SYLVANIA

engineering data service

5647

MECHANICAL DATA

Bulb	T-1
Base	Subminiature Button Flexible Leads
Outline	See Diagram
Basing	See Diagram
Cathode	Coated Unipotential
Mounting Position	Any

RATINGS[1] (Absolute Maximum)

Impact Acceleration	450 G
Uniform Acceleration	1000 G
Fatigue (Vibrational Acceleration for Extended Periods)	2.5 G
Bulb Temperature	165° C
Altitude[2]	60000 Ft.

ELECTRICAL DATA

HEATER CHARACTERISTICS

	Min.	Bogey	Max.
Heater Voltage[3]	6.0	6.3	6.6 V
Heater Current		150	mA

DIRECT INTERELECTRODE CAPACITANCES

	Shielded[4]	Unshielded
Cathode to Plate	2.4	2.6 μμf
Cathode to Heater	4.2	4.0 μμf
Plate to Heater	1.8	0.8 μμf
Plate to Cathode and Heater	4.2	3.4 μμf
Cathode to Plate and Heater	6.0	6.0 μμf

RATINGS[1 & 5] (Absolute Maximum)

Plate Supply Voltage, RMS	165 Vac
Peak Inverse Plate Voltage[6]	460 v
Steady State Peak Plate Current	60 ma
Transient Peak Plate Current	350 ma
Output Current	10 mAdc
Heater-Cathode Voltage[6]	
Heater Positive with Respect to Cathode	360 v
Heater Negative with Respect to Cathode	360 v

CHARACTERISTICS

Tube Voltage Drop for Ib = 18 mAdc	2.8 Vdc

TYPICAL OPERATION

Half-Wave Rectifier—Capacitor Input to Filter		
Plate Supply Voltage	117	150 Vac
Total Plate Supply Impedance	820	1000 Ohms
Output Current	9.0	9.0 mAdc

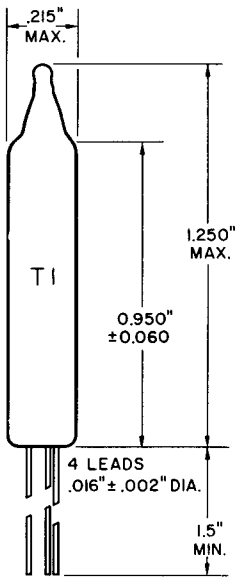
NOTES:

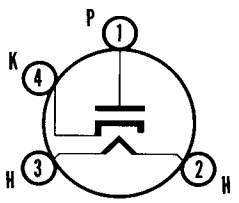
1. *Limitations beyond which normal tube performance and tube life may be impaired.*
2. *If altitude rating is exceeded, reduction of instantaneous voltages (Ef excluded) may be required.*
3. *Tube life and reliability of performance are directly related to the degree of regulation of the heater voltage to its center rated value of 6.3 volts.*
4. *External shield of 0.220 inch diameter connected to heater.*
5. *Values shown are as registered with RETMA.*
6. *The maximum voltage appearing between any pair of leads shall be no greater than the maximum peak inverse plate voltage.*
7. *Lead No. 1—Blue, Lead No. 2—Yellow.*

QUICK REFERENCE DATA

The Premium Subminiature Type 5647 is a cathode type diode employing a T-1 envelope. It is useful in uhf detector applications as well as clamping and/or gating circuits.

The 5647 is designed to provide dependable service under severe conditions of vibration, shock, high temperature and high altitude, and is manufactured and inspected to meet the applicable MIL-E-1 specification for reliable operation.





(Note 7)

SYLVANIA ELECTRIC PRODUCTS INC.

RADIO TUBE DIVISION
EMPORIUM, PA.

Prepared and Released By The
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FEBRUARY 1957

ACCEPTANCE CRITERIA

Test Conditions

Heater Voltage	6.3 V	Load Capacitance	8 μf
Plate Supply Voltage	165 Vac	Load Resistance	15000 Ohms

For the purposes of inspection, use applicable reliable paragraphs of MIL-E-1 and Inspection Instructions for Electron Tubes.

