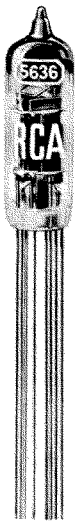
5636

SHARP-CUTOFF PENTODE

Two Independent Control Grids | **"Premium" Subminiature Type** | **For Operation At Altitudes Up to 60000 Feet**

TENTATIVE DATA

RCA-5636 is a subminiature sharp-cutoff pentode of the heater-cathode type having flexible leads. It is intended particularly for use in military and critical industrial applications including gated amplifier circuits, delay circuits, mixer circuits at frequencies up to 400 megacycles per second, and gain-controlled amplifier circuits. The 5636 is rated for service at altitudes up to 60000 feet without the use of pressurized chambers.



Actual Size

The design of the 5636 incorporates a compact structure in which special attention has been given to features which enable it to resist shock and vibration. These features include: (1) tube parts precisely made and accurately fitted to minimize mechanical movement, (2) special connections between tube electrodes and stem leads to reduce stresses on tube elements and to insure good welds and, (3) a pure-tungsten heater having high mechanical strength.

As a result of its structural design, this tube is characterized by small spread in electrical characteristics, reduced microphonic effects, and long life under conditions of frequent on-off switching.

The 5636 utilizes a separate terminal for grid No.3 as well as for grid No.1. Because both grids have a sharp-cutoff characteristic, either grid may be used independently as a control electrode. Furthermore, the cathode is provided with two lead terminals. This arrangement permits separation of the input and output circuit returns and facilitates isolation of the input and output circuits.

Manufactured under rigid controls, the 5636 undergoes rigorous tests during manufacture to insure its "premium" quality as follows: (1) factory controls and design tests under typical plate-current cutoff conditions in gated-amplifier circuits, (2) test readings at the end of 1 hour, 100 hours, and 500 hours to insure that tubes fall within the established tight characteristics limits and that early failures are held to a low percentage.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:			
Voltage (AC or DC)		6.3	volts
Current		0.150	ampere
Direct Interelectrode Capacitances:	*With External Shield**	*Without External Shield*	
Grid No.1 to plate	0.02 max.	0.034 max.	μμf
Grid No.1 to all other electrodes	4	4	μμf
Grid No.1 to grid No.3	0.15 max.	0.17 max.	μμf
Grid No.3 to all other electrodes	4	3.8	μμf
Grid No.3 to plate	1.1 max.	1.1 max.	μμf
Plate to all other electrodes	3.4	1.9	μμf

Mechanical:

Operating Position	Any
Maximum Bulb Length	1-3/8"
Length from Button Seal to Bulb top (Excluding Tip)	1.075" ± 0.060"
Diameter	0.366" - 0.400"
Bulb	T-3
Leads, Flexible	8
Length	1-1/2" to 1-3/4"
Orientation and Diameter	See Dimensional Outline

CLASS A_1 AMPLIFIER

Maximum Ratings, *Absolute Values:*

For Operation At Altitudes Up To 60000 Feet

PLATE VOLTAGE	165 max.	volts
GRID-No.3 (SUPPRESSOR-GRID) VOLTAGE:		
Positive bias value	30 max.	volts
GRID-No.2 (SCREEN-GRID) VOLTAGE	155 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Positive bias value	0 max.	volts
Negative bias value	55 max.	volts
PLATE CURRENT	11 max.	ma
GRID-No.2 CURRENT	7 max.	ma
PLATE DISSIPATION	1.1 max.	watts
GRID-No.2 INPUT	0.7 max.	watt
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	250 max.	°C

Characteristics and Typical Operation as Class A_1 Amplifier:

Plate Supply Voltage	100	100	volts
Grid No.3	Connected to Cathode	-	
Grid-No.3 Supply Voltage	-	-1	volt

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Grid-No.2 Supply Voltage . .	100	100	volts
Cathode Resistor	150	150	ohms
Plate Resistance (Approx.) .	0.11	0.05	megohm
Transconductance:			
Grid No.1 to plate	3200	1950	μmhos
Grid No.3 to plate	500	950	μmhos
Plate Current.	5.6	4	ma
Grid-No.2 Current.	4	5.8	ma
Grid-No.1 Voltage (Approx.) for plate current of 10 μa	-7.5	-	volts
Grid-No.3 Voltage (Approx.) for plate current of 10 μa	-	-8	volts

