



**ELECTRONIC
INNOVATIONS
IN ACTION**

TUBES

Beam Triode

6EN4

FOR HV SHUNT REGULATOR APPLICATIONS

■ **COLOR TV TYPE**

■ **30000 VOLTS DC**

■ **40 WATTS PLATE DISSIPATION**

■ **X-RADIATION RATING**

The 6EN4 is a low current, high-voltage, sharp cutoff beam triode intended for use as a shunt regulator in the high-voltage power supply of color television receivers.

The 6EN4 has a maximum d-c plate voltage rating of 30000 volts, a maximum d-c plate current rating of 1.6 milliamperes, and a maximum plate-dissipation rating of 40 watts.

The basing of the 6EN4 has been designed to permit the original equipment manufacturer to wire the tube socket so as to prevent the earlier high voltage regulator tubes from being used in place of the 6EN4. Moreover, the 6EN4, with its improved X-radiation features, can be used as a replacement for the 6BK4, 6BK4-A, 6BK4-C and 6EL4-A in earlier color television receivers.

Features of the 6EN4 include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output.

GENERAL

ELECTRICAL

| | | |
|--------------------------------------|-----------|---------|
| Cathode - Coated Unipotential | | |
| Heater Characteristics and Ratings | | |
| Heater Voltage, AC or DC * | 6.3 ± 0.6 | Volts |
| Heater Current • | 0.2 | Amperes |
| Direct Interelectrode Capacitances ▲ | | |
| Grid to Plate: (g to p) | 1.0 | pf |
| Input: g to (h+k) | 2.6 | pf |
| Output: p to (h+k) | 1.0 | pf |

MECHANICAL

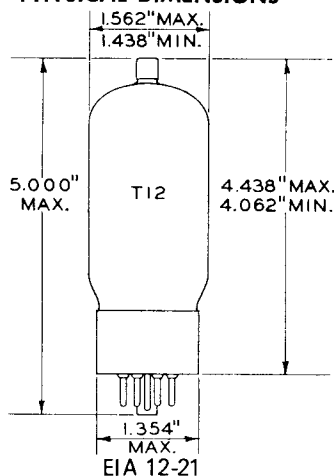
| | | |
|---|-------|--------|
| Operating Position - Any | | |
| Envelope - T-12, Glass | | |
| Base - B8-118, Short Medium Shell Octal 8-Pin | | |
| Top Cap - C1-50, Small | | |
| Outline Drawing - EIA 12-21 | | |
| Maximum Diameter | 1.562 | Inches |
| Minimum Bulb Diameter | 1.438 | Inches |
| Maximum Over-all Length | 5.000 | Inches |
| Maximum Seated Height | 4.438 | Inches |
| Minimum Seated Height | 4.062 | Inches |

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

| | | |
|--|-------|-----------------|
| Plate Voltage (Absolute-Maximum Value) | 30000 | Volts |
| Negative DC Grid Voltage | 135 | Volts |
| Peak Negative Grid Voltage ♦ | 440 | Volts |
| Plate Dissipation (Absolute-Maximum Value) | 40 | Watts |
| DC Plate Current (Absolute-Maximum Value) | 1.6 | Milliamperes |
| Heater-Cathode Voltage | | |
| Heater Positive with Respect to Cathode | | Not Recommended |
| Heater Negative with Respect to Cathode § | 450 | Volts |
| Grid-Circuit Resistance | 3.0 | Megohms |

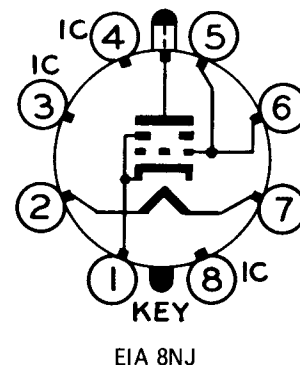
PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

