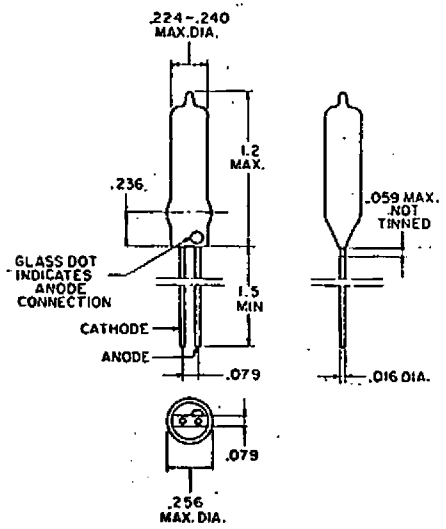
from JEDEC release #4505, Nov. 25, 1963

AMPEREX TUBE TYPE 8228

TENTATIVE DATA

The Amperex 8228 is a subminiature cold-cathode voltage reference tube for use in stable regulated power supplies, dc amplifiers, oscilloscope calibrators and similar applications.

Featuring an extremely low temperature coefficient of .0015% per °C, the 8228 affords excellent regulation and uniformity. The rugged construction of this extremely small voltage reference tube insures reliability. It is designed for a life of 30,000 hours.



JETEC T2

GENERAL CHARACTERISTICS

ELECTRICAL

Absolute Maximum Ratings	Min.	Max.
Cathode Current	2	4 ma
Peak Starting Current (T_{max} = 20 secs.)	--	10 ma [1]
Peak Inverse Voltage	--	100 volts
Bulb Temperature		
Operating	−55°C	+125°C
Storage and Standby	−55°C	+100°C

[1] To maintain maximum reference voltage stability this limit is restricted to once every 4 hours.

Characteristics (T_{amb} = 20 to 30°C)

	Min.	Typ.	Max.	
Cathode Current (Preferred Operating Point)	--	3	--	ma
Starting Voltage	115			volts [2]
DC Operating Voltage (I_C = 3 ma)	80.1	81.0	81.9	volts [3]
Incremental Resistance (I_C = 3 ma)	--	200	350	ohms [4]
AC Impedance (I_C = 2.5 ma to 3.5 ma)	--	--	400	ohms [5]
Temperature Coefficient of Operating Voltage at I_C = 3 ma:				
Averaged over t_{bulb} = + 20°C to + 125°C	--	−1.2	−2	mv/°C
Averaged over t_{bulb} = −55°C to + 20°C	--	−3.2	−4	mv/°C
Jump Voltage (I_C = 2 ma to 4 ma)	--	--	5	mv
Noise Voltage				
Oscillation	--	--	1	mv
Vibration	--	--	100	mv [6]
Ignition Breakdown Delay (In darkness E_b = 115 V)	--	--	5	msec.

Life Performance

Life Expectancy - Continuous Operation	
I_C = 3 ma	30,000 hours
Variation in DC Operating Voltage at	
I_C = 3 ma, t_{bulb} = 45°C	
0 to 1 hour	Δ Va = 100 mv
0 to 100 hours	Δ Va = 200 mv
0 to 2000 hours	Δ Va = 300 mv
Variation in DC Operating Voltage During Storage and Standby	
0 to 2000 hours (t_{bulb} = 25°C)	Δ Va = 100 mv
0 to 100 hours (t_{bulb} = 100°C)	Δ Va = 100 mv

[2] Circuit design should provide ignition voltage of 120 V minimum.

[3] Equilibrium conditions reached within 2 minutes after ignition.

[4] This is slope of V/I characteristic measured at a specified current.

[5] This is impedance of anode-cathode gap measured at I_C = 3 ma dc with 0.5 ma ac peak superimposed at 100 cycles.

[6] Sinusoidal vibration, 10 to 50 cycles, 2.5 g peak acceleration.

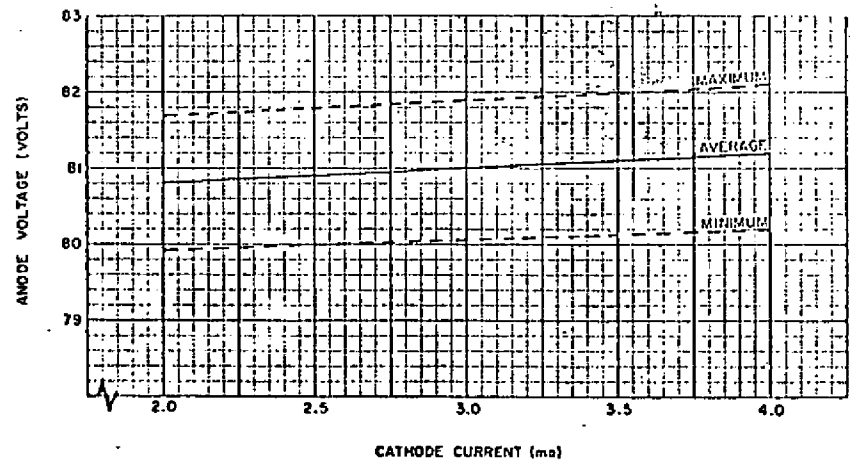
Environmental Ratings [7]

Shock Rating	500 g
NRL impact machine for electronic devices; five blows with 30° hammer angle in each of four different planes.	
Vibration Rating	2.5 g peak
Vibrated for 32 hours at 50 cycles per second in each of three different planes	

Circuit Note - Maximum external shunt capacitor = 0.1 μf maximum

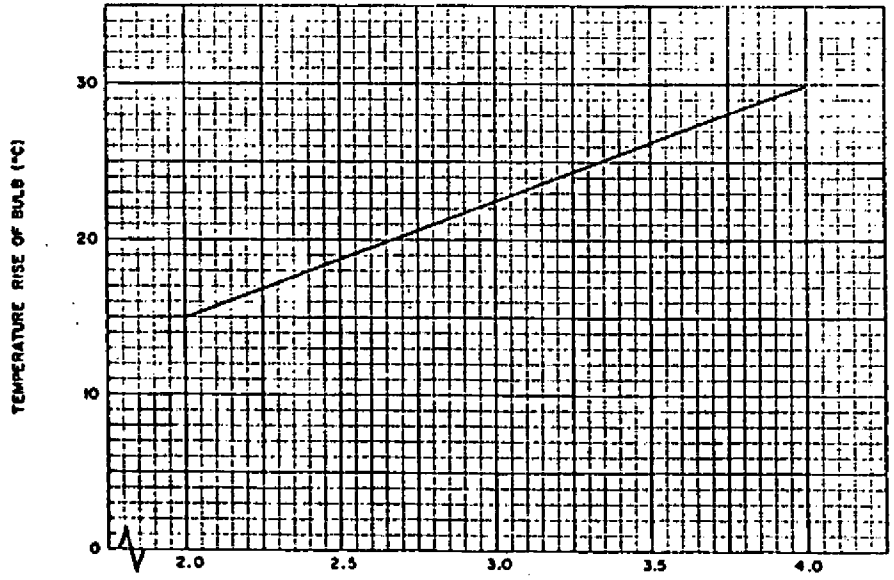
[7] These are quality evaluation conditions only. The tube is not intended to be operated continuously under these conditions.

8228



ANODE VOLTAGE VS CATHODE CURRENT

FIGURE 1



APPROX. TEMPERATURE RISE OF BULB VS CATHODE CURRENT (IN FREE AIR)

FIGURE 2