6486

Bendix Red Bank Type TE-11

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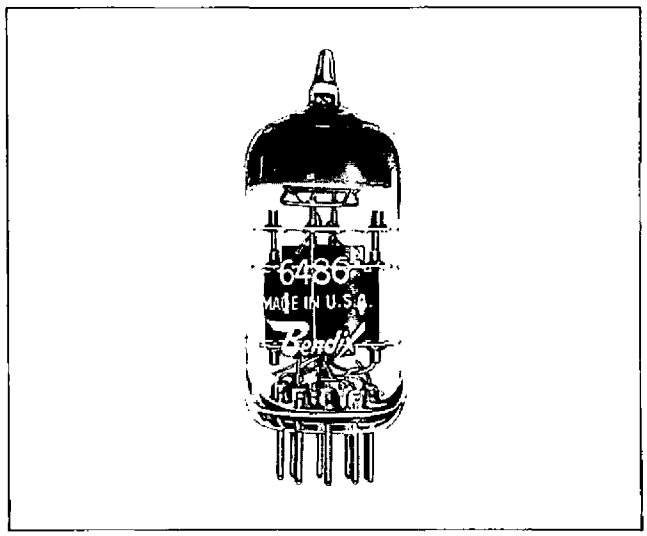
RELIABLE MINIATURE DUAL CONTROL PENTODE



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 ±5%.

CHART 2.

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	⅞ in.
Mounting position	Any
Max. bulb temp.	160°C

CHART 3. AVERAGE ELECTRICAL CHARACTERISTICS

Heater Current, If	0.25	0.25 amp
Plate Voltage, Eb	120	120 volts
Grid #2 Voltage, Ec2	120	120 volts
Grid #1 Voltage, Ec1	—2	—2 volts
Grid #3 Voltage, Ec3	—3	0 volts
Plate Current, Ib	4.2	3.5 mA
Grid #2 Current, Ic2	5.1	3.3 mA
Mutual conductance, Grid #1—plate	2100	3250 μmhos
Mutual conductance, Grid #3—plate	710	450 μmhos
Grid #1 Voltage for Ib = 10 μA (approx.)	—	—7 volts
Grid #3 Voltage for Ib = 10 μA (approx.)	—15	0 volts

Direct Inter-electrode Capacitances	(no shield)	(with shield)
Grid #1 to plate	0.04 max.	0.035 max. μμf
Input	4.4	4.5 max. μμf
Output	3.7	3.3 μμf
Grid #1 to Grid #3	0.16 max.	1.6 μμf
Grid #3 to all other electrodes	3.5	3.6 μμf

RED BANK DIVISION
BENDIX AVIATION CORPORATION
EATONTOWN, NEW JERSEY

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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 at 30 Cps. Prior to 100% Testing

