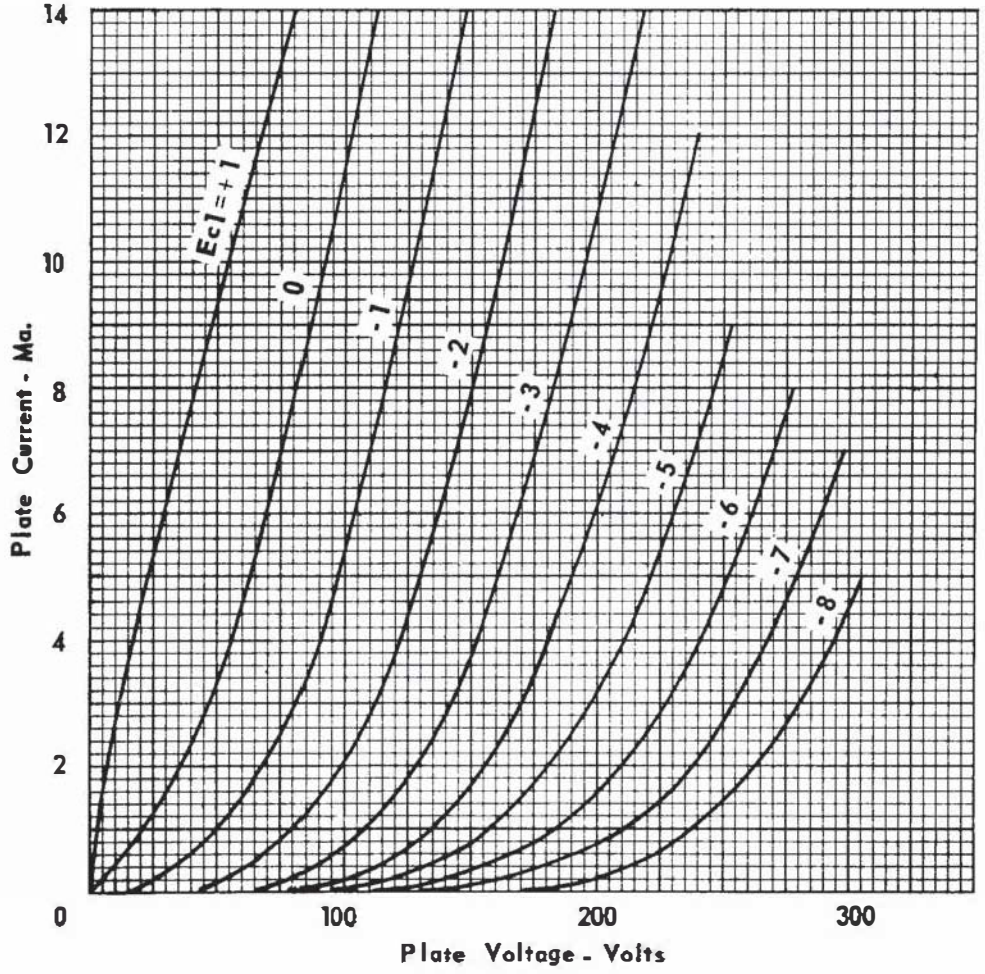
Note 7: For most applications the performance will not be adversely affected by ± 10% heater voltage variation, but when the application can provide a closer control of heater voltage, an improvement in reliability will be realized.

Note 8: Change of transconductance for individual tubes from that value measured at Ef= 6.3 V to that value measured at Ef= 5.7 V.

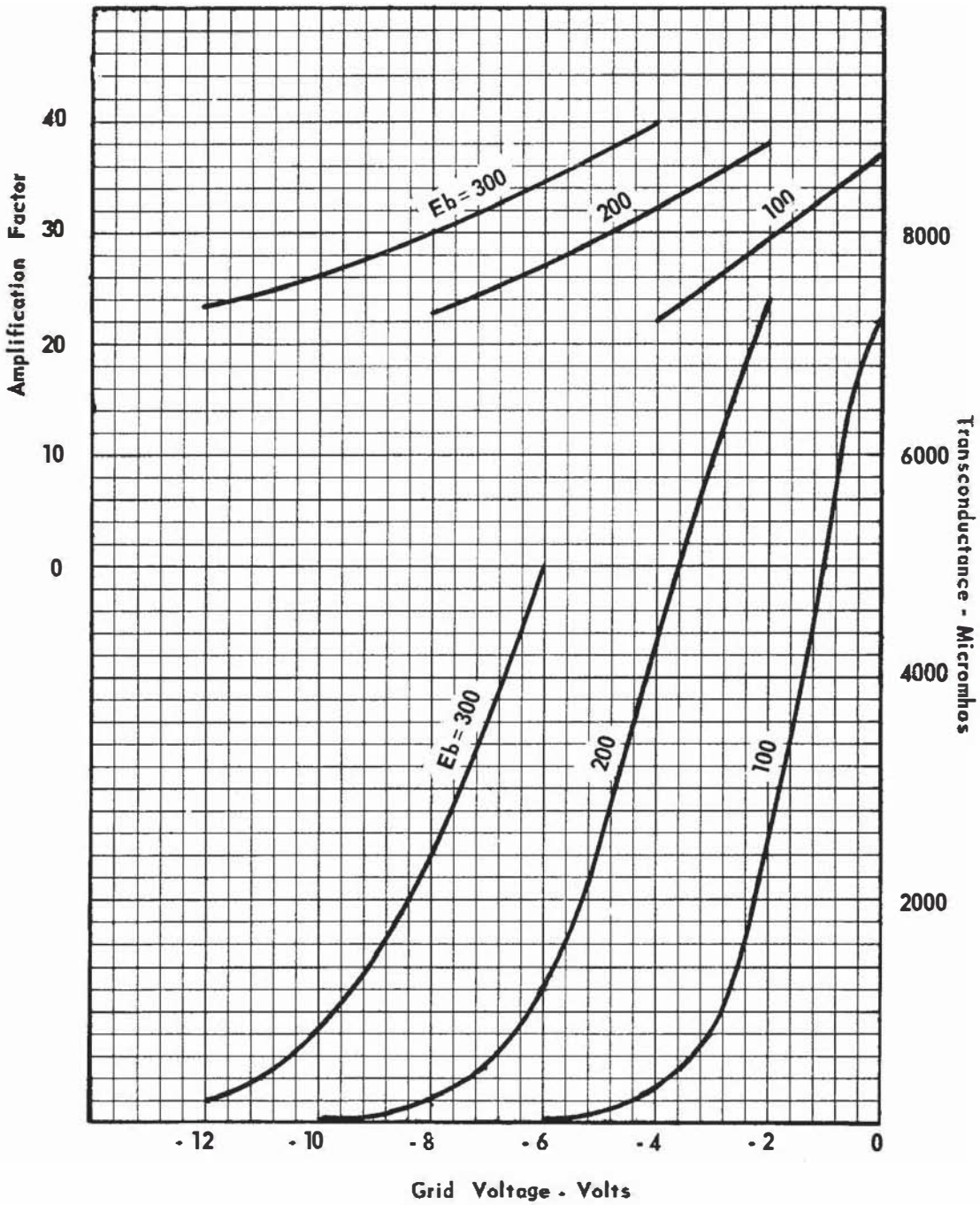
Note 9: Difficulty may be encountered if this tube is operated for long periods of time with very small values of cathode current.

Note 10: The average percentage change shall be ascertained from the determination of the individual changes for each tube (inoperatives excluded) from the zero hour value for the referenced characteristics

AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS



TUNG-SOL

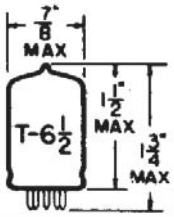
TWIN TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.35 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB

BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

8CJ

THE 5670WA IS A RUGGEDIZED, MEDIUM MU, TWIN TRIODE OF THE NINE-PIN MINIATURE CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT WITH A SHIELD BETWEEN SECTIONS BROUGHT OUT TO A SEPERATE BASE PIN. THE 5670WA MAY BE USED IN SUCH GENERAL PURPOSE APPLICATIONS AS AMPLIFIER, MIXER, OSCILLATOR AND MULTIVIBRATOR CIRCUITS OVER A FREQUENCY RANGE OF AF. THROUGH VHF. IT MAY ALSO BE OPERATED AS AN OSCILLATOR AT FREQUENCIES AS HIGH AS 800 MC IN AN OPEN-CIRCUITED RESONANT LINE OSCILLATOR WHEN THE TWO TRIODE SECTIONS ARE CONNECTED IN PARALLEL. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, TRANSCONDUCTANCE AND AMPLIFICATION FACTOR ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5670WA IS ESPECIALLY SUITED FOR USE IN MILITARY AND INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
PLATE TO GRID (EACH SECTION)[A] (RATED)	1.1	μμf
MAXIMUM	1.4	μμf
MINIMUM	0.8	μμf
OUTPUT (RATED)	1.0	μμf
MAXIMUM	1.3	μμf
MINIMUM	0.7	μμf
INPUT (RATED)	2.2	μμf
MAXIMUM	2.7	μμf
MINIMUM	1.7	μμf
MAXIMUM PLATE TO PLATE (RATED)	0.10	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION, EACH SECTION	1.65	WATT
MAXIMUM HEATER-CATHODE VOLTAGE	±100	VOLTS
MAXIMUM DC CATHODE CURRENT, EACH SECTION[AA]	18	mAdc

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.35	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR (EACH SECTION)	240	OHMS
PLATE CURRENT (EACH SECTION)	8.2	mA
TRANSCONDUCTANCE (EACH SECTION)	5 500	μMHOS
AMPLIFICATION FACTOR	35	
GRID VOLTAGE (APPROX.)		
FOR Ib = 10 μa	−8	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D.