MIL-E-1 Ref.	Test	AQL (%)	Limits					Units
			Min.	LAL	Bogey	UAL	Max.	
Measurements Acceptance Tests, Part 1, Note 1								
4.1.1.7	(Method A)							
4.10.8	Heater Current: ALD = 12	—	—	144	150	156	—	mA
4.10.8	Heater Current:	0.65	140	—	—	—	160	mA
4.10.15	Heater-Cathode Leakage:	0.65	—	—	—	—	—	
	Ehk = +360 Vdc	—	—	—	—	—	20	μAdc
	Ehk = −360 Vdc	—	—	—	—	—	20	μAdc
4.10.13	Operation: Note 5 Io	0.65	9.3	—	—	—	—	mAdc
4.7.5	Continuity and Shorts (Inoperatives):	0.4	—	—	—	—	—	
4.9.1	Mechanical:							
	Envelope (As Per Outline)	—	—	—	—	—	—	
Measurements Acceptance Tests, Part 2								
4.8.2	Insulation of Electrodes:							
	p-all	2.5	20	—	—	—	—	Meg
4.10.4.1	Plate Current:							
	Ebb = O V; Rp = 40,000 Ohms	2.5	5	—	—	—	25	μAdc
4.10.1.1	Emission: Is							
	Eb = 6 Vdc	2.5	25	—	—	—	—	mAdc
4.10.14	Capacitance: Note 2	6.5	—	—	—	—	—	
	0.220 In. Dia. Shield Cpk	—	1.70	—	—	—	3.30	μμf
	0.220 In. Dia. Shield Chk	—	3.4	—	—	—	5.2	μμf
	0.220 In. Dia. Shield Cph	—	1.0	—	—	—	2.6	μμf
4.9.12.1	Low Pressure Voltage Breakdown:							
	Pressure = 55 ±5 mm Hg.; Voltage = 330 Vac	6.5	—	—	—	—	—	
4.9.20.3	Vibration:							
	No Voltages; Post Shock and Fatigue Test End Points Apply	10.0	—	—	—	—	—	
Degradation Rate Acceptance Tests, Note 3								
4.9.5.3	Subminiature Lead Fatigue:	2.5	4	—	—	—	—	arcs
4.9.20.5	Shock:							
	Hammer Angle = 30°; Ehk = 100 Vdc	20	—	—	—	—	—	
4.9.20.6	Fatigue:							
	G = 2.5; Fixed Frequency; F = 25 min., 60 max.	6.5	—	—	—	—	—	
- - - -	Post Shock and Fatigue Test End Points:							
	Heater-Cathode Leakage							
	Ehk = +360 Vdc	—	—	—	—	—	40	μAdc
	Ehk = −360 Vdc	—	—	—	—	—	40	μAdc
	Operation Io	—	9.0	—	—	—	—	mAdc
4.9.6.3	Glass Strain:	6.5	—	—	—	—	—	

ACCEPTANCE CRITERIA (Continued)

MIL-E-1 Ref.	Test	AQL (%)	Allowable Defectives per Characteristic		Limits		Units
			1st Sample	Combined Samples	Min.	Max.	
Acceptance Life Tests, Note 3							
4.11.7	Heater Cycling Life Test: Ef = 7.0 V; 1 min. on, 4 min. off; Ehk = 140 Vac; Eb = O V	2.5	—	—	—	—	
4.11.3.1	Stability Life Test: (1 Hour) Note 6 TA = Room	1.0	—	—	—	—	
4.11.4	Stability Life Test End Points: Change in Operation of Individual Tubes Δ Io $_t$	—	—	—	—	10	%
4.11.3.1							
4.11.3.1.1	Survival Rate Life Test: (100 Hours) Stability Life Test Conditions or Equivalent; TA = Room	—	—	—	—	—	
4.11.4	Survival Rate Life Test End Points: Continuity and Shorts (Inoperatives)	0.65	—	—	—	—	
	Operation Io	1.0	—	—	9.0	—	mAdc
4.11.5							
4.11.3.1	Intermittent Life Test: Note 4 Stability Life Test Conditions; T Envelope = +165°C min.; 1000 Hour Requirements Do Not Apply	—	—	—	—	—	
4.11.3.1							
4.11.4	Intermittent Life Test End Points: (500 Hours)						
	Inoperatives	—	1	3	—	—	
	Heater Current	—	2	5	138	164	mA
	Operation Io	—	1	3	8.5	—	mAdc
	Change in Operation of Individual Tubes From Initial Δ Io $_t$	—	1	3	—	15	%
	Heater-Cathode Leakage	—	2	5	—	—	
	Ehk = +360 Vdc	—	—	—	—	60	μAdc
	Ehk = —360 Vdc	—	—	—	—	60	μAdc
	Insulation of Electrodes	—	2	5	—	—	
	p-all	—	—	—	10	—	Meg
	Total Defectives	—	4	8	—	—	

