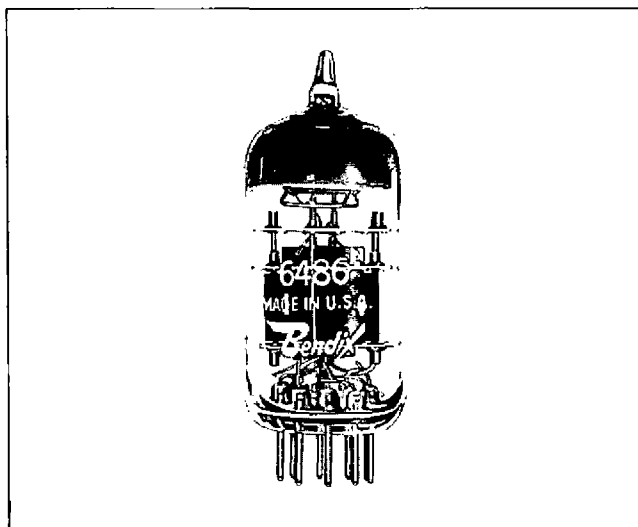


from JETEC release #1626, April 9, 1956

RELIABLE MINIATURE DUAL CONTROL PENTODE



DESCRIPTION

This miniature nine-pin dual control sharp cut-off, R.F. pentode 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 6AS6 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 control grid (Grid #1) and the suppressor grid (Grid #3) may be used as independent control electrodes for such circuits as mixers, gated amplifiers, delay circuits and gain controlled amplifiers.

CHART 1. DESIGN CENTER MAXIMUM RATINGS*

Heater Voltage (ac or dc)**	6.3 volts
Plate Voltage	180 volts
Grid #2 Voltage	140 volts
Grid #3 Voltage	30 volts
Plate Dissipation	2.0 watts
Grid #2 Dissipation	0.75 watt
Cathode Current	18 mA
Heater-Cathode Voltage	300 volts
Cathode Warm-up Time	25 seconds
Bulb Temperature (at hottest point on bulb surface)	160°C

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

** Voltage should not fluctuate more than $\pm 5\%$.

CHART 2.

PHYSICAL CHARACTERISTICS

Base	Miniature button 9-pin
Bulb	T-6 $\frac{1}{2}$
Max. overall length	2 $\frac{3}{16}$ in.
Max. seated height	1 $\frac{15}{16}$ in.
Max. diameter	$\frac{7}{8}$ in.
Mounting position	Any
Max. bulb temp.	160°C

CHART 3. AVERAGE ELECTRICAL CHARACTERISTICS

Heater Current, I _f	0.25	0.25 amp
Plate Voltage, E _b	120	120 volts
Grid #2 Voltage, E _{c2}	120	120 volts
Grid #1 Voltage, E _{c1}	-2	-2 volts
Grid #3 Voltage, E _{c3}	-3	0 volts
Plate Current, I _b	4.2	3.5 mA
Grid #2 Current, I _{c2}	5.1	3.3 mA
Mutual conductance, Grid #1—plate	2100	3250 μ mhos
Mutual conductance, Grid #3—plate	710	450 μ mhos
Grid #1 Voltage for I _b = 10 μ A (approx.)	—	-7 volts
Grid #3 Voltage for I _b = 10 μ A (approx.)	-15	0 volts
Direct Inter-electrode Capacitances	(no shield)	(with shield)
Grid #1 to plate	0.04 max.	0.035 max. μ mf
Input	4.4	4.5 max. μ mf
Output	3.7	3.3 μ mf
Grid #1 to Grid #3	0.16 max.	1.6 μ mf
Grid #3 to all other electrodes	3.5	3.6 μ mf