CLASS AB_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.35	AMP.
PLATE VOLTAGE	300	VOLTS
CATHODE RESISTOR	800	OHMS
AF GRID TO GRID VOLTAGE (RMS)	14	VOLTS
ZERO-SIGNAL PLATE CURRENT (EACH SECTION)	4.9	mA
MAXIMUM SIGNAL PLATE CURRENT (EACH SECTION)	6.3	mA
LOAD IMPEDANCE (PLATE-TO-PLATE)	27 000	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.0	WATT

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef = 6.3v, Eb = 150Vdc, Ec = 0Vdc, Rk/k = 240 OHMS
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	330	370	---	---	330	370	mA
HEATER-CATHODE LEAKAGE[B] (E_{hk} =±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (R_g =0.5 meg.)	0	-0.3	---	---	0	-0.3	μAdc
PLATE CURRENT (1)	5.9	10.5	7.3	9.1	---	---	mAdc
PLATE CURRENT (2) (Ec = 10Vdc, R_p=0.25 meg., R_k =0)	---	45	---	---	---	---	μAdc
TRANSCONDUCTANCE (1)	4500	6500	5125	5875	3850	6500	μMHOS
Δ AVG. TRANSCONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES[C] (Ef=6.3V, E(g-all)= 100Vdc, g negative; E(p-all)= 300Vdc, p negative)							
R(g-all)	100	---	---	---	50	---	MEGOHM
R(p-all)	100	---	---	---	50	---	MEGOHM
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS	---	2.0	---	---	---	---	mAdc
TRANSCONDUCTANCE (2)[D] (Ef = 5.7V)	---	15	---	---	---	15	PERCENT
GRID CURRENT (2)[E] (Ef = 7.0V)	0	-0.5	---	---	---	---	μAdc
AMPLIFICATION FACTOR	26	44	30	40	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[H] (R_p=2000, R_k=0, E_{c1}=-3Vdc)	---	100	mVac
VIBRATIONAL FATIGUE[F]	---	---	
SHOCK[G] (HAMMER ANGLE =42°, E_{hk}=100Vdc, HEATER POSITIVE, R_g=0.1 meg.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	300	mVac
HEATER-CATHODE LEAKAGE	---	±30	μAdc
TRANSCONDUCTANCE (1)	3850	---	μMHOS
GRID CURRENT (1)	0	-0.6	μAdc
GLASS STRAIN[J]	---	---	
CONTINUITY AND SHORT[K]	---	---	
RF NOISE LBM[M] (E_p=250Vdc, E_{cal}=1.1 mVac, C_k=0.2 μf)	---	3.0	mW

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL REQUIREMENTS — CONT'D.

	MIN.	MAX.	
NOISE AND MICROPHONICS[NBMP] (E_f=6.3Vac, E_{hk}=0, E_{bb}=250Vdc, E_{ci}=0, R_p=10,000)	---	200	mVac
LOW FREQUENCY VIBRATION[QB] (E_c =-3Vdc, Rk=●, R_p=2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[R] (PRESSURE =55±5mm mercury, temp=25±5°C, HUMIDITY=0, VOLTAGE=500Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST INTERMITTENT LIFE TEST CONDITIONS	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
1●● HOUR SURVIVAL RATE LIFE TEST INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
HEATER CYCLING LIFE TEST (Ef=7.5V, E_{hk}=135Vdc, HEATER POSITIVE, E_c=E_b=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER—CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST (E_{hk}=135Vdc, HEATER POSITIVE, R_g=●.5 meg, min. BULB TEMPERATURE =+165°C)	---	---	

NOTES

[A] INTERNAL SHIELD AND HEATER CONNECTED TO CATHODE.

[AA] DIFFICULTY MAY BE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] TIE 1p TO 2p, 1g TO 2g, 1k TO 2k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM PERMITTED.)

[C] SEE MIL-E-1C 4.8.2

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

[E] PRIOR TO TEST TUBES TO BE PREHEATED FIVE (5) MINUTES AT FOLLOWING CONDITIONS. TEST IMMEDIATELY AFTER PREHEATING. Ef = 7.0V, E_{c1} =0 Vdc, R_k = 240 OHMS, E_b = 150Vdc, R_g = 0.5 MEG.

[F] SEE MIL-E-1C 4.9.20.6

[G] SEE MIL-E-1C 4.9.20.5

[H] SEE MIL-E-1C 4.9.20.3

[J] GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST TWO (2) LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

[K] SEE MIL-E-1C 4.7.5

[L] SEE MIL-E-1C 4.10.3.1

[M] TIE CATHODES TOGETHER AND GROUND THRU A 240 OHM RESISTOR. GRIDS ARE GROUNDED.

[N] SEE MIL-E-1C 4.10.3.5

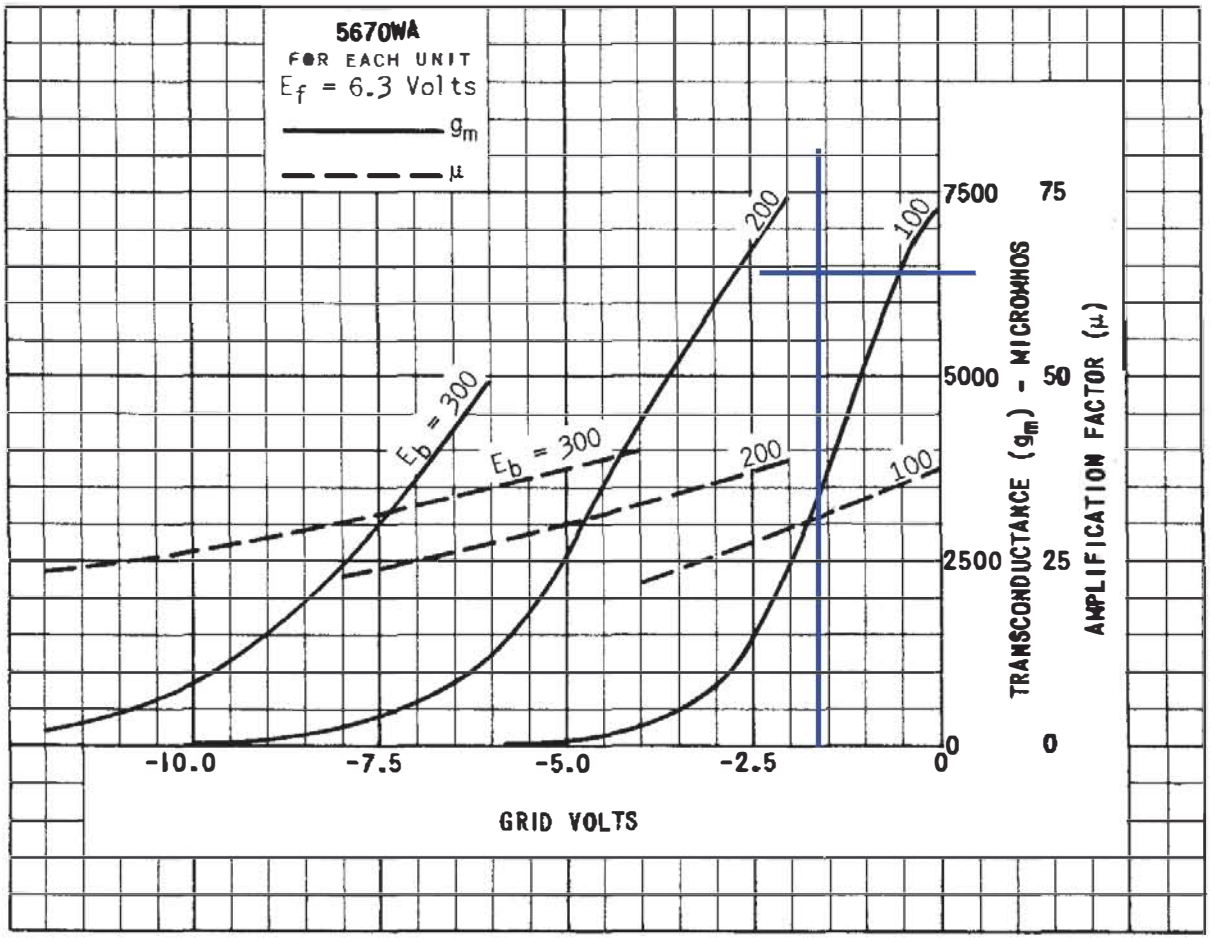
[P] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

