6BN6—3BN6
4BN6—12BN6

GATED-BEAM DISCRIMINATOR

FOR FM AND TV LIMITER AND DISCRIMINATOR APPLICATIONS

DESCRIPTION AND RATING

The 6BN6 is a miniature beam tube primarily designed to perform the combined functions of the limiter, discriminator, and audio-voltage amplifier in FM and intercarrier television receivers. Advantages inherent in this application of the 6BN6 include excellent performance, circuit simplicity, and ease of alignment. Additional applications of the tube include use as a limiter or as a sync-clipper.

Except for heater ratings and heater-cathode voltage ratings, the 3BN6 and 4BN6 are identical to the 6BN6. As a result of their controlled heater-warm-up characteristic, the 3BN6 and 4BN6 are especially suited for use in television receivers that employ series-connected heaters.

The 12BN6 is identical to the 6BN6 except for heater ratings.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

	3BN6	4BN6	6BN6	12BN6	
Heater Voltage, AC or DC	3.15	4.2	6.3	12.6	Volts
Heater Current	0.6	0.45	0.3	0.15	Amperes
Heater Warm-up Time*	11	11	...	...	Seconds

Direct Interelectrode Capacitances†

Grid-Number 1 to All	4.2	μμf
Grid Number 3 to All	3.3	μμf
Grid-Number 1 to Grid-Number 3, maximum	0.004	μμf

MECHANICAL

Mounting Position—Any
Envelope—T5½, Glass
Base—E7-1, Miniature Button 7-Pin

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES

Plate-Supply Voltage	330	Volts
Accelerator Voltage	110	Volts
Peak Positive Limiter-Grid Voltage	60	Volts
DC Cathode Current	13	Milliamperes

Heater-Cathode Voltage	3BN6 4BN6	6BN6 12BN6	
Heater Positive with Respect to Cathode			
DC Component	100	...	Volts
Total DC and Peak	200	100	Volts
Heater Negative with Respect to Cathode			
Total DC and Peak	200	100	Volts

Design-Maximun ratings are limiting values of operating and environmental conditions applicable to a bogey tube of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

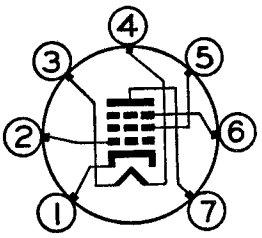
The tube manufacturer chooses these values to provide acceptable serviceability of the tube, taking responsibility for the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, and environmental conditions.

GENERAL ELECTRIC

Supersedes ET-T874, dated 7-54
△*Supersedes pages 1 and 2, dated 11-56.*

BASING DIAGRAM



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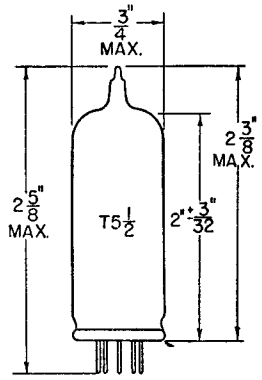
TERMINAL CONNECTIONS

Pin 1—Cathode, Focus Electrode, and Internal Shields
Pin 2—Grid Number 1 (Signal or Limiter)
Pin 3—Heater
Pin 4—Heater
Pin 5—Grid Number 2 (Accelerator)
Pin 6—Grid Number 3 (Quadrature)
Pin 7—Plate

PHYSICAL DIMENSIONS



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CHARACTERISTICS AND TYPICAL OPERATION

LIMITER-DISCRIMINATOR SERVICE (SEE CIRCUIT DIAGRAM)

Input-Signal Center Frequency	10.7	10.7	4.5	Megacycles
Frequency Deviation	±75	±75	±25	Kilocycles
Plate-Supply Voltage	85	285	270	Volts
Plate Voltage	63	122	121	Volts
Accelerator Voltage	55	100	100	Volts
Cathode-Bias Resistor (Variable)‡	200–400	200–400	200–400	Ohms
Plate Load Resistor	85000	330000	330000	Ohms
Plate Linearity Resistor	470	1500	1000	Ohms
Integrating Capacitor	0.002	0.001	0.001	Microfarads
Coupling Capacitor	0.25	0.01	0.25	Microfarads
Minimum Signal Voltage for Limiting Action, RMS§	1.25	1.25	1.25	Volts
DC Plate Current	0.25	0.49	0.44	Milliamperes
Accelerator Current	4.1	9.8	10	Milliamperes
Input Signal Level for AM Rejection Adjustment‡	1.25	2.0	2.0	Volts
AM Rejection at Esig = 2.0 Volts, RMS	31	20	25	Decibels
AM Rejection at Esig = 3.0 Volts, RMS	30	29	30	Decibels
Total Harmonic Distortion	2.0	1.6	1.8	Percent
Peak Audio Output Voltage	6.0	16.6	16.8	Volts

* The time required for the voltage across the heater to reach 80 percent of its rated value after applying 4 times rated heater voltage to a circuit consisting of the tube heater in series with a resistance equal to 3 times the rated heater voltage divided by the rated heater current.