RED BANK DIVISION
 BENDIX AVIATION CORPORATION
 EATONTOWN, NEW JERSEY



ELECTRICAL CHARACTERISTICS AND TEST DATA

CHART 4. TEST CONDITIONS AND CHARACTERISTICS LIMITS

All Tubes are Stabilized for 45 Hours Under Test Conditions and

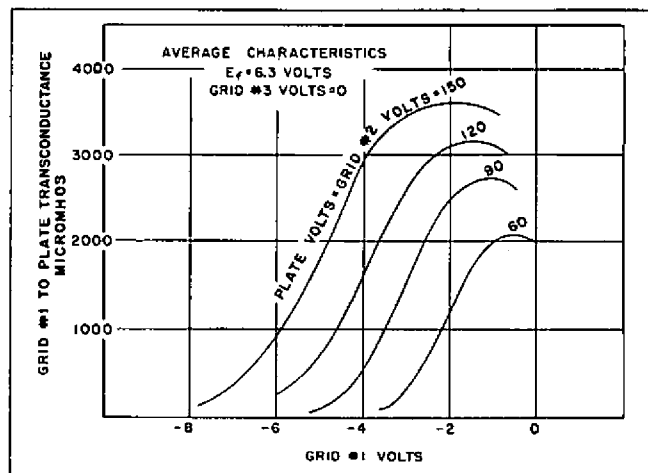
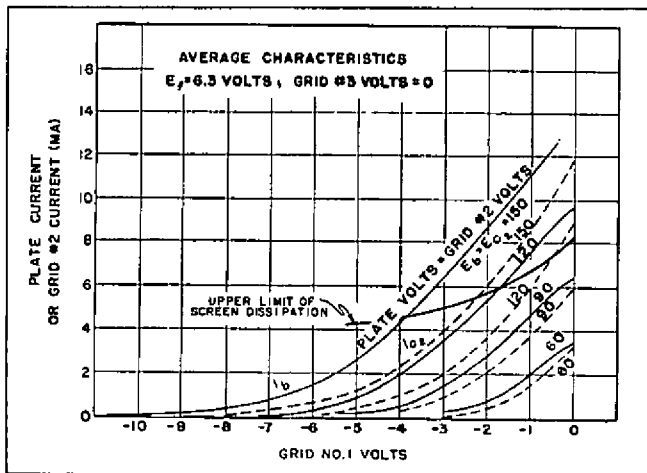
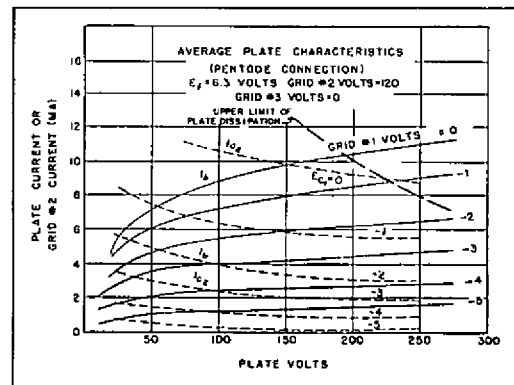
2 G Vibration of 30 Cps. Prior to 100% Testing