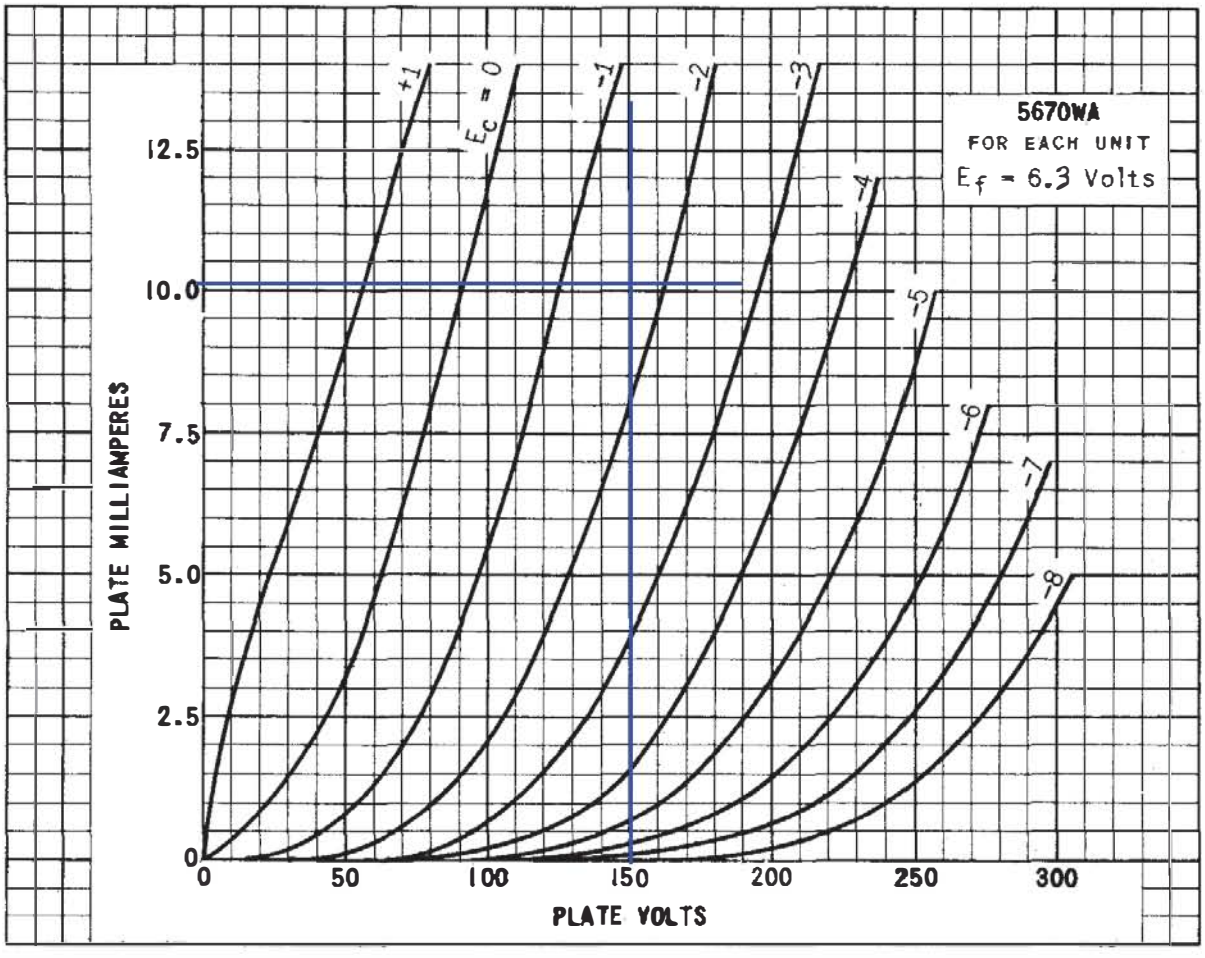
[Q] SEE MIL-E-1C 4.9.20.4

[R] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

5670WA

PREMIUM TUBE

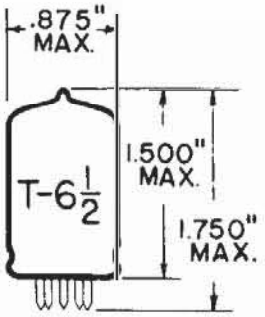




TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



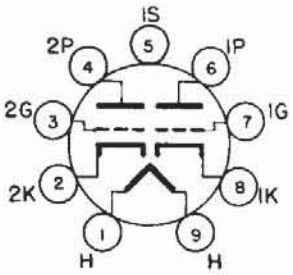
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-1

COATED UNIPOTENTIAL CATHODE

FOR

APPLICATIONS IN THE LOW TO VHF FREQUENCY RANGE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8CJ

THE 2C51 COMBINES TWO INDEPENDENT AND SHIELDED, MEDIUM-MU, INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN AMPLIFIER, MIXER, OSCILLATOR, MULTIVIBRATOR AND CLAMP CIRCUITS. THE USEFUL RANGE EXTENDS FROM LOW FREQUENCIES THROUGH THE VHF RANGE.

→ DIRECT INTERELECTRODE CAPACITANCES

EACH SECTION

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	1.3[A]	1.3	pf
INPUT: G TO (H+K+I.S.)	2.3[A]	2.2	pf
OUTPUT: P TO (H+K+I.S.)	1.3[A]	1.0	pf
PLATE TO PLATE	0.03[B]	0.04	pf

A
PIN #5 & EXTERNAL SHIELD #315 CONNECTED TO CATHODE PIN OF SECTION UNDER TEST. ELEMENTS OF OTHER SECTION GROUNDED.

B
PIN #5 & EXTERNAL SHIELD #315 CONNECTED TO GROUND WITH OTHER ELEMENTS.

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		90	VOLTS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN CENTER VALUES – SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	300	VOLTS
PLATE POSITIVE DC GRID VOLTAGE*	0	VOLTS
PLATE DISSIPATION	1.5	WATTS
CATHODE CURRENT	18	MA.
GRID CIRCUIT RESISTANCE*	1	MEGOHM

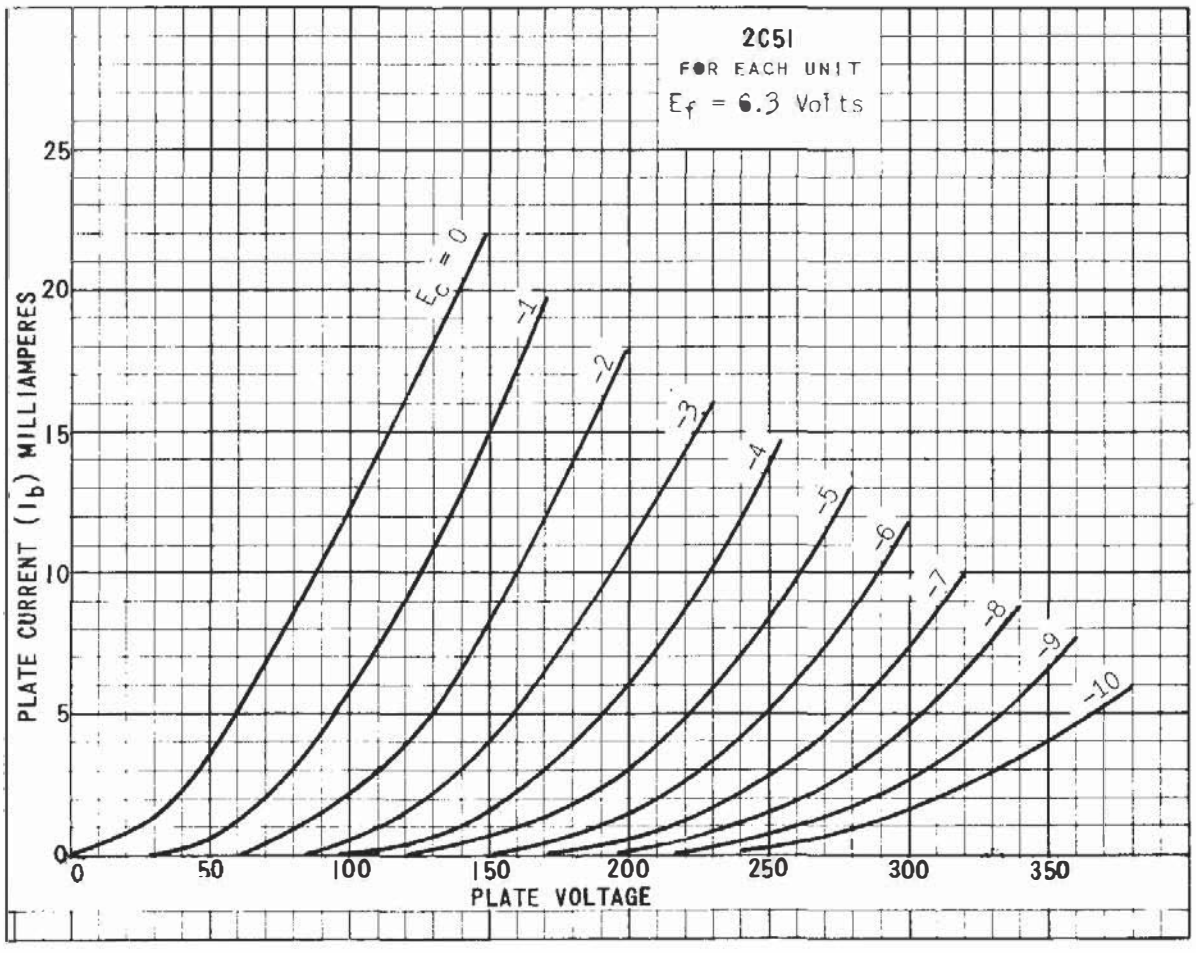
→ TYPICAL OPERATING CHARACTERISTICS

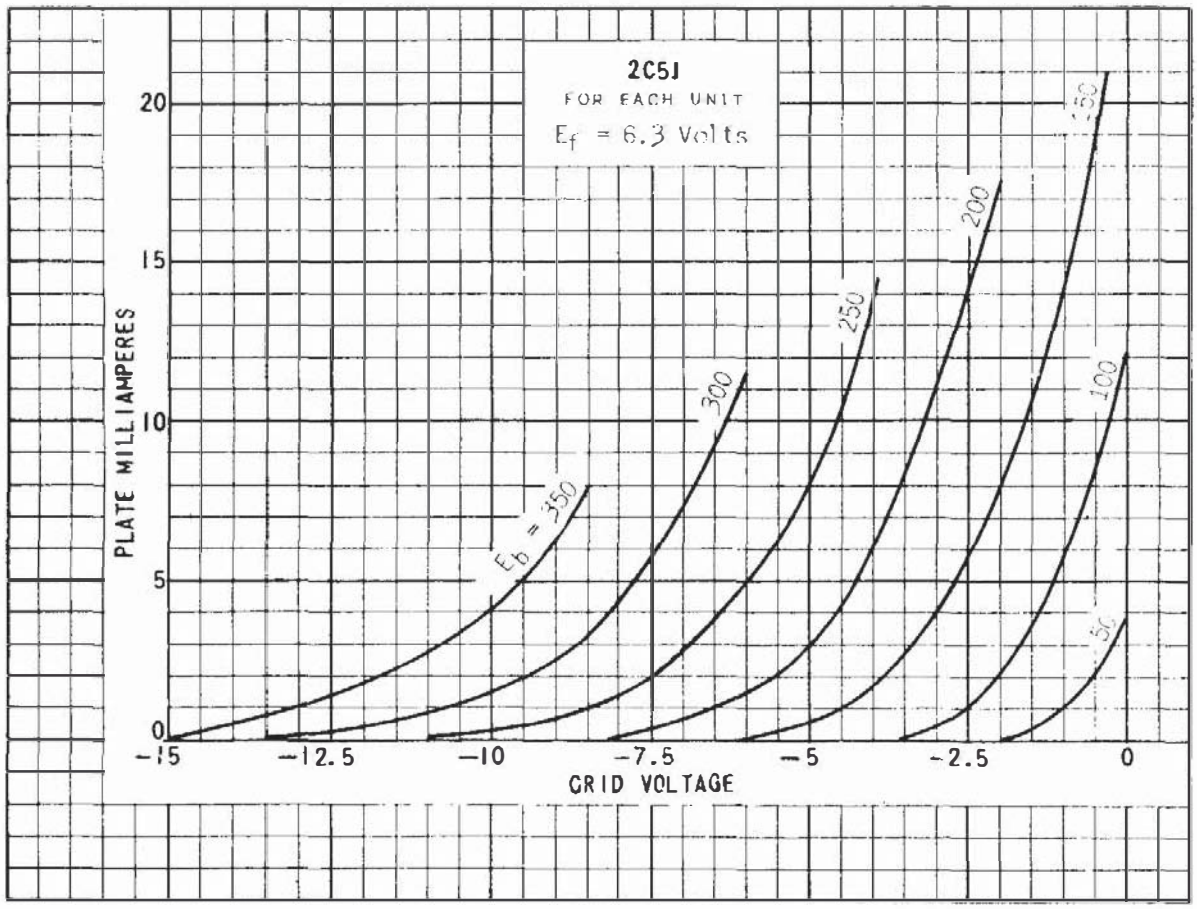
CLASS A_1 AMPLIFIER

EACH SECTION

PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	240	OHMS
PLATE CURRENT	8.2	MA.
PLATE RESISTANCE (APPROX.)	6500	OHMS
TRANSCONDUCTANCE	5500	µMHOS
AMPLIFICATION FACTOR	35	
GRID #1 VOLTAGE FOR Ib = 10 µA	−8	VOLTS

*INDICATES AN ADDITION.
→ INDICATES A CHANGE.