Characteristics and Typical Operation as Mixer:[o]

Plate Supply Voltage	100	volts
Grid-No.3 Supply Voltage (RMS)	15	volts
Grid-No.2 Supply Voltage	100	volts
Cathode Resistor	150	ohms
Plate Resistance (Approx.)	0.32	megohm
Conversion Transconductance.	1280	μmhos
Plate Current.	3.5	ma
Grid-No.2 Current.	5.7	ma

Maximum Circuit Values:

Grid-No.1-Circuit Resistance:		
For cathode-bias operation	1.1 max.	megohm

* With 0.405" internal diameter shield connected to lead terminal No.8.

o With local oscillator injection to grid No.3. DC grid-No.3-circuit resistance should be kept at as low as possible at the high frequencies.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN*

Values Are Initial, Unless Otherwise Specified

	Note	*Min.*	*Max.*	
Heater Current	1	0.140	0.160	amp
Direct Interelectrode Capacitances:				
Grid No.1 to all other electrodes	2	3.5	4.5	μμf
Grid No.3 to all other electrodes	2	3.5	4.5	μμf
Plate to all other electrodes	2	2.9	3.9	μμf
Plate Current (1).	1,3	3.7	6.9	ma
Plate Current (2).	1,4	-	100	μa
Plate Current (3).	1,5	-	100	μa
Grid-No.2 Current.	1,3	2.8	5.4	ma
Transconductance, Grid No.1 to Plate:				
Range with heater volts = 6.3.	3	2700	4000	μmhos
Change with heater volts = 5.7.	3	-	15	per cent
Change at end of 500 hours with heater volts = 6.3.	3	-	20	per cent
Change at end of 500 hours with heater volts = 5.7.	3	-	15	per cent
Difference between average transconductance initially, and average after 500 hours, expressed as a percentage of the initial average. . . .	1,3	-	15	per cent
Transconductance, Grid No.3 to plate.	1,6	500	1800	μmhos
Reverse Grid Current . . .	1,7	-	0.3	μa
Reverse Grid Current at 500 hours.	1,7	-	0.9	μa
Grid-Emission Current. . .	8	-	0.5	μa
Heater-Cathode Leakage Current:				
Heater 100 volts negative with respect to cathode	1,3	-	5	μa
Heater 100 volts positive with respect to cathode	1,3	-	5	μa
Heater-Cathode Leakage Current at 500 hours:				
Heater 100 volts negative with respect to cathode	1,3	-	10	μa
Heater 100 volts positive with respect to cathode	1,3	-	10	μa
Leakage Resistance:				
Grid No.1 to all other electrodes	1,9	100	-	megohms
Plate to all other electrodes	1,10	100	-	megohms
Leakage Resistance at 500 hours:				
Grid No.1 to all other electrodes	1,9	50	-	megohms
Plate to all other electrodes	1,10	50	-	megohms

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With shield having internal diameter of 0.405" connected to cathode.

Note 3: With plate supply voltage of 100 volts, grid No.3 tied to cathode, grid-No.2 supply voltage of 100 volts, and cathode resistor of 150 ohms.

Note 4: With plate voltage of 100 volts, grid No.3 connected to cathode, grid-No.2 voltage of 100 volts, and grid-No.1 voltage of -7.5 volts.

Note 5: With plate supply voltage of 100 volts, grid-No.3 supply voltage of -8 volts, grid-No.2 supply voltage of 100 volts, and cathode resistor of 150 ohms.

Note 6: With plate supply voltage of 100 volts, grid-No.3 supply voltage of -1 volt, grid-No.2 supply voltage of 100 volts, and cathode resistor of 150 ohms.

Note 7: With plate supply voltage of 100 volts, grid No.3 tied to cathode, grid-No.2 supply voltage of 100 volts, cathode resistor of 150 ohms, and grid-No.1 resistor of 1 megohm.

Note 8: With heater voltage of 7.5 volts ac or dc, plate voltage of 100 volts, grid-No.3 voltage of 0 volts, grid-No.2 voltage of 100 volts, grid-No.1 voltage of -7.5 volts, and grid-No.1 resistor of 1 megohm.

Note 9: With grid-No.1 voltage of -100 volts with respect to all other electrodes.

Note 10: With plate voltage of -300 volts with respect to all other electrodes.