† Without external shield.

‡ The cathode resistor should be adjusted for maximum AM rejection in the output of the limiter-discriminator stage at the specified signal level. AM rejection is measured with an applied signal containing 30-percent amplitude modulation and 30-percent frequency modulation.

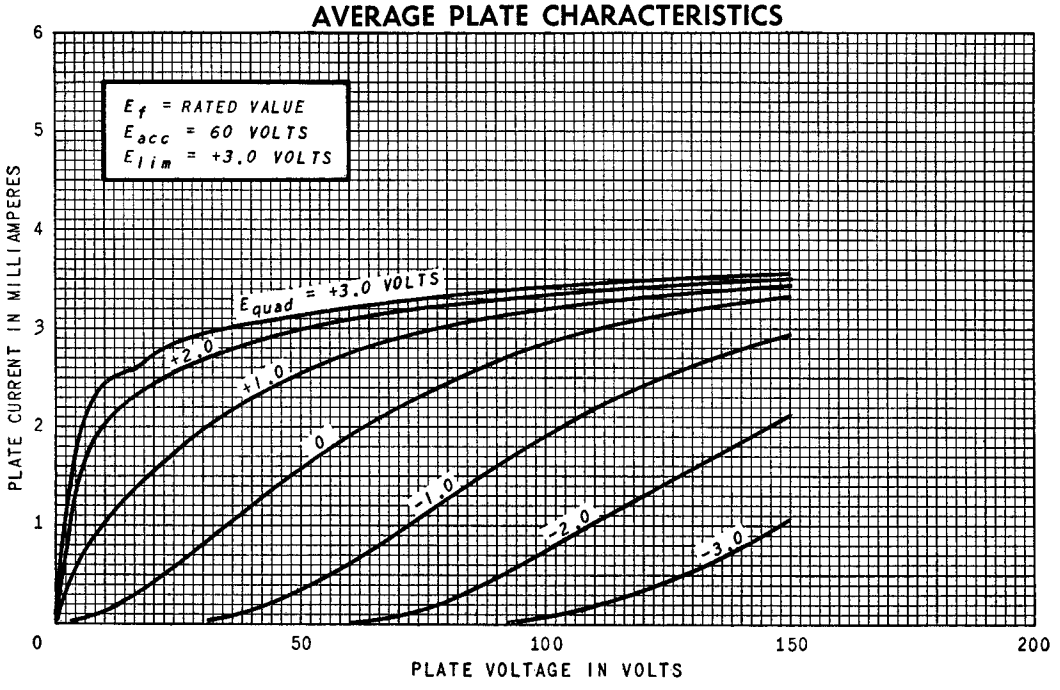
§ At signal levels above specified value, limiting is within ±2 decibels.

Adequate shielding between components of the limiter grid and the quadrature grid must be used to insure proper phasing of the voltage developed on the quadrature grid.

Standard de-emphasis requirements for FM are included.