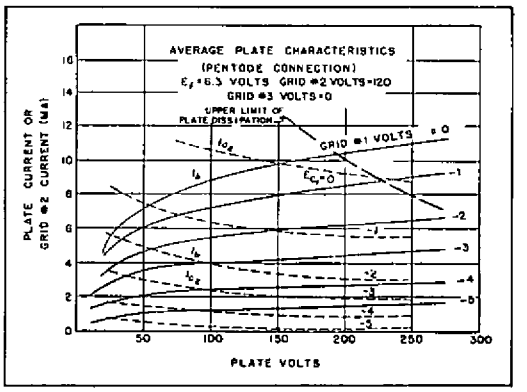
CHARACTERISTIC	SYMBOL	MIN.	DESIGN CENTER	MAX.	UNITS
PRODUCTION TESTS					
Heater Current	If	235	250	265	mA
Heater-Cathode Leakage	Ihk	—	—	10	μAdc
Grid Current	Ic1	—	—	0.1	μAdc
Plate Current	Ib	2.5	5.5	9.0	mAdc
Screen Grid Current	Ic2	1.0	2.5	6.0	mAdc
Transconductance (1) g1-p	Sm	2250	3250	4500	μmhos
Short and Continuity					
DESIGN TESTS					
Insulation of Electrodes					
Eg1-all = −100 Vdc	R	100	—	—	meg
Ep-all = −300 Vdc	R	100	—	—	meg
Cut Off Plate Current					
Ec1 = 8 Vdc Ec3 = 0	Ib	—	—	200	μAdc
Ec1 = −6 Vdc Ec3 = 0	Ib	5	—	—	μAdc
Cut Off Plate Current					
Ec1 = −3 Vdc Ec3 = −10 Vdc	Ib	—	—	200	μAdc
Ec1 = −3 Vdc Ec3 = −6 Vdc	Ib	5	—	—	μAdc
Transconductance (2) g1-p Ec = 5.7	ΔSm	—	—	15	%
Transconductance (3) g3-p Ec3 = −3	Sm	400	710	1300	μmhos
Transconductance (4) g1-p Ec3 = −5	Sm	500	1150	1700	μmhos
RF Noise Ecat = 15 mV		—	—	3	mW
Noise and Microphonics Ebb = Ecc2 = 250 Vdc Ec1 = 0 RK = 1000 ohm Rg2 = 0.5 Meg. Rp = 0.1 Meg. Cg2 = 2 μf RK = 1000 μf Ecat = 200 mVac	—	—	—	200	mVac
Capacitance (with shield)					
	Cg1-p	—	—	0.035	μμf
	Cin	4.0	4.5	5.0	μμf
	Cout	2.9	3.3	3.7	μμf
	Cg1g3	—	—	0.16	μμf
	Cg3-all	3.2	3.6	4.0	μμf

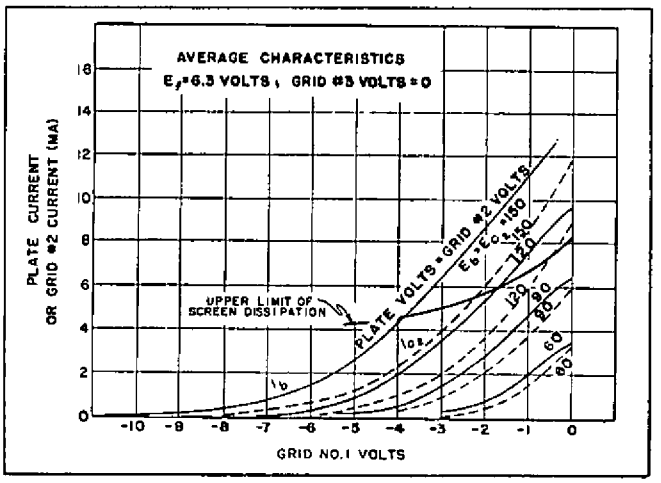
ELECTRODE:	Ef	Eb	Ec1	Ec2	Ec3	Ehk
TEST CONDITIONS:	6.3 Volts	120 Vdc	−2 Vdc	120 Vdc	0	±250 Vdc

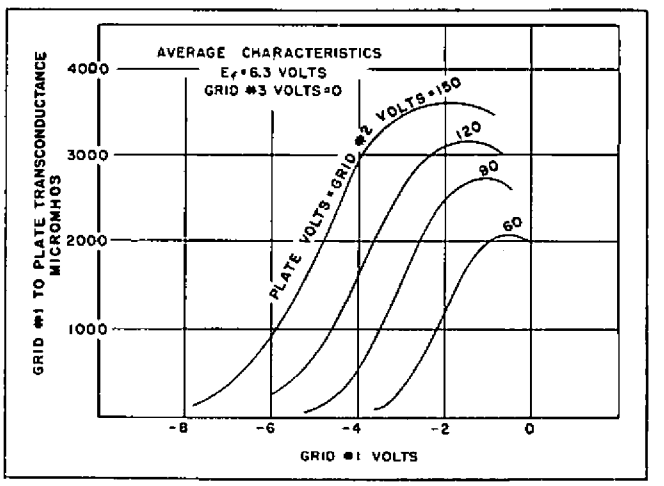
CHART 5. ADDITIONAL TESTS

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 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"	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	