* Each tube is stablized before characteristics testing by continuous operation for at least 45 hours at room temperature and with dissipation values equivalent to life test conditions.

SPECIAL RATINGS AND PERFORMANCE DATA

Shock Rating:

Impact Acceleration. . . . . 450 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are held rigid and are tested in four different positions. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for low-frequency vibration, heater-cathode leakage current, and transconductance change.

Fatigue Rating:

Vibrational Acceleration . . . . . 2.5 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected in each of three positions to 2.5 g vibrational acceleration at 60 cycles per second for 32 hours. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for low-frequency vibration, heater-cathode leakage current, and transconductance change.

Low-Frequency Vibration Performance:

RMS Output Voltage . . . . . 60 max. mv

This test is performed on a sample lot of tubes from each production run under the following conditions: Heater voltage of 6.3 volts, plate supply voltage of 100 volts, grid No.3 tied to cathode, grid-No.2 supply voltage of 100 volts, cathode resistor of 150 ohms, cathode-bypass capacitor of 1000 μf, plate load resistor of 10000 ohms and vibrational acceleration of 15 g at 40 cps.

Heater-Cycling Life Performance:

Cycles of Intermittent Operation . . 2000 min. cycles

Under the following conditions: Heater voltage of 7.0 volts cycled one minute on one minute off, heater 140 volts rms with respect to cathode, and all other elements grounded.

Audio-Frequency Noise and Microphonic Performance:

Output Voltage . . . . . 70 max. mv

This test is performed on a sample lot of tubes from each production run under the following conditions: Heater voltage of 6.3 volts, plate supply voltage of 100 volts, grid No.3 connected to cathode, grid-No.2 supply voltage of 19 volts, cathode resistor of 150 ohms, grid-No.1 resistor of 0.1 megohm, grid-No.2 resistor of 1000 ohms, plate load resistor of 0.2 megohm, and cathode-bypass capacitor of 1000 μf. The output voltage of a tube, when tapped, will not cause a reading on a vu meter greater than that produced when a calibrating signal of 70 millivolts rms is applied to the plate of the tube.

Shorts and Continuity Test:

This test is performed on a sample lot of tubes from each production run. In this test a tube is considered inoperative if it shows a permanent or temporary short or open circuit, or a value of reverse grid current in excess of 1.0 microampere under the conditions specified in the CHARACTERISTICS RANGE VALUES for reverse grid current.

1-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. Tubes are checked for transconductance under conditions specified under 500-Hour Intermittent Life Performance. At the end of 1 hour, the value of transconductance is read. The variation in transconductance from the 0-hour reading will not exceed 15 per cent.

100-Hour Survival Life Performance:

This test is performed on a sample lot of tubes from each production run under conditions specified under 500-Hour Intermittent Life Performance to insure a low percentage of early inoperatives. At the end of 100 hours, a tube is considered inoperative if it shows a permanent or temporary short or open circuit or a grid-No.1-to-plate transconductance of less than 2350 micromhos under the conditions specified in Characteristics Range Values.

500-Hour Intermittent Life Performance:

This test is performed on a sample lot of tubes from each production run to insure high quality of the individual tube and to guard against epidemic failures of any of the characteristics indicated below. Life testing is conducted under the following conditions: Heater voltage of 6.3 volts, plate supply voltage of 100 volts, grid No.3 tied to cathode, grid-No.2 supply voltage of 100 volts, heater-cathode voltage of 200 volts (heater positive with respect to cathode), cathode resistor of 150 ohms, grid-No.1 resistor of 1 megohm and bulb temperature of 220°C. At the end of 500 hours, tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to pass established initial limits of heater current, grid-No.1-to-plate transconductance change, grid-No.3-to-plate transconductance, and 500 hour limits for reverse grid current, heater-cathode leakage current, leakage resistance, and the difference in grid-No.1-to-plate transconductance between the initial value and average value shown under Characteristics Range Values.

OPERATING CONSIDERATIONS

The *maximum ratings* in the tabulated data for the 5636 are limiting values above which the serviceability of the 5636 may be impaired from the viewpoint of life and satisfactory performance. Therefore, in order not to exceed these absolute ratings, the equipment designer has the responsibility of determining an average design value below each absolute rating by an amount such that the absolute values will never be exceeded under any usual condition of supply-voltage variation, load variation, or manufacturing variation in the equipment itself.