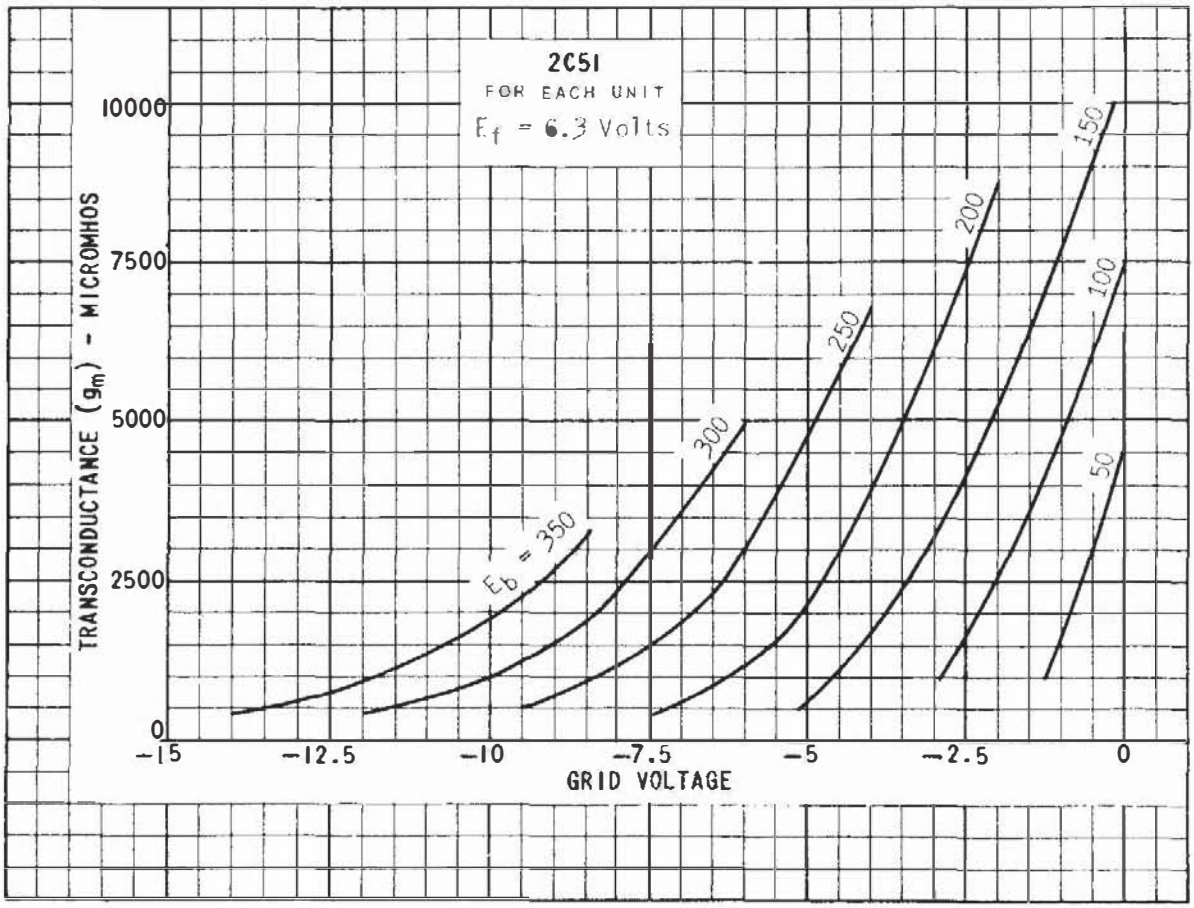


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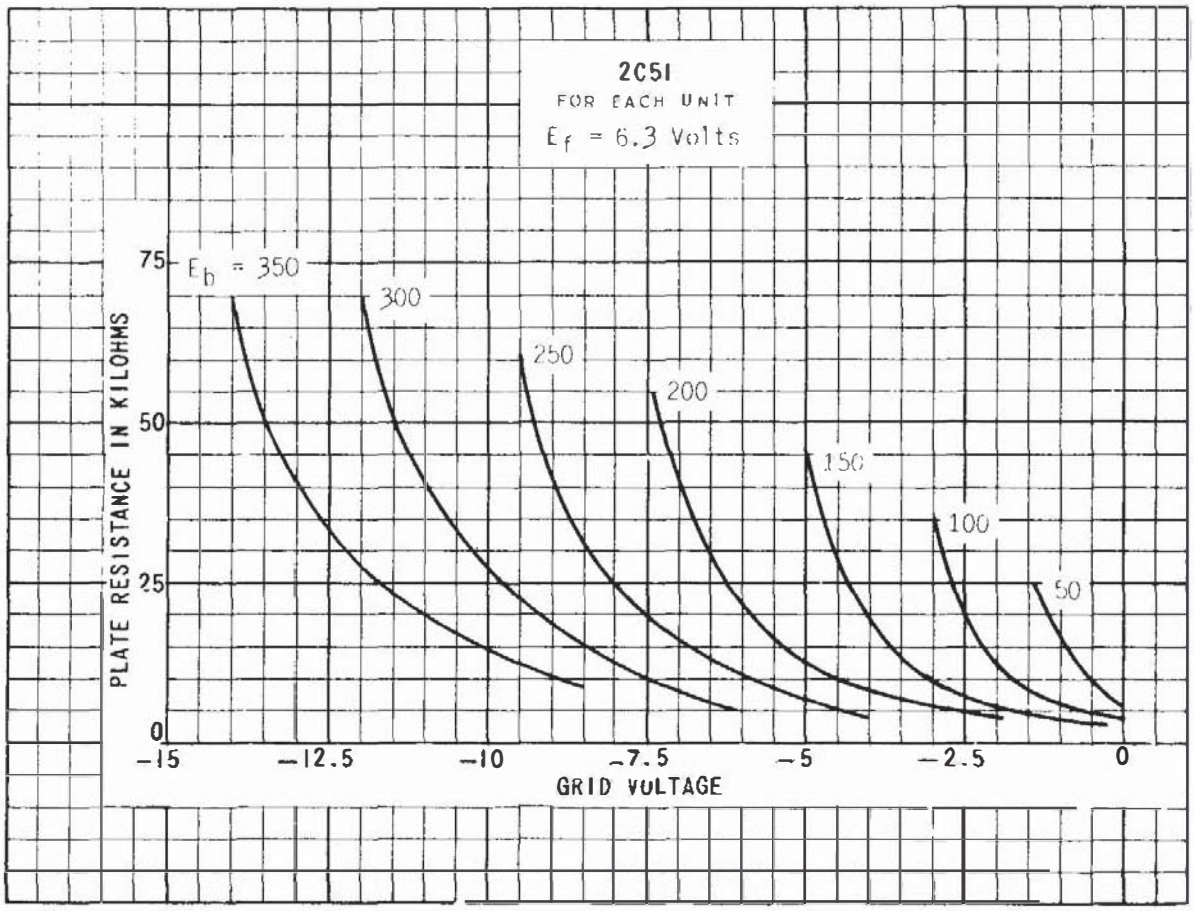
PLATE
2645
MAY 1
1951

2C51



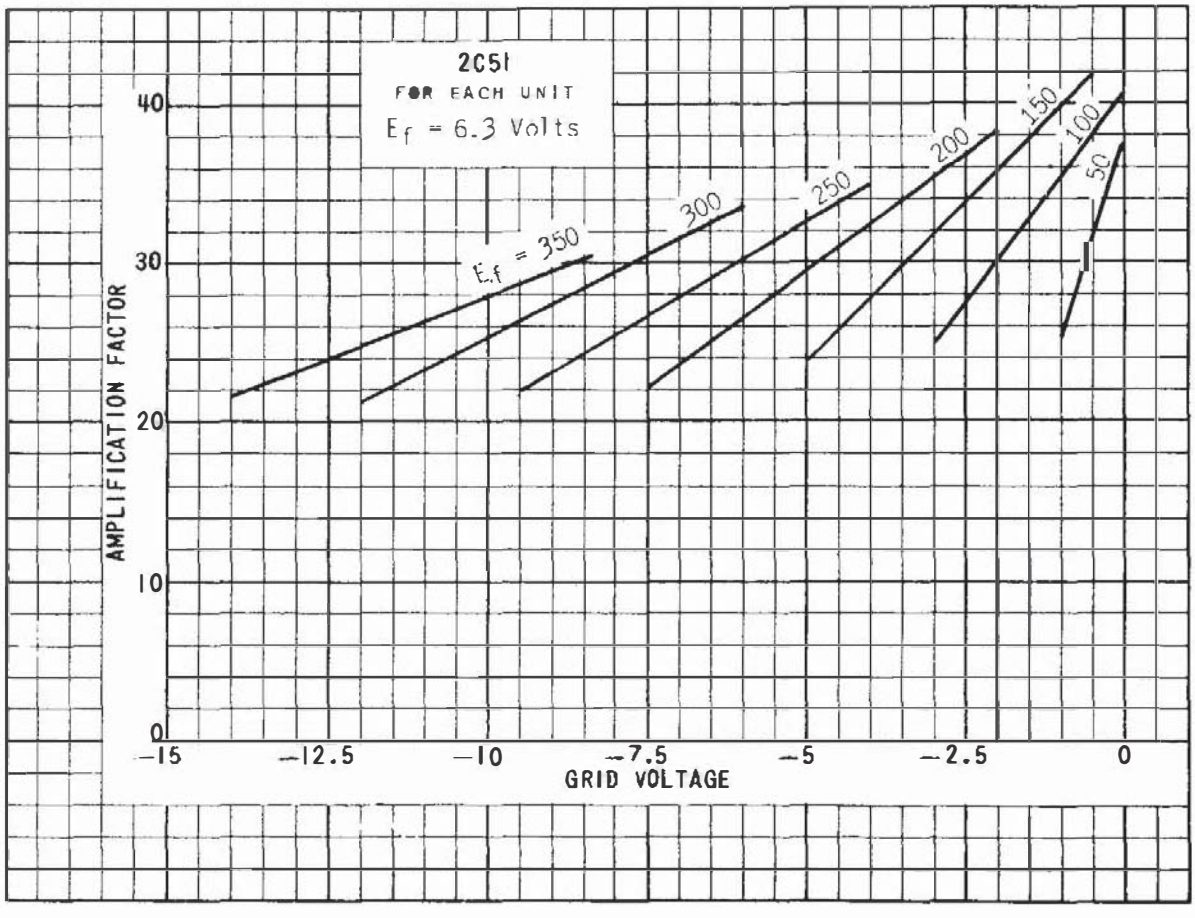
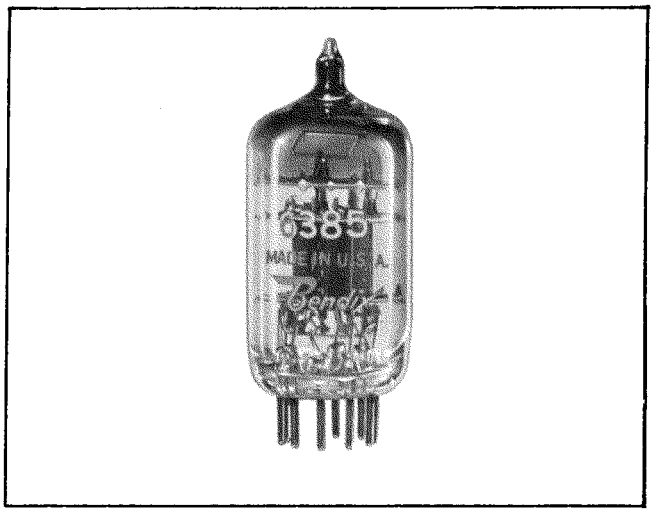