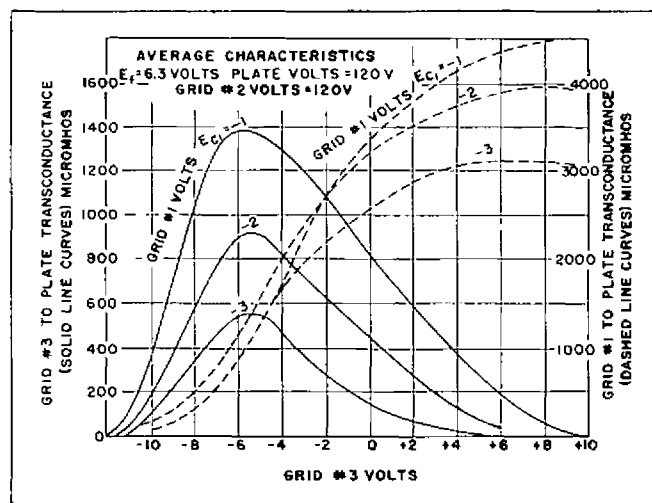
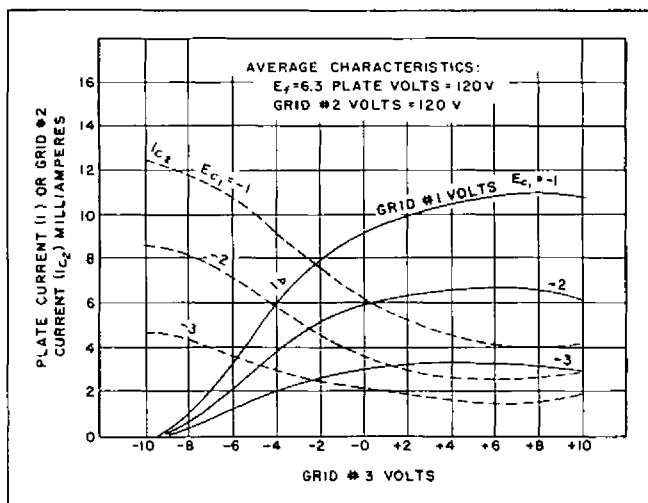
CHARACTERISTIC	SYMBOL	MIN.	DESIGN CENTER	MAX.	UNITS	
PRODUCTION TESTS						
Heater Current	If	235	250	265	mA	
Heater-Cathode Leakage	Ihk	—	—	10	μ A _{dc}	
Grid Current	Ic1	—	—	0.1	μ A _{dc}	
Plate Current	Ib	2.5	5.5	9.0	mA _{dc}	
Screen Grid Current	Ic2	1.0	2.5	6.0	mA _{dc}	
Transconductance (1) g _{1-p}	S _m	2250	3250	4500	μ mhos	
Short and Continuity						
DESIGN TESTS						
Insulation of Electrodes						
E _{g1-all} = -100 Vdc	R	100	—	—	meg	
E _{p-all} = -300 Vdc	R	100	—	—	meg	
Cut Off Plate Current						
E _{c1} = 8 Vdc E _{c3} = 0	Ib	—	—	200	μ A _{dc}	
E _{c1} = -6 Vdc E _{c3} = 0	Ib	5	—	—	μ A _{dc}	
Cut Off Plate Current						
E _{c1} = -3 Vdc E _{c3} = -10 Vdc	Ib	—	—	200	μ A _{dc}	
E _{c1} = -3 Vdc E _{c3} = -6 Vdc	Ib	5	—	—	μ A _{dc}	
Transconductance (2) g _{1-p} E _c = 5.7	Δ S _m	—	—	15	%	
Transconductance (3) g _{3-p} E _{c3} = -3	S _m	400	710	1300	μ mhos	
Transconductance (4) g _{1-p} E _{c3} = -5	S _m	500	1150	1700	μ mhos	
RF Noise E _{cat} = 15 mV				3	mW	
Noise and Microphonics						
E _{bb} = E _{cc2} = 250 Vdc						
E _{c1} = 0 R _K = 1000 ohm						
R _{g2} = 0.5 Meg. R _p = 0.1 Meg.						
C _{g2} = 2 μ f R _K = 1000 μ f						
E _{cat} = 200 mVac				200	mVac	
Capacitance (with shield)						
C _{g1-p}		—	—	0.035	μ μ f	
C _{in}		4.0	4.5	5.0	μ μ f	
C _{out}		2.9	3.3	3.7	μ μ f	
C _{g1g3}		—	—	0.16	μ μ f	
C _{g3-all}		3.2	3.6	4.0	μ μ f	
ELECTRODE:						
	E _f	E _b	E _{c1}	E _{c2}	E _{c3}	E _{hk}
TEST CONDITIONS:						
	6.3	120	-2	120	0	\pm 250
	Volts	Vdc	Vdc	Vdc	Vdc	Vdc

CHART 5. ADDITIONAL 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 2 1/2 Min. OR 2 1/2 Min. E _f = 7.5 E _{hk} = 250	3,000 On-Off Cycles
Life Test	Under "Test Conditions"	1,000 Hours
Life "Expectancy" Test	Under "Test Conditions"	5,000 Hours
High Level Fatigue Test	50G—Shock Excitation 18 Cycles/Sec.	100 Hours
Shock	500 G	20 Impacts
Altitude Test	80,000 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	