- Pin 1 - Cathode and Internal Shield
- Pin 2 - Heater
- Pin 3 - Internal Connection - Do Not Use
- Pin 4 - Internal Connection - Do Not Use
- Pin 5 - Grid
- Pin 6 - Grid
- Pin 7 - Heater
- Pin 8 - Internal Connection - Do Not Use
- Cap - Plate

BASING DIAGRAM



MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron 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, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

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, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron 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, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of

all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

| | | |
|--|-------|--------------|
| Unregulated DC Supply Voltage | 36000 | Volts |
| Equivalent Resistance of Unregulated Supply | 11 | Megohms |
| Voltage Divider Values: | | |
| R1 (5 Watts) | 220 | Megohms |
| R2 (2 Watts) | 1 | Megohms |
| R3 (½ Watt) | 0.82 | Megohms |
| DC Reference Voltage | 200 | Volts |
| Equivalent Resistance of Reference Supply | 1000 | Ohms |
| Effective Grid-Plate Transconductance | 200 | Micromhos |
| DC Plate Current for Zero Load Current | 1000 | Microamperes |
| DC Plate Current for Load Current of 1 Milliampere | 45 | Microamperes |
| Regulated DC Output Voltage at Zero Load Current | 25000 | Volts |
| Regulated DC Output Voltage at Load Current of 1 Milliampere | 24500 | Volts |

X-RADIATION RATING

X-radiation, maximum 0.5 mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life, when operated within the maximum ratings, including filament voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Operation of the 6EN4 outside of the Absolute-Maximum

Ratings indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute-Maximum Ratings are not exceeded.

The above X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein.

WARNING**X-RADIATION**

Operation of the 6EN4 outside of the Absolute-Maximum Ratings indicated may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of the equipment employing the 6EN4 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

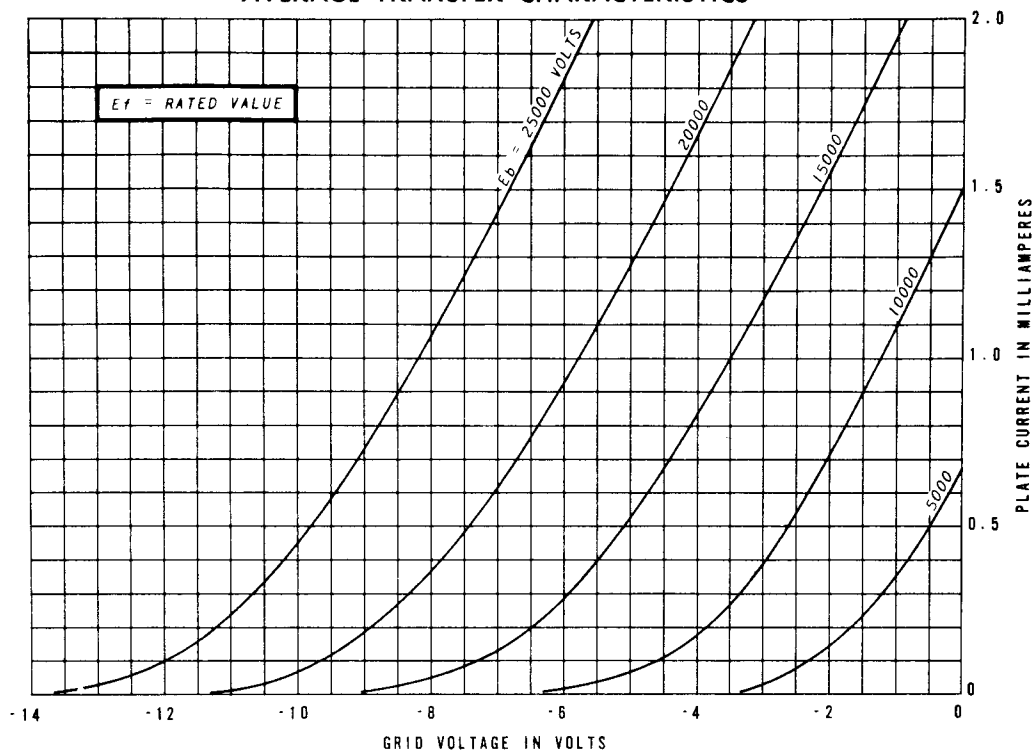
The high voltages at which the 6EN4 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and for the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 6EN4 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