ACCEPTANCE CRITERIA NOTES:

1: The AQL for the combined defectives for attributes in Measurements Acceptance Tests, Part 1, excluding inoperatives and mechanical shall be one (1) percent. A tube having one (1) or more defects shall be counted as one (1) defective.

2: This tube incorporates random header leads. With tube properly positioned in adapter face plate, maintain ¼ inch clearance between bottom of tube header and top of face plate.

3: Tubes subjected to the following destructive tests are not to be accepted under this specification.

- 4.9.5.3 Subminiature lead fatigue
- 4.9.20.5 Shock
- 4.9.20.6 Fatigue
- 4.11.7 Heater cycling life test
- 4.11.5 Intermittent life test

4: Envelope temperature is defined as the highest temperature indicated when using a thermocouple of #40 BS or smaller diameter elements welded to a ring of 0.025 inch diameter phosphor bronze placed in contact with the envelope. Envelope temperature requirement will be satisfied if a tube, having bogey Ib (±5%) under normal test conditions, is determined to operate at maximum specified temperature at any position on the life test rack.

5: In a half-wave circuit adjust Zp so that a bogey tube gives Io = 10 mAdc. A bogey tube has a tube drop of Etd = 6 Vdc at Is = 45 mAdc. Ehk = Eo +117 Vac.

6: In a half-wave life test circuit, the values specified for RL and CL may be considered as approximate and shall be adjusted initially to give not less than Io = 10 mAdc and ib = 50 ma with a bogey tube. Ehk = Eo +117 Vac.

APPLICATION DATA

The 5647 is a Premium Subminiature heater-cathode type diode employing a T-1 envelope. It is particularly useful in a variety of low frequency and uhf detector circuits as well as clamping and/or gating applications. The small size also lends the tube to test equipment probes.

The 5647 is capable of operation to 1000 megacycles in many applications. The self-resonant frequency of the tube structure is approximately 9000 megacycles with a short at the tube base. However, in uhf detector applications, the external tuned circuit may be arranged to reflect the short within the tube envelope, and thus provide operation well beyond the 900-megacycle self-resonant point.

In critical detector applications, a reduction in hum output and contact potential voltage may be realized by lowering the operating heater voltage. Such a reduction will, however, result in a plate characteristic curve which departs from that obtained with rated heater voltage, Figure 1. With practical values of reduced heater voltage, hum output may be lowered by as much as 60% and contact potential by 20 to 30%. Operation under these conditions is satisfactory, providing the current requirements are consistent with values normally encountered in low level detection. An alternative method of lowering hum output and contact potential is to bias the heater with respect to the cathode.

The 5647 is intended for operation under conditions of severe shock, vibration, high altitude and high temperature and is manufactured and inspected to meet the applicable MIL-E-1 specification for reliability.

Life expectancy is described by the life tests, specified on the attached pages and/or individual MIL-E-1 specification. The actual life expectancy of the tubes in an operating circuit is affected by both the operating and environmental conditions involved. Likewise, the life tests specified indicate performance under certain operating criteria to a set of specified end points. Performance at conditions other than those specified can usually be estimated only roughly as giving better or poorer life expectancy. For further discussion of life expectancy, reference should be made to the frontal section of this manual.

When operated under conditions common to on-off control applications the tube exhibits freedom from the development of interface resistance. The heater-cathode construction is designed to withstand intermittent operation.