The *heater supply* should be well regulated because life and reliability of the 5636 are adversely affected by departures from the 6.3-volt value. The extent to which life is affected is a function of the amount of these departures and their durations.

The *flexible leads* of the 5636 are usually soldered to the circuit elements. Soldering of the connections should be made as far as possible from the glass button. If this precaution is not followed, the heat of the soldering may crack the glass seals of the leads and damage the tube.

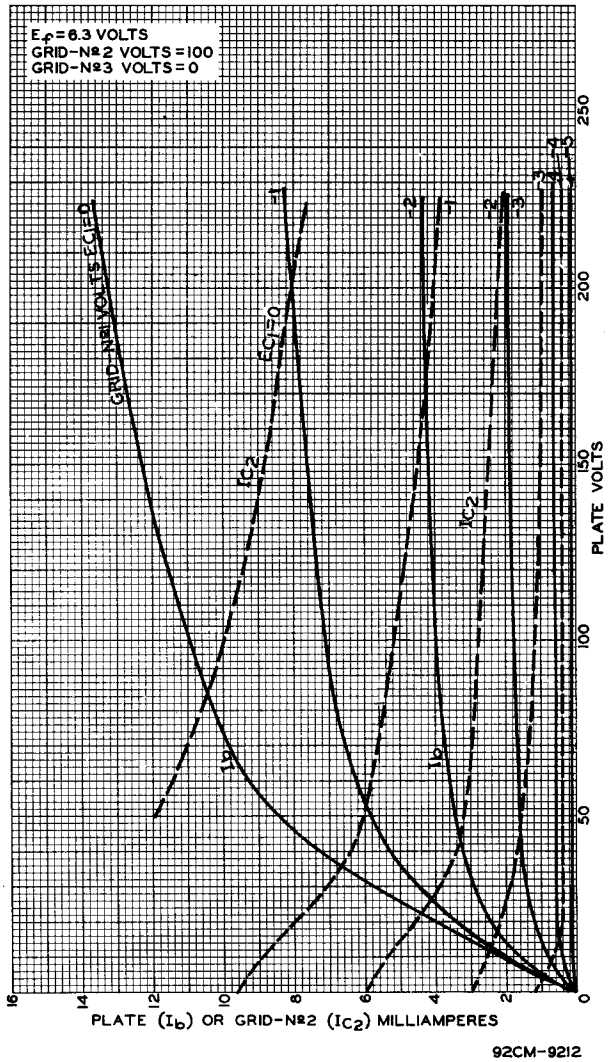


Fig. 1 - Average Characteristics of Type 5636.

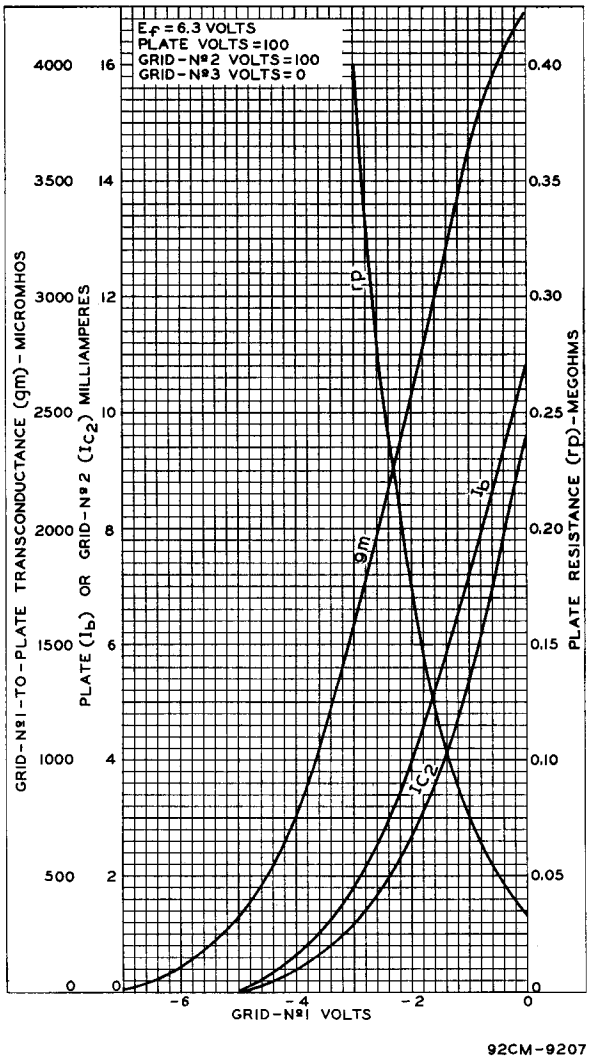


Fig. 2 - Average Characteristics of Type 5636.