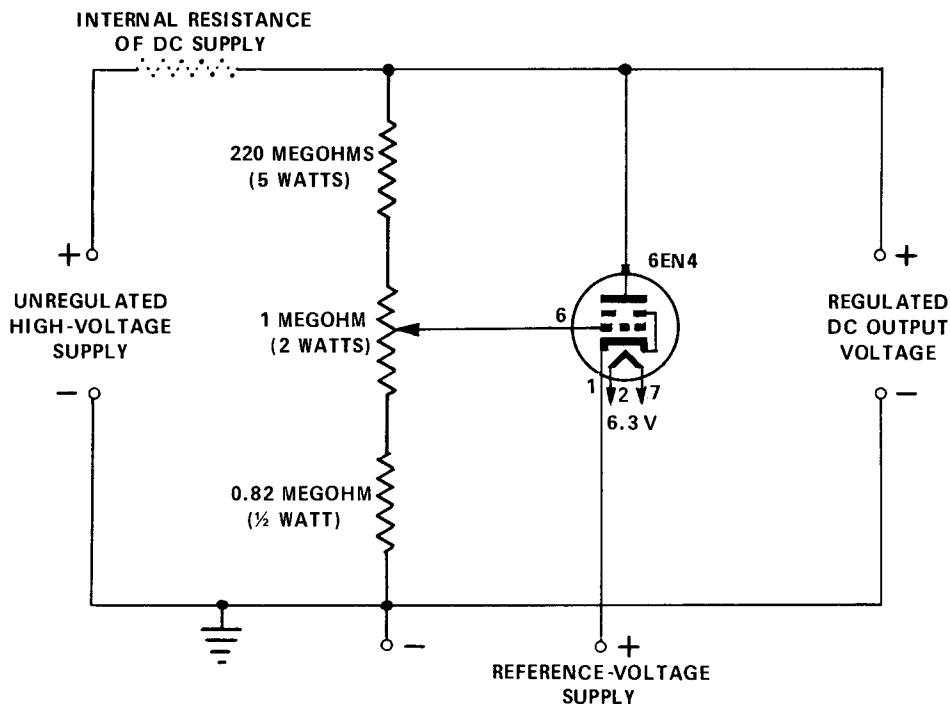
THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

- ★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
- Heater current of a bogey at $E_f = 6.3$ volts.
- ▲ Without external shield.
- ◆ Peak value for duration of 20 seconds maximum during equipment warmup.
- § Sufficient impedance (1000 ohms is recommended) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

AVERAGE TRANSFER CHARACTERISTICS

TYPICAL SHUNT REGULATOR CIRCUIT



APPLICATION CONSIDERATIONS

The base pins of the 6EN4 fit the standard octal socket. Socket terminals for pins 3, 4, and 8 should not be used for tie points. Tube performance may be adversely affected should this precaution not be followed.

Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short circuit conditions to 450 ma. This protection impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

The bulb of the 6EN4 becomes hot during operation. Therefore, it is essential that provision be made for free

circulation of air around the tube in order to insure sufficient cooling. Darkening of the bulb during service is a normal occurrence and has no effect on performance of the 6EN4.

The plate of the 6EN4 exhibits a dull red color when the tube is operated at maximum plate dissipation. In addition, it may exhibit a bluish glow on the upper half of the bulb inner wall surface during normal operation. This bluish glow is a result of fluorescence and it should not be mistaken for gas.

To prevent any strain from being exerted on the seal of the plate cap, it is important that connection to the plate cap be made by an appropriate connector which has a flexible lead.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or elements. In the absence of an

express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

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