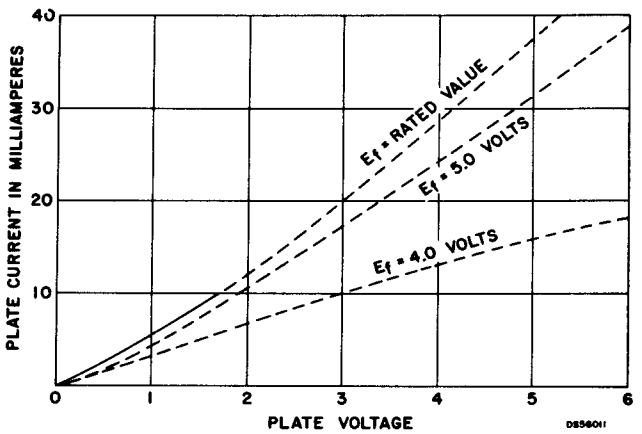
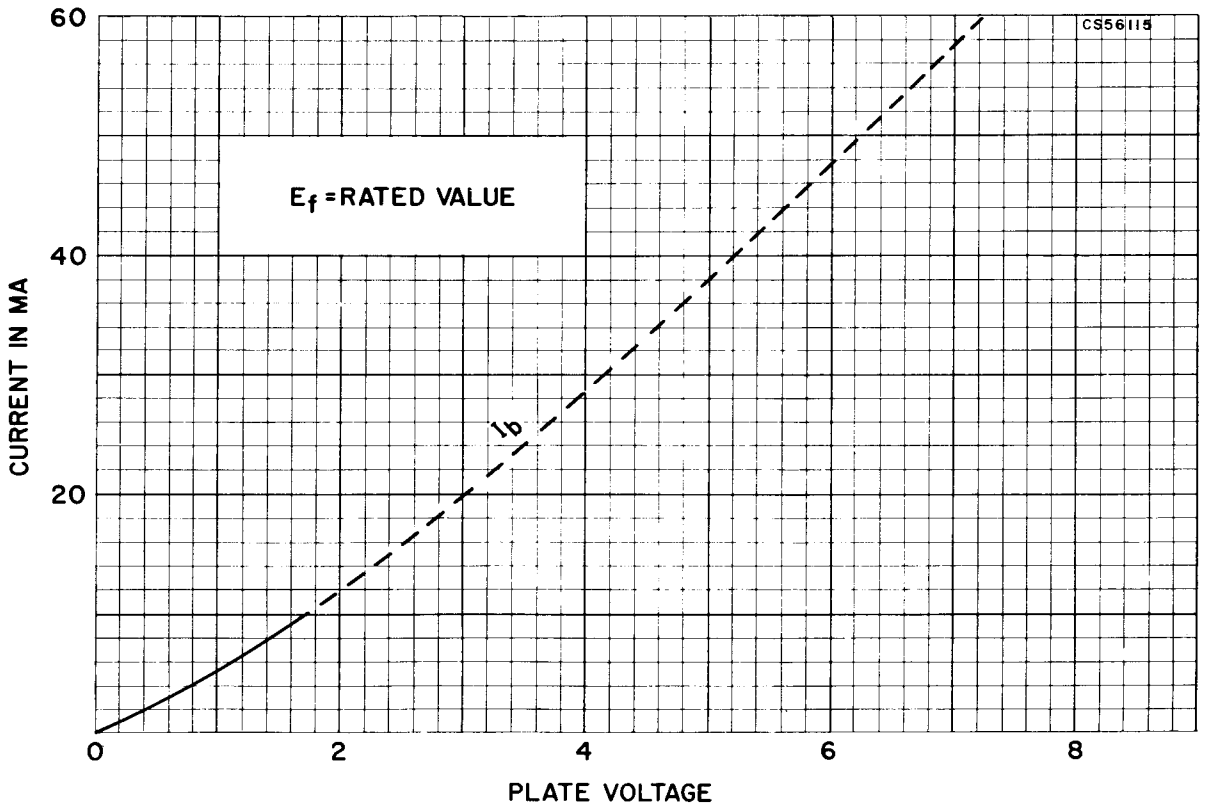


Figure 1—Approximate Plate Characteristics at reduced heater voltage.

AVERAGE PLATE CHARACTERISTICS



AVERAGE CHARACTERISTICS