APPLICATION NOTES

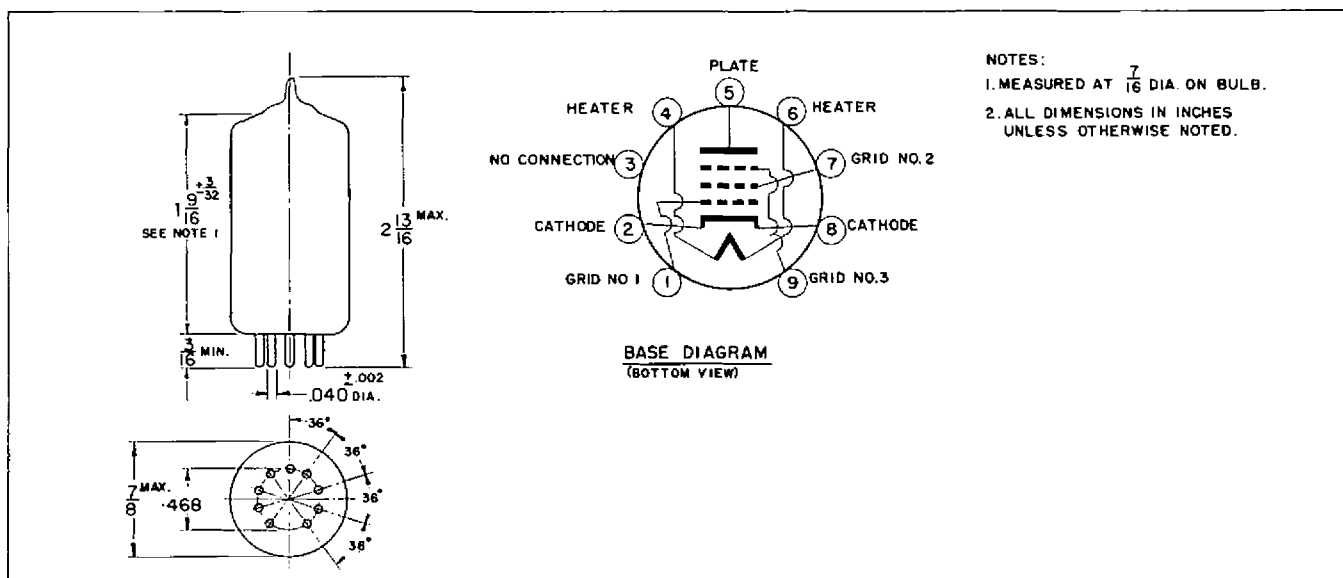
Special attention should be given to the temperatures at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy will be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced 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.