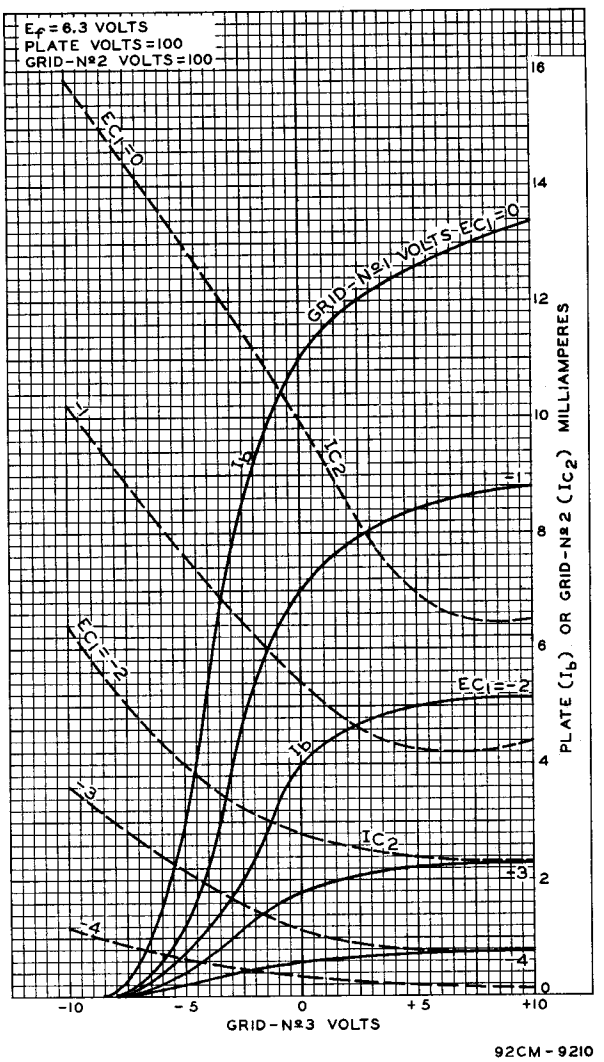


Fig.3 - Average Characteristics of Type 5636.

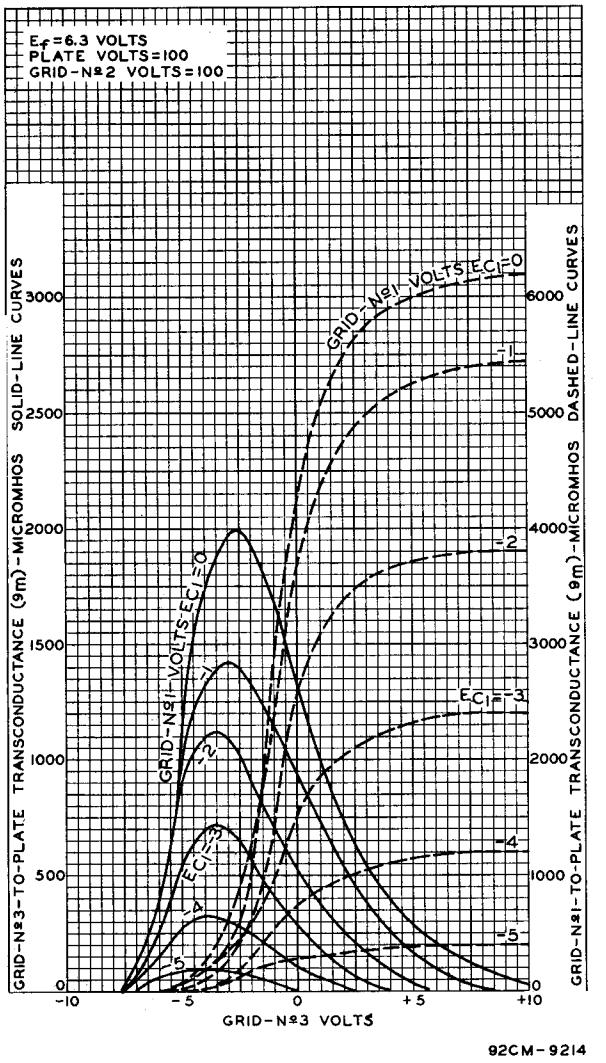


Fig.4 - Average Characteristics of Type 5636.