PLATE
2646
MAY 1
1951

 ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U. S. A.

6385
Bendix Type TE-21
(Generic Type 5670)

RELIABLE MINIATURE DOUBLE TRIODE



RATINGS*

Heater voltage—(AC or DC)**	6.3 volts
Heater current	0.50 amps
Plate voltage—(max.)	300 volts
Max. peak plate current (per plate)	25 mA
Max. plate dissipation (per plate)	1.5 watts
Max. peak grid voltage	+0 volts —100 volts
Max. heater-cathode voltage	300 volts
Max. grid resistance	1.0 megohm
Warm-up time	25 sec.
Life expectancy***	10,000 hrs.

(Plate and heater voltage may be applied simultaneously)

*To obtain greatest life expectancy from tube, avoid designs where the tube is subject to all maximum ratings simultaneously.

**Voltage should not fluctuate more than ± 5%.

***See application notes.

PHYSICAL CHARACTERISTICS

Base	Miniature button 9-pin
Bulb	T-6½
Max. overall length	2 3/16 in.
Max. seated height	1 15/16 in.
Max. diameter	7/8 in.
Mounting position	Any
Max. bulb temp.	160°C
Max. altitude****	80,000 ft.

****See Altitude Rating Chart on page 3.

DESCRIPTION

This miniature nine-pin double triode is one of the Bendix Red Bank line of reliable vacuum tubes specifically designed for aircraft and industrial applications where freedom from early failure, long average service life, and uniform operating characteristics are extremely important. It is intended to replace the 2C51 or the 5670 in applications where reliability is the primary consideration. Each tube is given a 45-hour run-in under various overload, vibration, and shock conditions likely to be encountered in service. This run-in serves to reduce early failures by eliminating tubes with any minor defects that might lead to failure under actual operating conditions.

The use of a coil type heater inside an extruded alumina insulator gives a long life heater structure which stands up well under high heater to cathode voltage. The mount structure is so designed that the tube is capable of withstanding severe shock and vibration.

The tube is intended for use as an amplifier—to increase or control alternating voltages or power; as a mixer—to change electrical energy at one frequency to electrical energy at another frequency; or as an oscillator—to generate an alternating voltage. It can also be used in control equipment as part of a multivibrator or clamp circuit. When used as an oscillator, the upper limit of its frequency range is approximately 500 Mc.

This tube has been designed to minimize noise and microphonic effects.

AVERAGE ELECTRICAL CHARACTERISTICS

Heater voltage, E_f	6.3 volts
Heater current, I_f	0.50 amps.
Plate voltage, E_b	150 volts
Grid voltage, E_c	—2.0 volts
Plate current, I_b	8.0 mA
Mutual conductance, g_m	5000 μmhos
Amplification factor, μ	35
Cut-off voltage	—10 volts
Direct interelectrode capacitances (no shield)	
Plate-grid (per section)	1.7 μμf
Plate-cathode (per section)	1.1 μμf
Grid-cathode (per section)	2.4 μμf
Plate-plate	0.1 μμf

THE Bendix CORPORATION
Red Bank DIVISION, EATONTOWN, NEW JERSEY

Publication No. R 610-28 (Supersedes No. R 51-9)

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DOUBLE TRIODE

6385
Bendix Type TE-21
(Generic Type 5670)

ELECTRICAL CHARACTERISTICS AND TEST DATA

TEST CONDITIONS AND CHARACTERISTIC LIMITS

All Tubes are Stabilized for 45 Hours Under Test Conditions and 2 G. Vibration at 30 cps Prior to 100% Testing

CHARACTERISTIC	SYMBOL	MIN	DESIGN CENTER	MAX.	UNITS
PRODUCTION ON TESTS					
Heater Current	If	460	500	540	mA
Heater-Cathode Leakage	Ihk	—	—	±10	μAdc
Grid Current	Ic	—	—	—0.3	μAdc
Plate Current	Ib	5.5	8.0	11.5	mAdc
Transconductance	Sm	4000	5000	6500	μmhos
Trans. Ef = 5.7 v.	Sm	—	—	15%	
Cut Off Plate Current (Ecl = — 10 v. D.C.)	Ib	—	—	45	uAdc
DESIGN TESTS					
Short and Continuity					
Noise and Microphonics	Ep			200	mVac
Ehk = 0 Ebb = 250					
Ecl = 0 Ecal = 200 mVac					
Rp = 10,000 V					
R. F. Noise				3.0	mWac
Electrode Insulation		500	—	—	Meg
Eg-all = — 100 V					
Ep-all = — 300 V					
Vibration 30 cps 2.5 g.	Ep	—	—	100	mVac
Ecl = — 3 v. D.C. Rp = 2000 ohms					
Eb = 150 v. D.C.					
Grid Emission Test Ef = 7.0 v.	Ic			—0.5	μAdc
Time = 5 minutes @ Ef = 7.5 V.	Cgp	1.4	1.7	2.0	μμfds
Capacitance	Cin	1.9	2.4	2.9	μμfds
	Cout	0.8	1.1	1.4	μμfds
	Cpp	—	—	0.15	μμfds

ELECTRODE:	Ef	Eb	Ec	Ehk
TEST CONDITIONS:	6.3 Volts	150 Vdc	—2.0 Vdc	±250 Vdc

SPECIAL TESTS

In addition to the production and design tests shown in Chart 3 other tests are performed on a sampling basis to assure a high outgoing quality level. See below.

TEST	CONDITIONS	DURATION
Heater Cycling Life Test	On 2½ Min. Off 2½ Min. Ef = 7.5 Ehk = 250	3,000 On-Off Cycles
Life Test	Under "Test Conditions"	1,000 Hours
Life "Expectancy" Test	Under "Test Conditions"	10,000 Hours
High Level Fatigue Test	50G—Shock Excitation 18/sec. rep. rate	100 Hours
Shock	500 g.	20 Impacts
Altitude Test	60,000 Feet	5 Minutes
Glass Strain Test	Boiling Water to Ice Water	15 Seconds in Each
Mount Inspection	100% Test—Microscopic Inspection of 30 Possible Trouble Points	

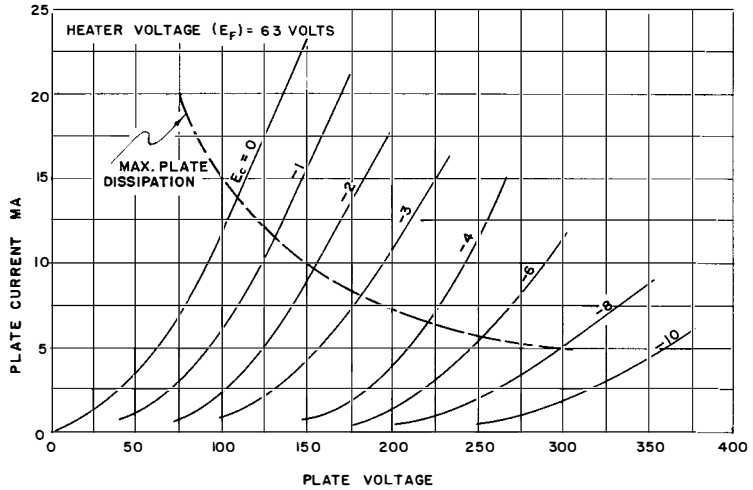
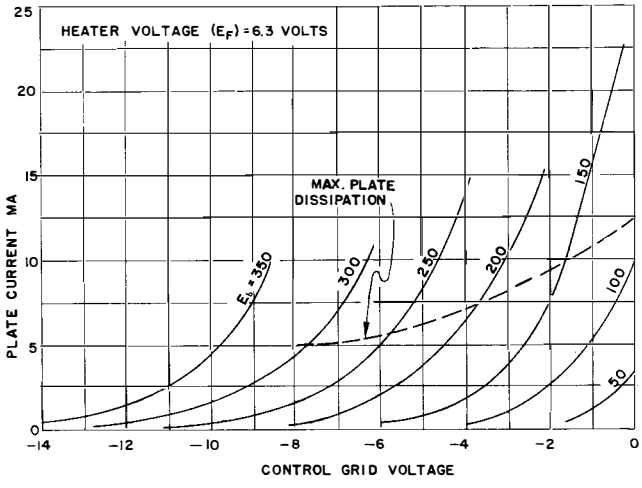