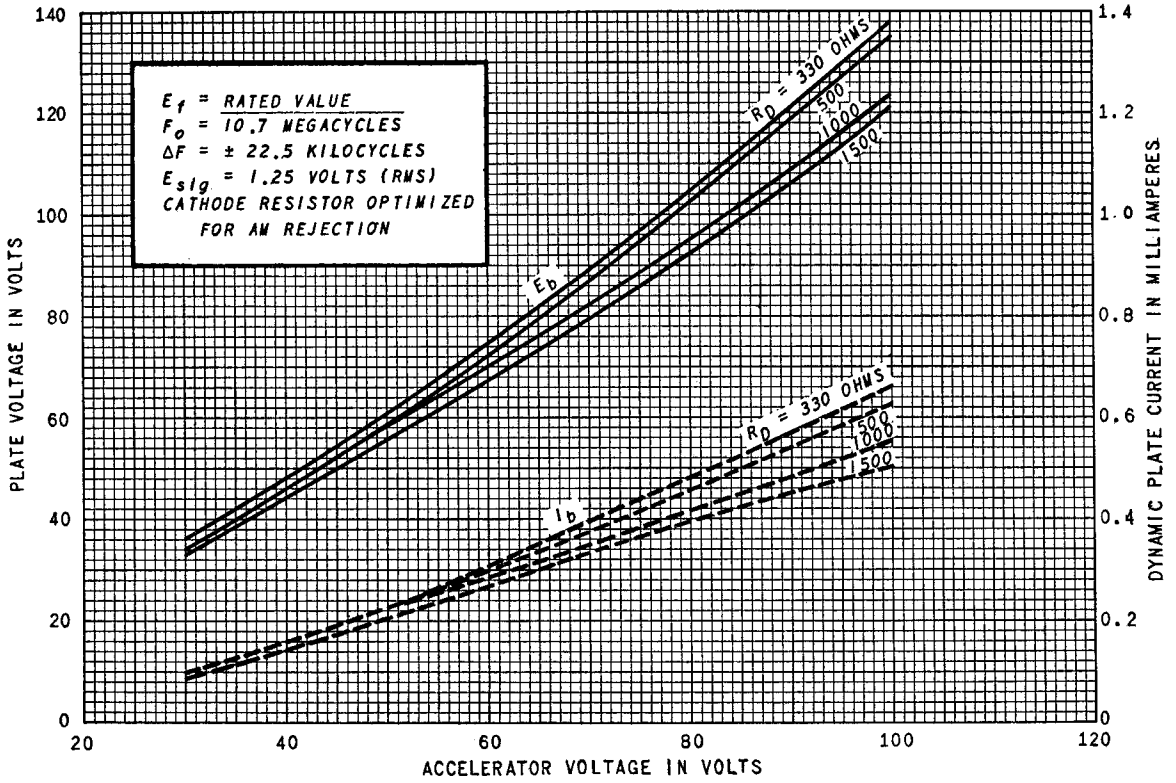
The Q of the quadrature grid circuit should be high enough to develop a minimum of 4 volts (RMS) signal with 2 volts (RMS) of the center-frequency signal applied to the limiter grid. It is recommended that the coil be shunted by a minimum of 10 $\mu\mu$f. The capacitance may be composed of tube input capacitance, stray capacitance, and distributed capacitance, as well as physical capacitance.