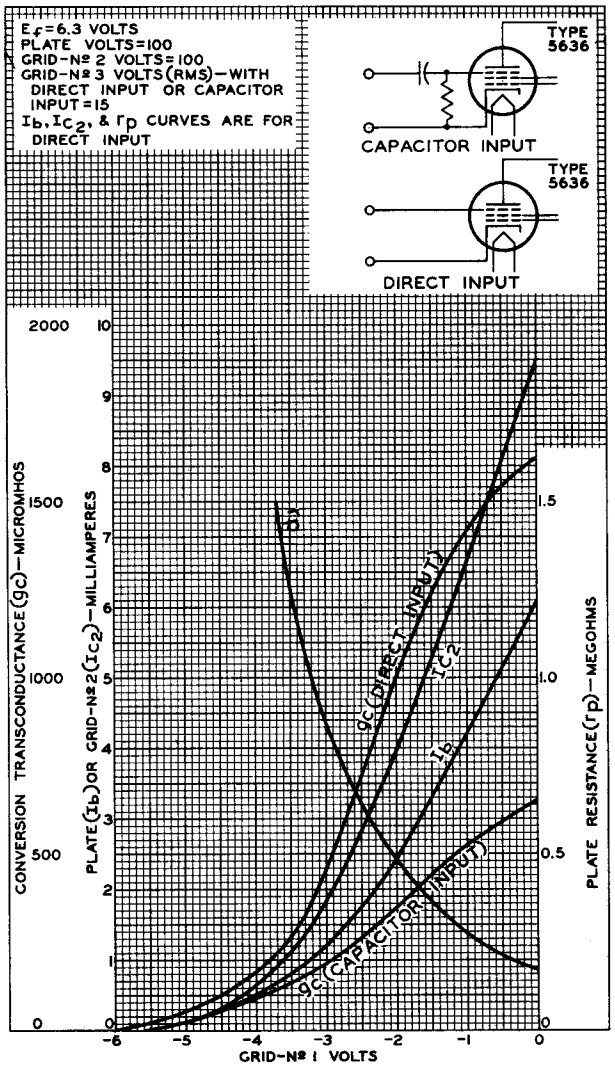


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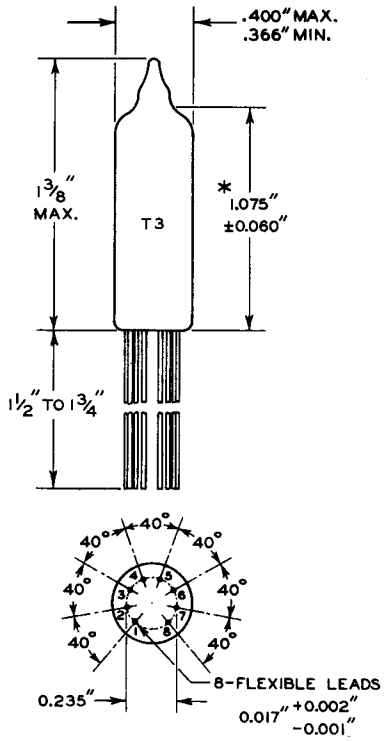
Fig.5 - Average Characteristics of Type 5636.

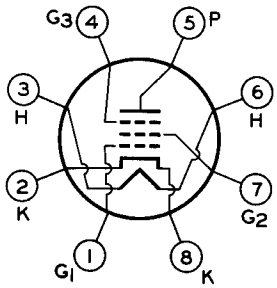
DIMENSIONAL OUTLINE



* MEASURED FROM BULB SEAT TO BULB-TOP LINE AS DETERMINED BY A RING GAUGE OF 0.210" ± 0.001" I.D.

TERMINAL CONNECTIONS

Bottom View



8DC

LEAD No.1: GRID No.1
LEAD No.2: CATHODE
LEAD No.3: HEATER
LEAD No.4: GRID No.3
LEAD No.5: PLATE
LEAD No.6: HEATER
LEAD No.7: GRID No.2
LEAD No.8: CATHODE