PLATE CHARACTERISTICS



TRANSFER CHARACTERISTICS

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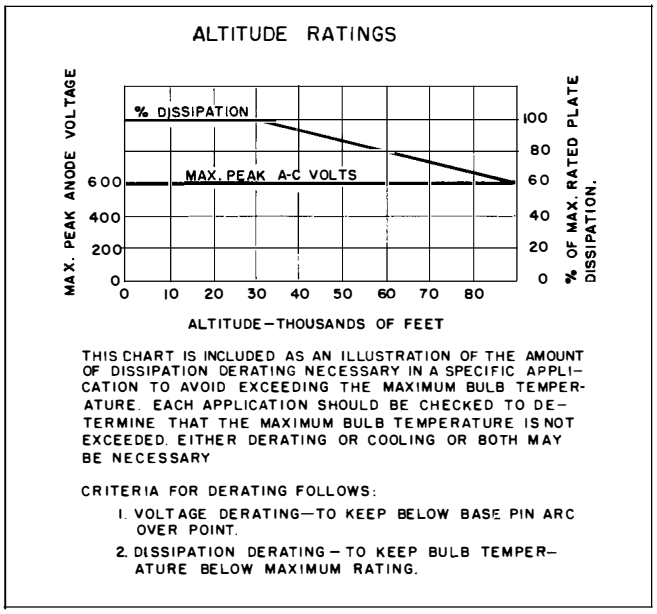


THIS CHART IS INCLUDED AS AN ILLUSTRATION OF THE AMOUNT OF DISSIPATION DERATING NECESSARY IN A SPECIFIC APPLICATION TO AVOID EXCEEDING THE MAXIMUM BULB TEMPERATURE. EACH APPLICATION SHOULD BE CHECKED TO DETERMINE THAT THE MAXIMUM BULB TEMPERATURE IS NOT EXCEEDED. EITHER DERATING OR COOLING OR BOTH MAY BE NECESSARY

CRITERIA FOR DERATING FOLLOWS:

1. VOLTAGE DERATING—TO KEEP BELOW BASE PIN ARC OVER POINT.
2. DISSIPATION DERATING – TO KEEP BULB TEMPERATURE BELOW MAXIMUM RATING.

EFFECT ON LIFE OF INCREASED RATINGS

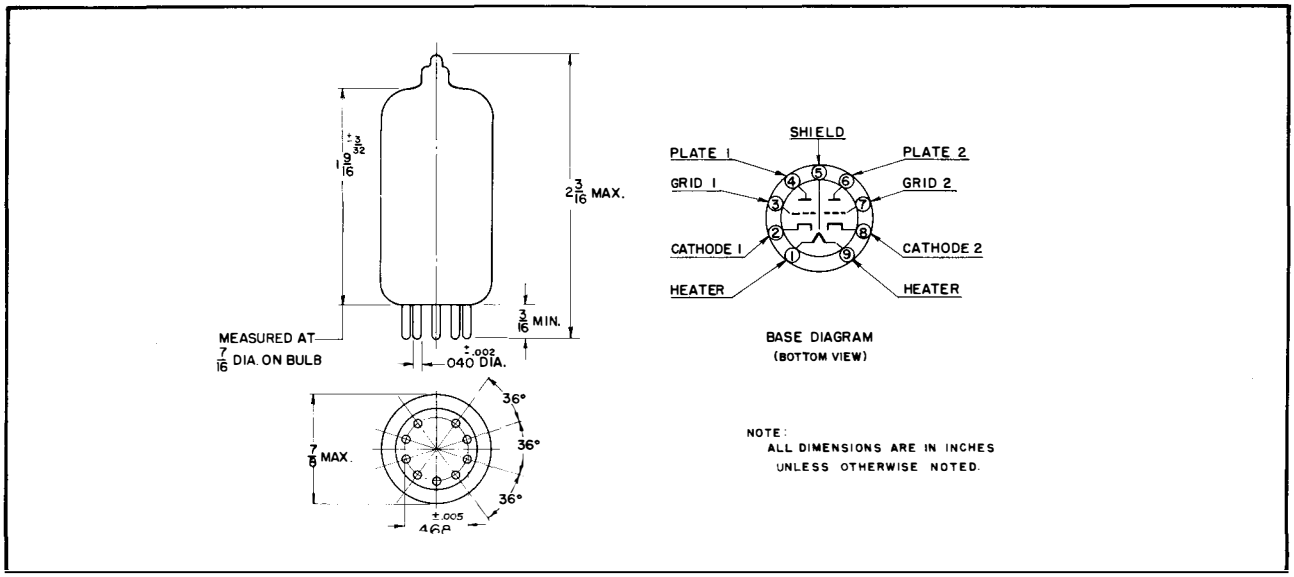
See also Application Notes	OPERATING CONDITIONS		
RATING OR CHARACTERISTIC	CONSERVATIVE	TYPICAL	MAXIMUM
Heater Voltage	6.3 ± 2%	6.3 ± 5%	6.3 ± 10%
Plate Voltage	130 Vdc	150 Vdc	180 Vdc
Peak Plate Voltage	200 V	250 V	300 V
Plate Current (Av.)	6 mA	7 mA	8 mA
Cathode Current (Peak)	15 mA	20 mA	25 mA
H-K Voltage	200 V	250 V	300 V
Grid Resistance	250,000 ohms	750,000 ohms	1,000,000 ohms
Bulb Temperature	120°C	140°C	160°C
Altitude	0-20,000 ft	60,000 ft	80,000 ft
Vibration	1 G	2½ G	5 G
LIFE EXPECTANCY	MAXIMUM	HIGH	MEDIUM

APPLICATION NOTES

Special attention should be given to the temperatures at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy will be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are directly related to the degree that regulation of the heater voltage is maintained at its center rated value.

The altitude rating chart shows the correct voltage derating necessary for various altitudes. However, the dissipation derating is only approximate and must be measured for each application because of the additive effects mentioned above.

The increased rating chart is presented to emphasize the dangers of operating simultaneously at or near all maxima. In general, the effect on the life of operation at increased ratings is additive and cumulative. Interpolation within this chart will give the designer a general idea of the life expectancy and reliability of his application. Each proposed application should be life tested under maximum environmental conditions in order to check that the design gives the desired reliability. When conservatively used this tube has a life expectancy of 10,000 hours.



OUTLINE DRAWING

DOUBLE TRIODE

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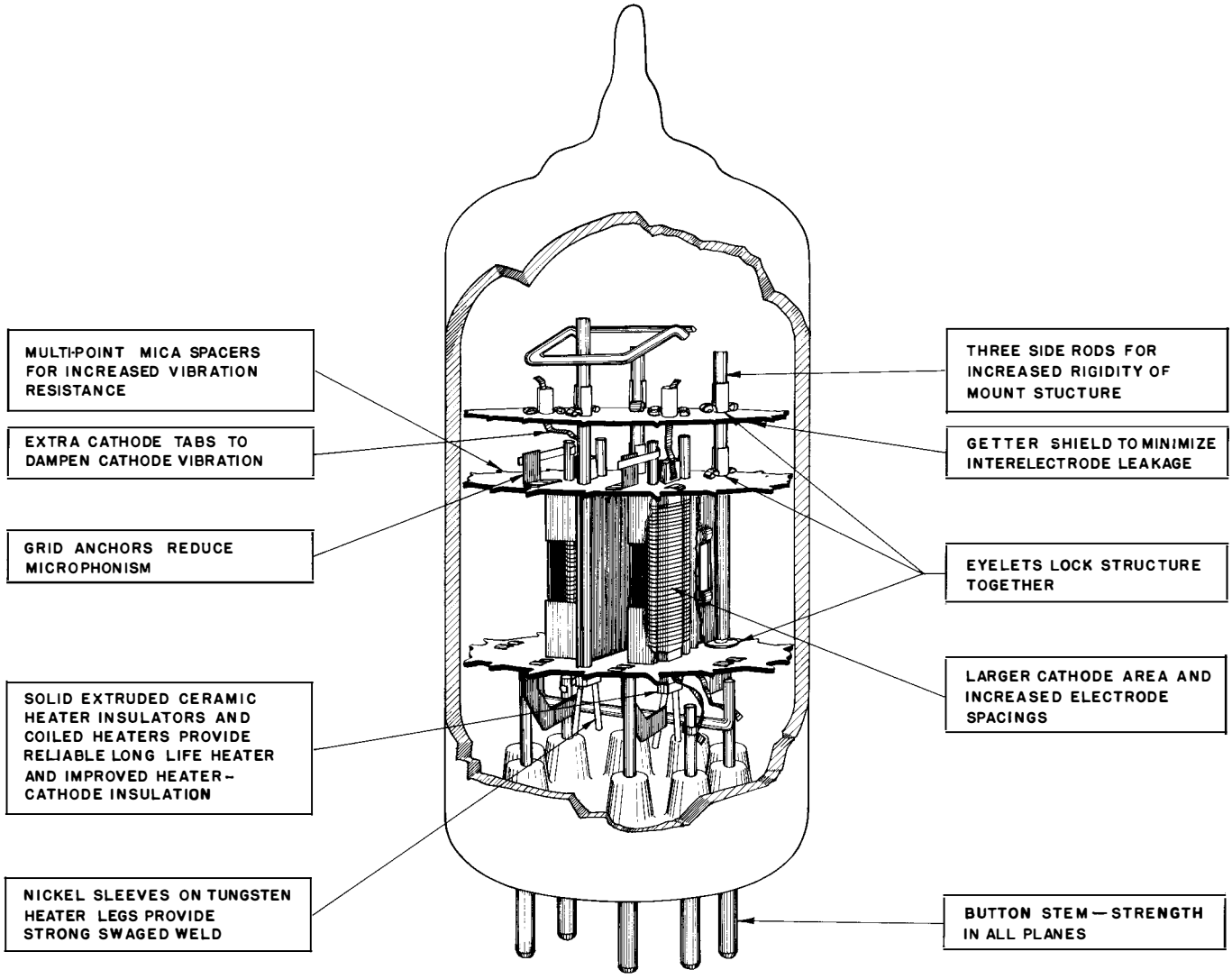

STRUCTURAL FEATURES OF 6385 PROVIDE HIGH RELIABILITY AND LONG LIFE.