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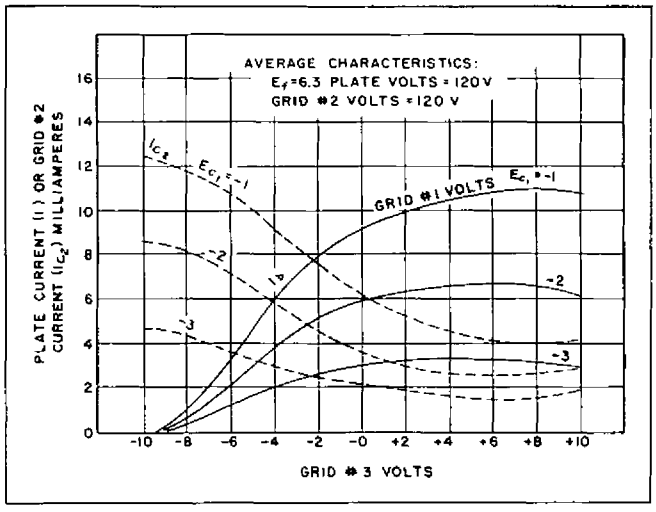
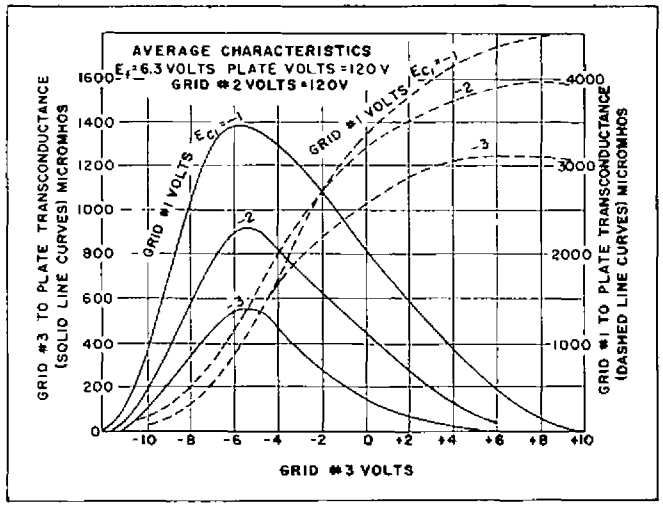




APPLICATION NOTES

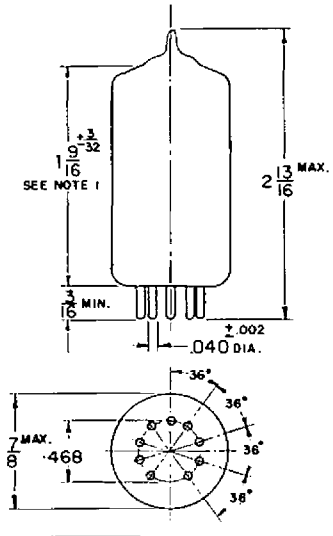
Special attention should be given to the temperatures at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy will be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced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

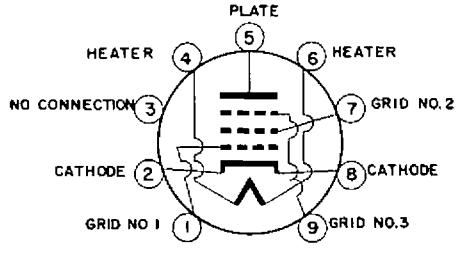
The bulb temperature should never exceed the maximum rated value at the hottest point and cooling should be employed if necessitated by the additive effects of operation at higher altitudes and high dissipation simultaneously or by other sources of heat in the equipment. Each proposed application should 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		
RATING OR CHARACTERISTIC	CONSERVATIVE	TYPICAL	MAXIMUM
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





BASE DIAGRAM
(BOTTOM VIEW)

NOTES:
1. MEASURED AT 7/16 DIA. ON BULB.
2. ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