AVERAGE PLATE CHARACTERISTICS

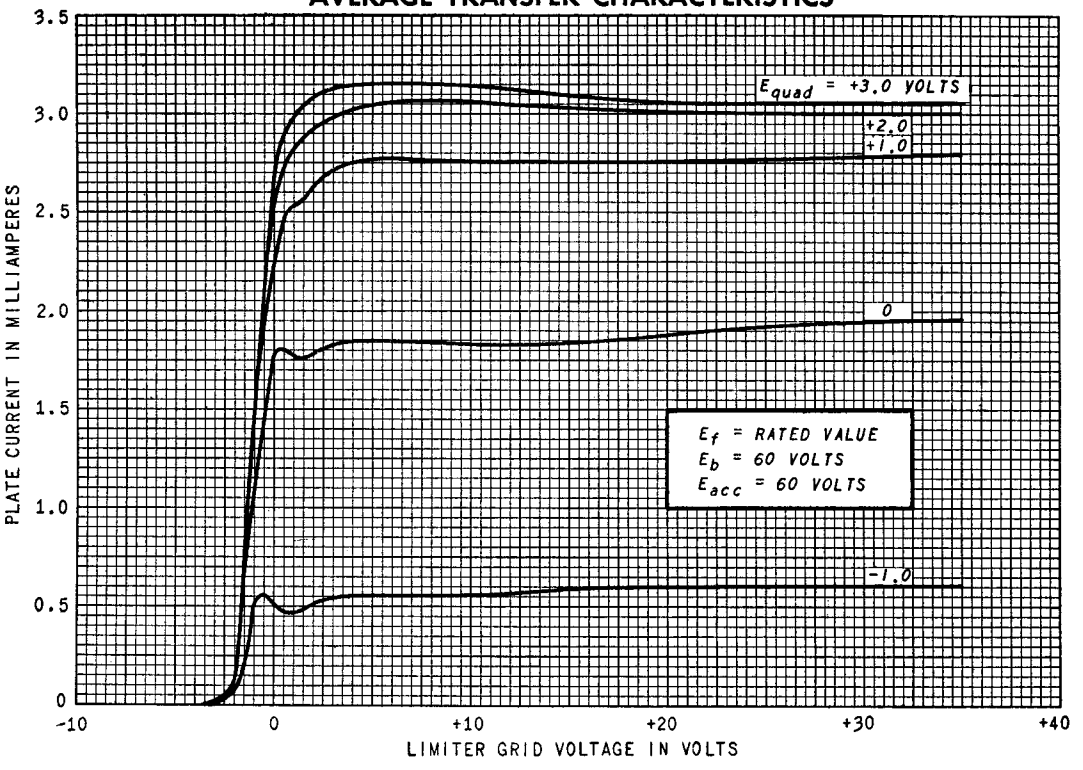


OPERATION CHARACTERISTICS

To obtain the optimum dial-tuning characteristic (a symmetrical discriminator response curve) in FM applications, it is essential that the ratio of plate current with no signal to plate current with an unmodulated signal should equal unity. After a value of accelerator voltage is chosen, the plate voltage applied to the tube should be chosen as indicated by the following graph in order to realize this unity ratio of plate current. The graph also shows the average dynamic plate current that is flowing under the specified plate and accelerator voltage conditions. The plate load resistor should be chosen to drop the plate supply voltage to the specified plate voltage.