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Export Sales & Service: Bendix International Division, 205 E. 42nd St., New York 17, N.Y.
Canadian Distributor: Computing Devices of Canada, Ltd., P.O. Box 508, Ottawa 4, Ontario

ELECTRON TUBE DATA SHEET

WESTERN ELECTRIC 396A* ELECTRON TUBE

DESCRIPTION

The 2C51/396A* is a 9-pin miniature double triode having separate indirectly heated cathodes. It is designed for use in amplifier, mixer, oscillator, multivibrator and clamp circuits. The useful frequency extends through the VHF range.

CHARACTERISTICS

Heater Voltage		6.3 volts
Plate Current per Section	E_b = 150 volts; E_c = -2.0 volts	8.2 milliamperes
Transconductance per Section		5500 micromhos

File: Miniature Section
Issue 5, 11-54

GENERAL CHARACTERISTICS

ELECTRICAL DATA

Heater Voltage	6.3 volts
Heater Current	300 milliamperes

Direct Interelectrode Capacitances	without external shield	with external shield (RETMA #315)
Grid to Plate per Section	1.3	*1.3 uuf
Input per Section: g to (h+k+i.s.)	2.2	*2.3 uuf
Output per Section: p to (h+k+i.s.)	1.0	*1.3 uuf
Plate-to-Plate	0.04	**0.03 uuf
Plate-to-Plate, Maximum	0.11	**0.10 uuf

MECHANICAL DATA

Cathode	Coated Unipotential
Bulb	T6 1/2
Base	Small Button, 9-pin
Mounting Position	Any

Dimensions and pin connections shown in outline drawing on Page 4

MAXIMUM RATINGS, Design-Center Values (Each Section)

Plate Voltage	300 volts
Plate Dissipation	1.5 watts
Plate Current	18 milliamperes
Grid Dissipation	0.1 watt
Heater-Cathode Voltage	90 volts
Bulb Temperature	120° centigrade

Maximum Grid Circuit Resistance for	
Fixed Bias	1 megohm
Cathode Bias	2 megohms

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CLASS A_1 AMPLIFIER

(Each Section)

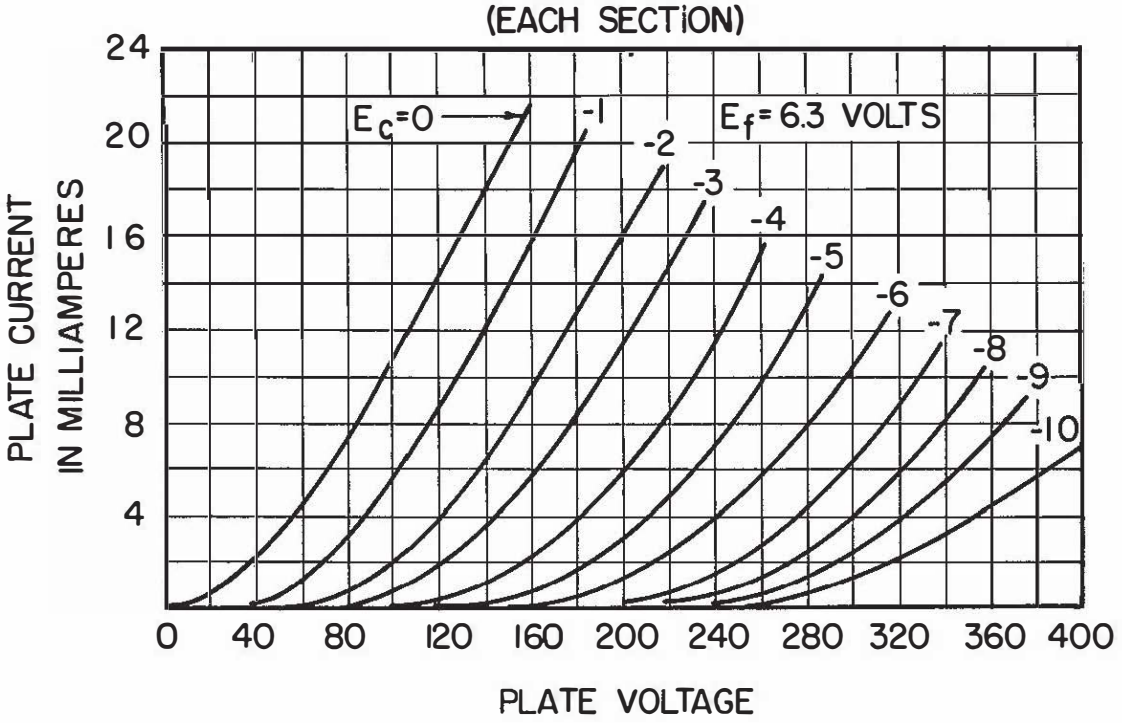
Plate Voltage	150	150 volts
Grid Voltage	-2.0	--- volts
Cathode Resistor	---	240 ohms
Plate Current	8.2	8.2 milliamperes
Transconductance	5500	5500 micromhos
Amplification Factor	35	35
Grid Voltage (approximate) for Plate Current of 10 microamperes	-8	--- volts

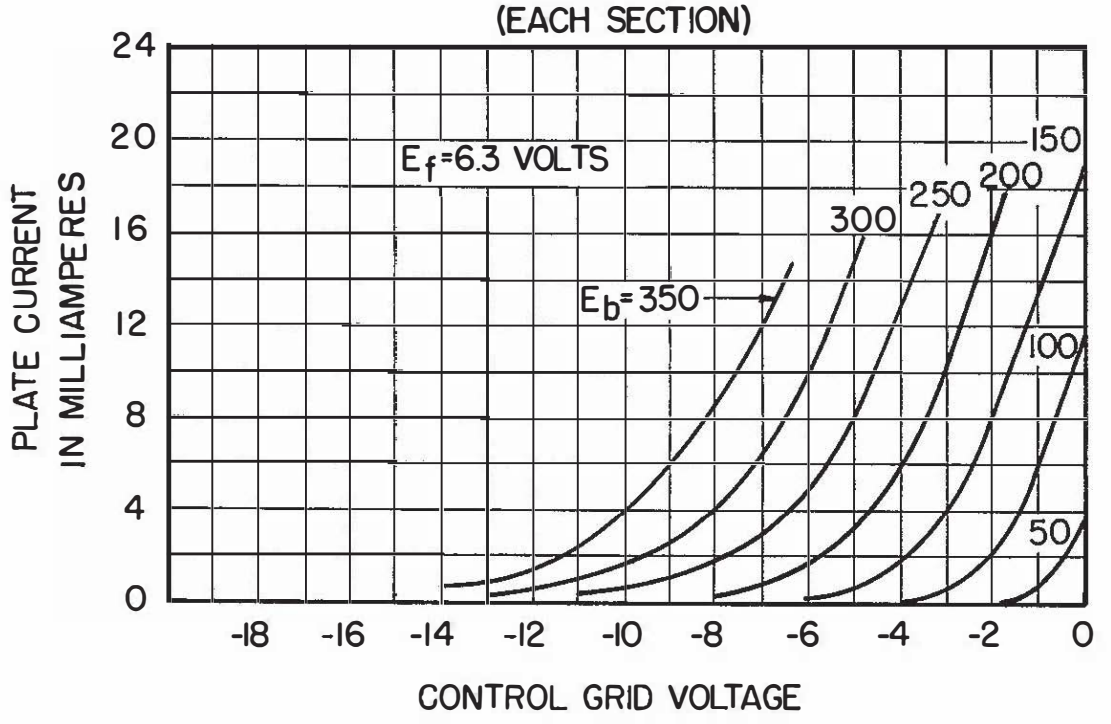
* Pin 5 and external shield (RETMA #315) connected to cathode pin of section under test. Elements of other section grounded.

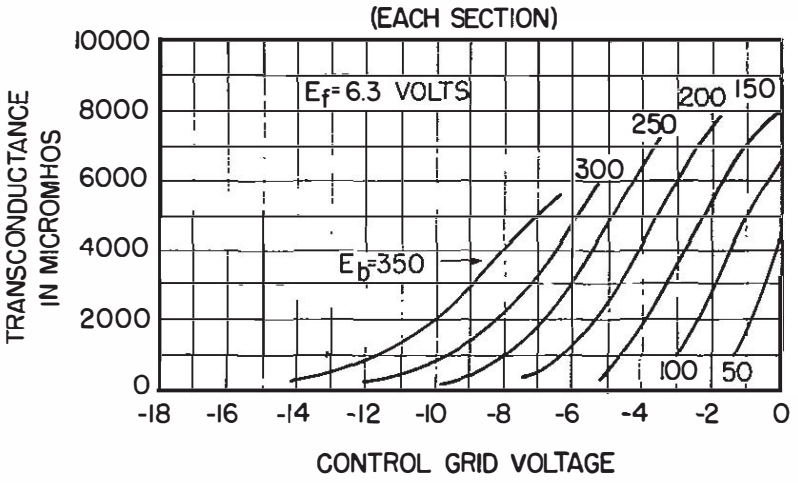
** Pin 5 and external shield (RETMA #315) connected to ground with other elements.