MINIATURE BEAM POWER AMPLIFIER

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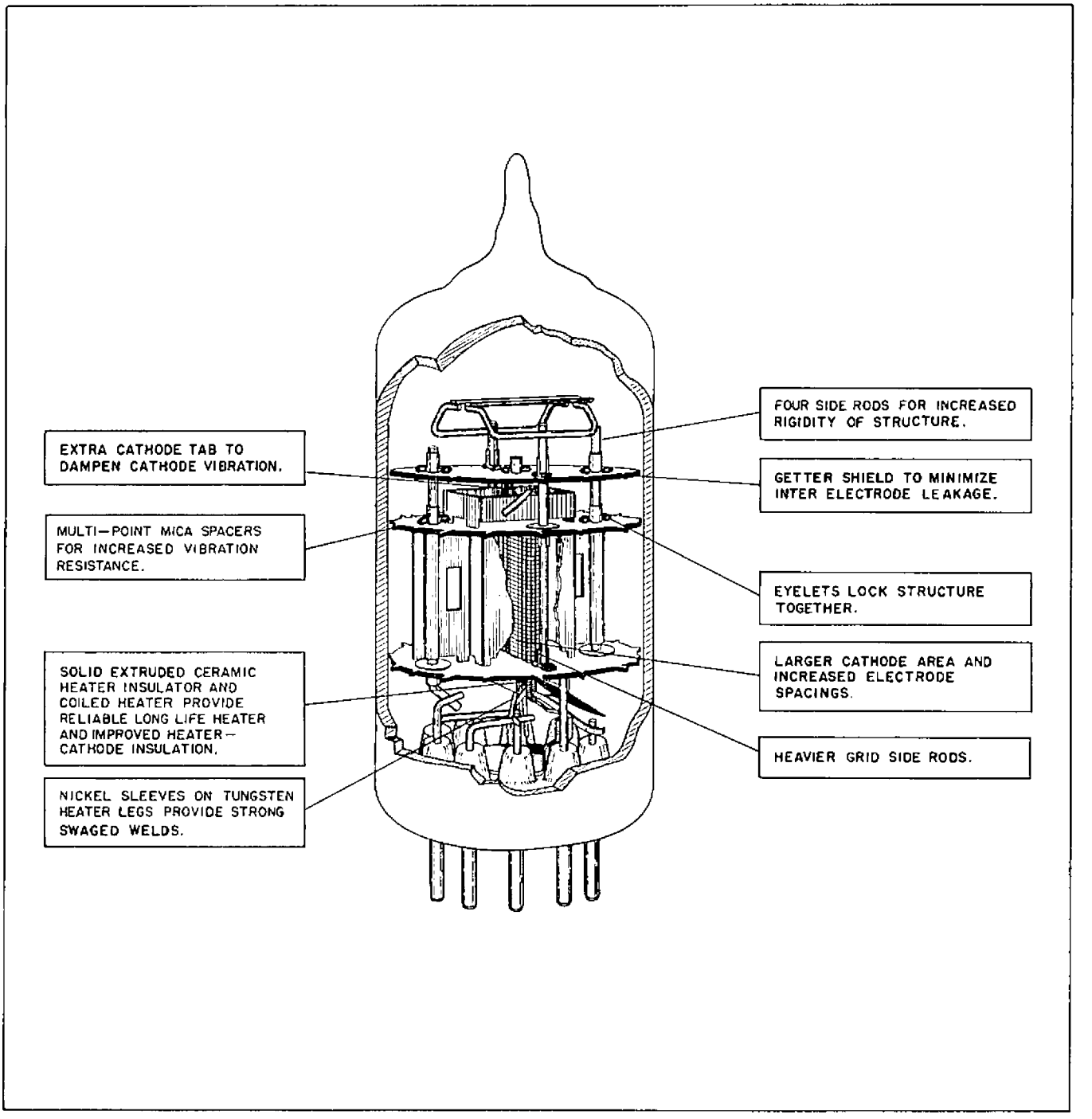

STRUCTURAL FEATURES OF 6486 PROVIDE HIGH RELIABILITY AND LONG LIFE.

RED BANK DIVISION
BENDIX AVIATION CORPORATION
EATONTOWN, NEW JERSEY

Bendix Red Bank

West Coast Sales and Service: 117 E. Providencia, Burbank, Calif.
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.
Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, P.Q.