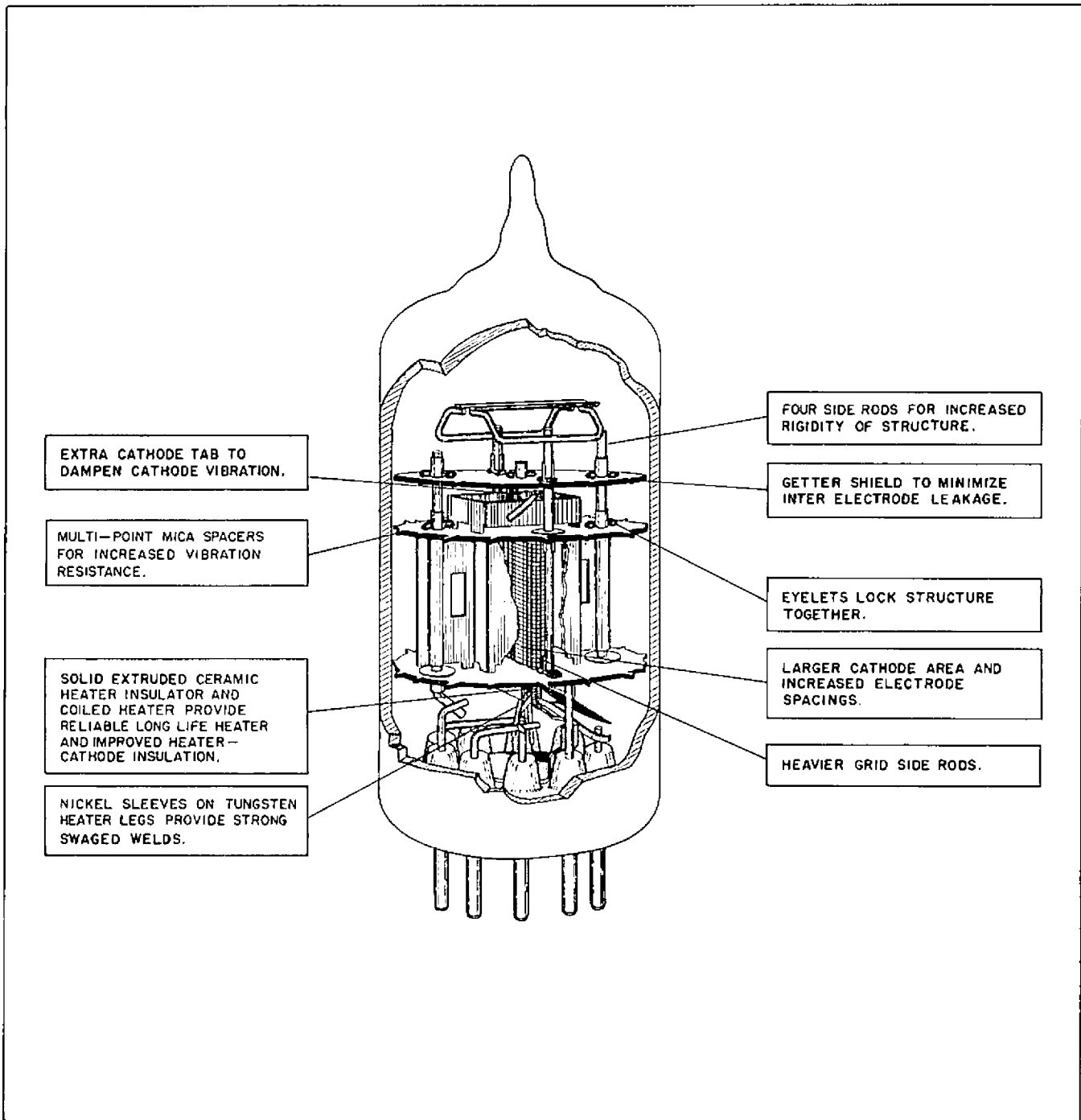
The bulb temperature should never exceed the maximum rated value at the hottest point and cooling should be employed if necessitated by the additive effects of operation at higher altitudes and high dissipation simultaneously or by other sources of heat in the equipment. Each proposed application should be life tested under maximum environmental conditions in order to check that the design gives the desired reliability.

Chart 11 is presented to emphasize the dangers of operating simultaneously at or near all maxima. In general, the effect on 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.

CHART 11. EFFECT ON LIFE OF INCREASED RATINGS

See Also Application Notes	OPERATING CONDITIONS		
	CONSERVATIVE	TYPICAL	MAXIMUM
RATING OR CHARACTERISTIC			
Heater Voltage	6.3 V ± 2%	6.3 V ± 5%	6.3 V ± 10%
Plate Voltage	120 Vdc	150 Vdc	180 Vdc
Screen Voltage	100 Vdc	120 Vdc	140 Vdc
Plate Current (Av.)	2.5 mA	5.5 mA	9 mA
Screen Current (Av.)	1.0 mA	3.5 mA	6 mA
Cathode Current (Peak)	8 mA	10 mA	18 mA
H-K Voltage	200 V	250 V	300 V
Bulb Temperature	100°C	120°C	160°C
Altitude	0-20,000 ft	60,000 ft	80,000 ft
Vibration	1 G	2.5 G	5 G
LIFE EXPECTANCY	MAXIMUM	HIGH	MEDIUM





STRUCTURAL FEATURES OF 6486 PROVIDE HIGH RELIABILITY AND LONG LIFE.

RED BANK DIVISION
BENDIX AVIATION CORPORATION
EATONTOWN, NEW JERSEY



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