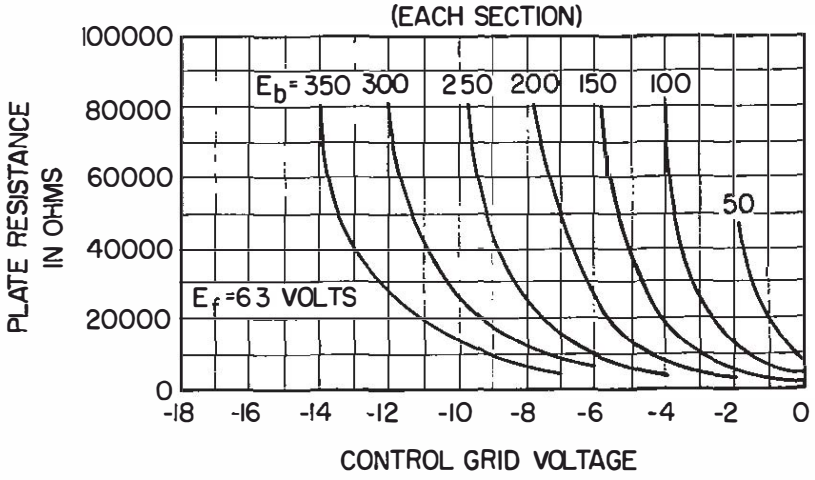
TYPICAL OPERATING CONDITIONS - CLASS AB_1 PUSH-PULL AMPLIFIER

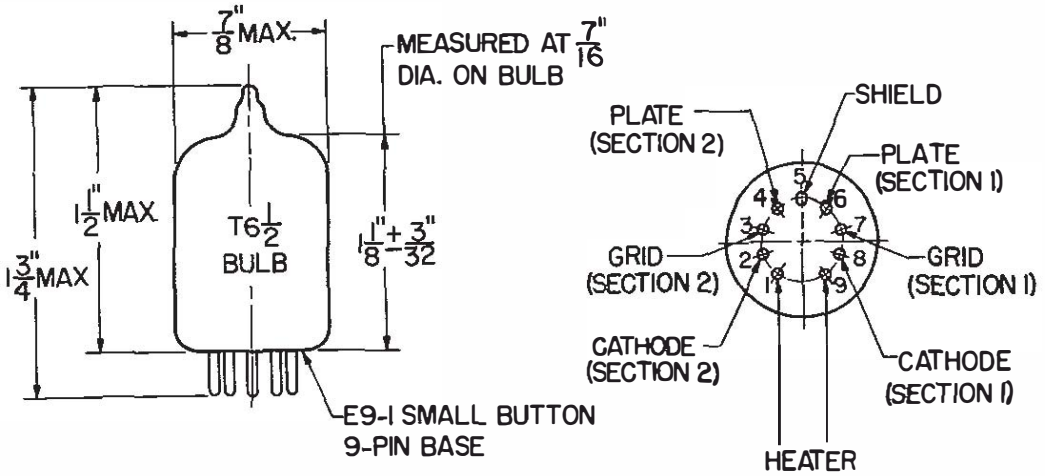
Plate Voltage	200	300 volts
Cathode Resistor (Cathodes Tied Together)	400	800 ohms
Peak A-F Grid-to-Grid Voltage	9.0	20 volts
Zero Signal Plate Current per Section	5.0	4.7 milliamperes
Maximum Signal Plate Current per Section	5.6	6.0 milliamperes
Load Impedance, Plate-to-Plate	30000	40000 ohms
Signal Power Output	0.40	0.95 watt
Total Harmonic Distortion Less Than	5	10 percent











A development of Bell Telephone Laboratories, the research laboratories of the American Telephone and Telegraph Company and the Western Electric Company

Двойной триод
Double triode

6Н3П

Двойной триод 6Н3П предназначен для усиления напряжения и генерирования колебаний низкой частоты.

Низкочастотные двойные триоды 6Н3П выпускаются в миниатюрном оформлении, в стеклянном баллоне с девятиштырьковой ножкой, с оксидным катодом косвенного накала.

Двойные триоды 6Н3П устойчивы к воздействию окружающей температуры от —60 до +70° С и относительной влажности 95—98% при температуре +40°С, а также к воздействию механических нагрузок: линейных до 100 *g*, вибрационных до 2,5 *g*, ударных многократных до 35 *g*.

Наибольший вес 15 *г*.

Гарантированная долговечность 1500 часов.

The 6Н3П double triode is designed for voltage amplification and generation of low-frequency oscillations.

The 6Н3П low-frequency double triodes are miniature devices enclosed in glass bulb and provided with a nine-pin base and an indirectly heated oxide-coated cathode.

The 6Н3П double triodes are resistant to ambient temperature from —60 to +70° C and relative humidity of 95 to 98% at +40° C, as well as to mechanical loads: linear loads up to 100 *g*, vibration loads up to 2.5 *g* and multiple impact loads up to 35 *g*.

Maximum weight: 15 gr.

Service life guarantee: 1500 hr.

ЭЛЕКТРИЧЕСКИЕ ДАННЫЕ
ELECTRICAL CHARACTERISTICS

U_h	6,3 V	I_a [2]	8,75±2,75 mA
I_h	350±35 mA	I_{az} [3]	⩽40 μA
U_a	150 V	S [2]	$6_{-1,2}$ mA
U_g	−2 V	μ [2]	36±8
R_k [1]	240 Ω	R_{glk} [4]	14 kΩ

[1]) Для автоматического смещения.
For self-bias.
[2]) Каждого триода.
For each triode.
[3]) $U_{gT} = -10$ V.
$U_{gT} = -10$ V.
[4]) При f = 60 MHz.
At f = 60 MHz.

МЕЖДУЭЛЕКТРОДНЫЕ ЕМКОСТИ
INTERELECTRODE CAPACITANCES

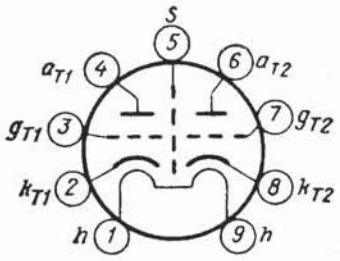
C_{glk}	2,8 pF	C_{gla}	⩽1,6 pF
C_{ak}	1,4 pF	C_{a1a2}	⩽0,15 pF

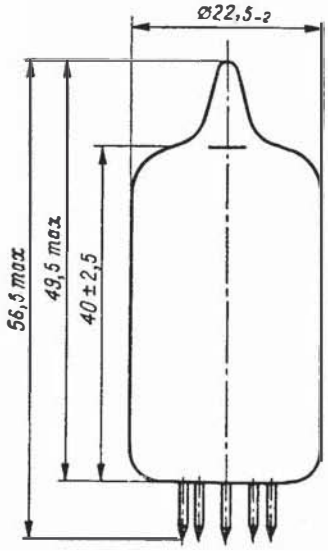
ПРЕДЕЛЬНО ДОПУСТИМЫЕ ЭКСПЛУАТАЦИОННЫЕ ДАННЫЕ
MAXIMUM AND MINIMUM PERMISSIBLE RATINGS

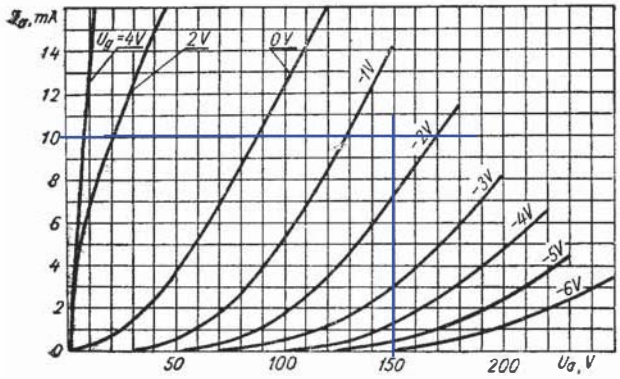
	Max	Min
U_h	7 V	5,7 V
U_a	300 V	
P_a	1,5 W	
I_k	18 mA	
U_{kh}	100 V	
R_{gT}	1 MΩ	
$T_{баллона}$ bulb	120° C	

6Н3П

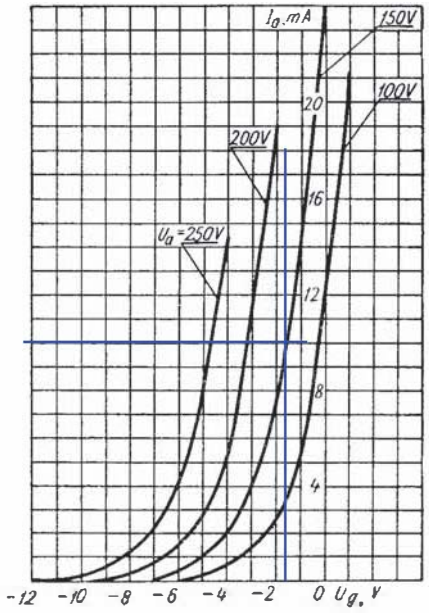
Двойной триод
Double triode



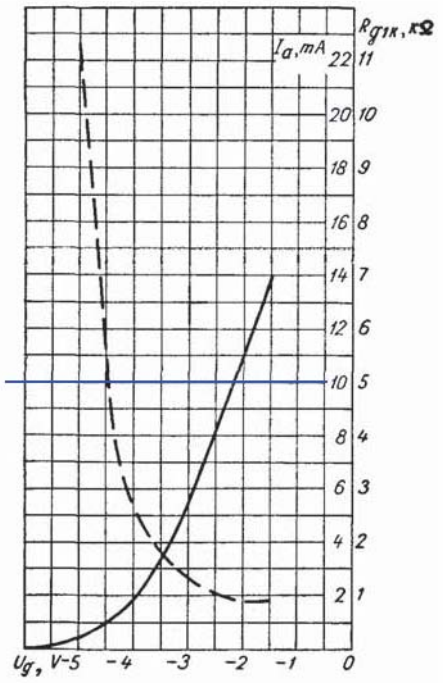




$I_a = f(U_a)$
(каждого триода)
(for each triode)
$U_h = 6{,}3$ V

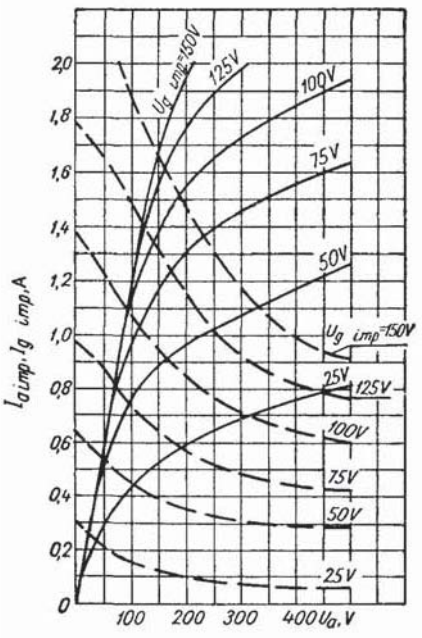


$I_a = f(U_{gT})$
(каждого триода)
(for each triode)
$U_h = 6{,}3$ V



I_a, $R_{g1k} = f(U_{gT})$
(каждого триода)
(for each triode)

——— I_a $U_h = 6{,}3$ V
— — — R_{g1k} $U_a = 150$ V
$f = 210$ MHz



I_a, $I_{gT} = f(U_a)$
(каждого триода)
(for each triode)

——— I_a $U_h = 6{,}3$ V
— — — I_{gT} $f_{imp} = 1$ kHz
$\tau = 2$ μs