AVERAGE TRANSFER CHARACTERISTICS



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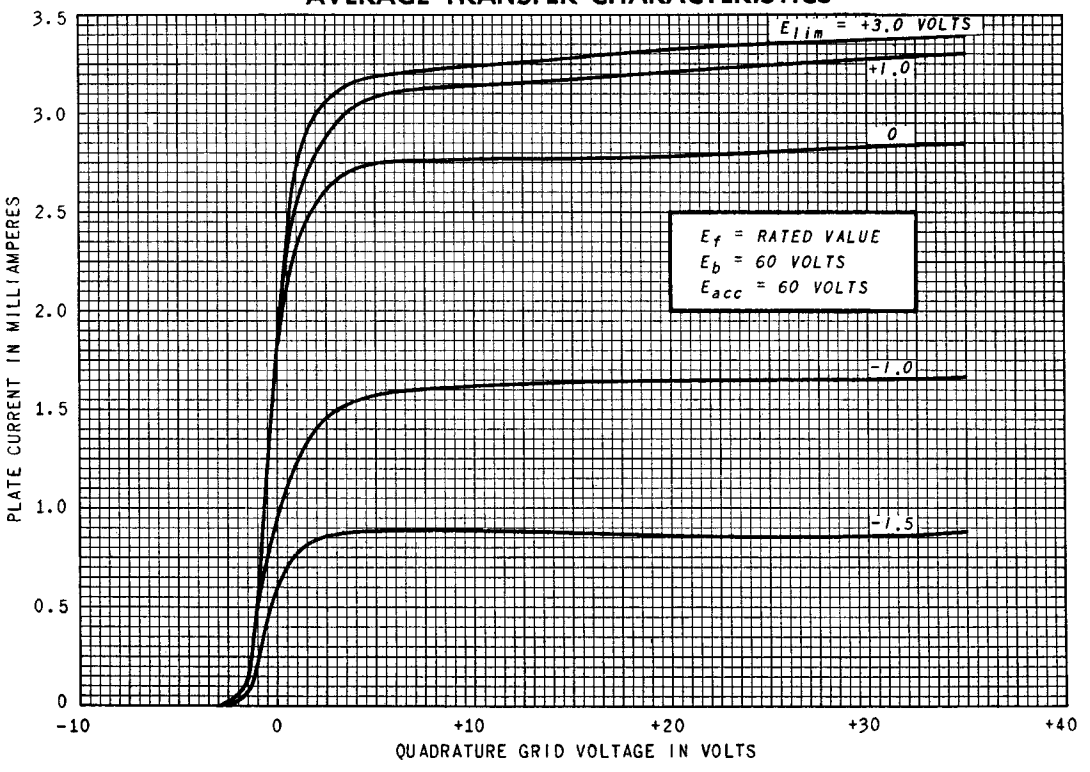
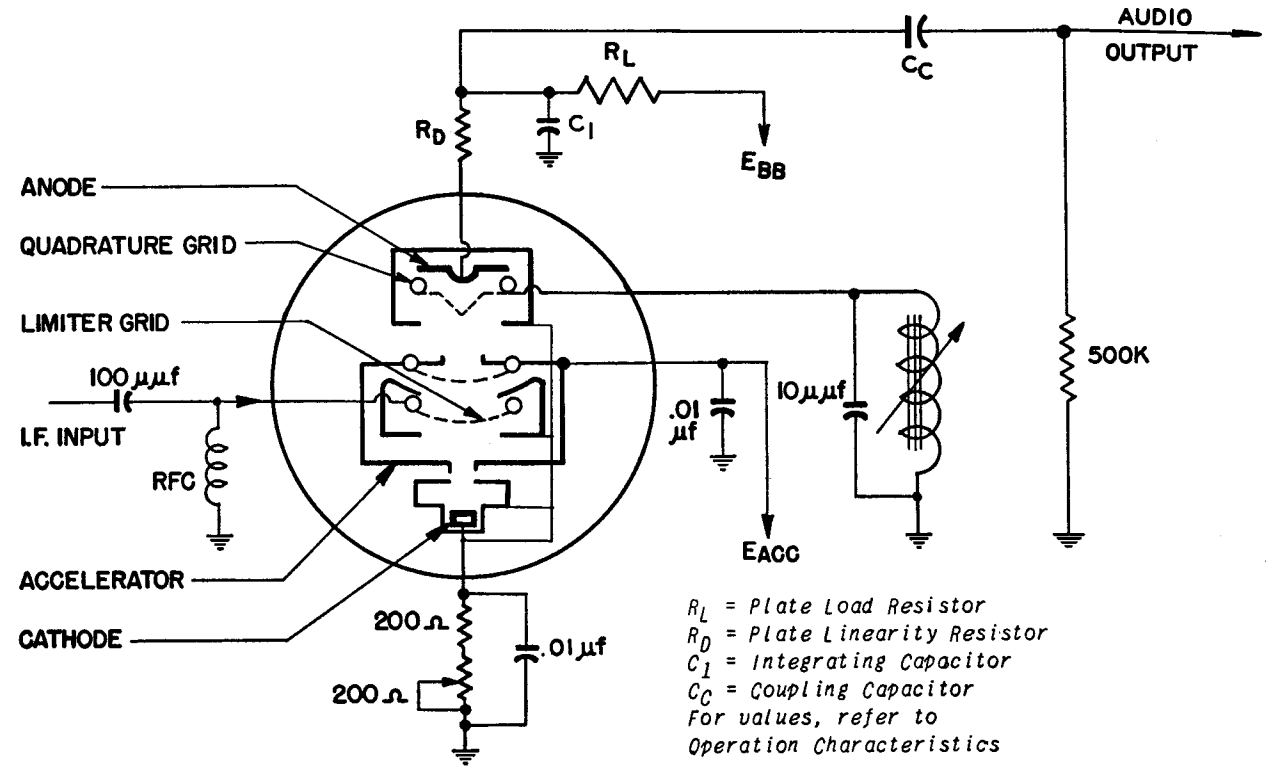


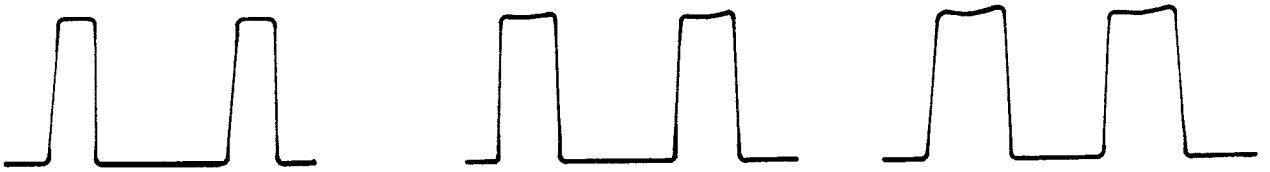
SCHEMATIC DIAGRAM SHOWING TYPICAL CIRCUIT AND INTERNAL CONSTRUCTION OF THE 6BN6



R_L = *Plate Load Resistor*
R_D = *Plate Linearity Resistor*
C_1 = *Integrating Capacitor*
C_C = *Coupling Capacitor*
For values, refer to Operation Characteristics

WAVEFORMS OF PLATE CURRENT

f = *frequency of applied signal*
f_0 = *center-frequency of applied signal*



$f > f_0$ $\quad$ $f = f_0$ $\quad$ $f < f_0$