



ELECTRONIC TUBE REFERENCE

12EN6

Power - TV Vertical Output electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

BEAMPOWER

Beam-power pentode designed as a television vertical-deflection amplifier, with controlled heater warm-up and high positive-pulse plate-voltage capability for sweep-output circuits.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	7
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Beam Power	
PLATE RESISTANCE	300000 Ω
TRANSCONDUCTANCE	0.006 S
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM SCREEN VOLTAGE	150 V
MAXIMUM PLATE DISSIPATION	7 W
MAXIMUM SCREEN DISSIPATION	1.25 W
MAXIMUM CATHODE CURRENT	50 mA
<i>Published Westinghouse ratings, characteristics, capacitances, pulse/deflection data, and typical operating conditions promoted where applicable; additional values retained as parameters.</i>	

12EN6 — Beam Power Pentode

The **12EN6** is a glass octal beam power pentode designed primarily for use as a vertical deflection amplifier in television receiver sweep circuits. It features a controlled heater warm-up characteristic,

making it highly suited for television receivers employing series-connected heater strings, particularly where the picture-tube heater is wired in series with other heaters. This controlled warm-up minimizes heater voltage surges across individual tubes during the initial warm-up cycle when used with other similarly controlled tube types.

Construction, Physical Dimensions, and Basing

The 12EN6 is constructed with a coated unipotential cathode and is housed in a T-9 glass bulb. It utilizes an 8-pin octal base, with specifications listing either an intermediate shell octal base (JETEC B6-81 & JETEC B7-7) or a short intermediate shell octal base (JETEC B6-84 & JETEC B7-59). The tube can be mounted and operated in any position.

Physical Dimensions

- **Maximum Overall Length:** 3-5/16 inches
- **Maximum Seated Height:** 2-3/4 inches
- **Maximum Diameter:** 1-3/16 inches

Basing and Pin Connections

The 12EN6 uses the **7AC** basing arrangement. Viewed from the bottom of the base, the pin connections are assigned as follows:

Pin Number	Electrode Connection
Pin 1	No Connection (NC)
Pin 2	Heater (H)
Pin 3	Plate (P)
Pin 4	Grid #2 (Screen Grid, <u>G2</u>)
Pin 5	Grid #1 (Control Grid, G1)
Pin 6	No Connection
Pin 7	Heater (H)
Pin 8	Cathode (K) & Grid #3 (Beam Plates, G3)

Heater Characteristics and Controlled Warm-Up

The heater of the 12EN6 is designed for operation from either an AC or DC supply. Because it is intended for series-string applications, its thermal characteristics are tightly specified to prevent damaging voltage spikes across other heaters in the series chain.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	0.6 ± 6% A
Approximate Warm-Up Time	11.0 seconds

Heater Warm-Up Time Definition

The heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of its rated value (10.08 V) after applying four times the rated heater voltage (50.4 V) to a test circuit. This test circuit consists of the tube heater connected in series with a resistance equal to three times the nominal heater operating resistance. The nominal heater operating resistance is calculated as:

$$\text{Resistance} = \frac{\text{Rated Heater Voltage}}{\text{Rated Heater Current}} = \frac{12.6 \text{ V}}{0.6 \text{ A}} = 21 \Omega$$

Thus, the series test resistance is:

$$3 \times 21 \Omega = 63 \Omega$$

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12EN6, measured without an external shield, are as follows:

- **Grid #1 to Plate:** 0.65 μF
- **Input (G1 to all other electrodes except Plate):** 14 μF
- **Output (Plate to all other electrodes except G1):** 8.0 μF

Maximum Ratings

The maximum ratings for the 12EN6 are interpreted under the Design Center System or Design Maximum Ratings. The tube can be operated either as a standard pentode or in a triode configuration where Grid #2 is tied directly to the plate.

Rating Parameter	Triode Connection	Pentode Connection	Unit
Maximum DC Plate Voltage	300	300	Volts
Maximum Peak Positive Pulse Plate Voltage	1200	1200	Volts
Maximum Plate Dissipation	7.5	7.0	Watts

Rating Parameter	Triode Connection	Pentode Connection	Unit
Maximum Peak Negative Grid #1 Voltage	250	250	Volts
Maximum DC Grid #2 Voltage	—	150	Volts
Maximum Grid #2 Dissipation	—	1.25	Watts
Maximum Average Cathode Current	50	50	mA
Maximum Peak Cathode Current	175	175	mA
Maximum Grid #1 Circuit Resistance	2.2	2.2	Megohms

Heater-Cathode Voltage Ratings

- **Heater Positive with respect to Cathode:**
 - DC Component: 100 V max.
 - Total DC & Peak: 200 V max.
- **Heater Negative with respect to Cathode:**
 - DC Component: 200 V max.
 - Total DC & Peak: 300 V max.

Typical Operating Conditions and Characteristics

The 12EN6 is characterized under two distinct operating points for vertical deflection amplifier service. The first operating point represents a high-current, low-plate-voltage condition (such as during the peak of a sweep cycle), while the second represents a typical static bias point.

Parameter	Operating Point 1 (Peak/Zero Bias)	Operating Point 2 (Static Bias)	Unit
Heater Voltage	12.6	12.6	Volts
Plate Voltage	50	200	Volts
Grid #2 Voltage	110	110	Volts
Grid #1 Voltage	0	-9.5	Volts
Plate Current	135 to 140	50	mA

Parameter	Operating Point 1 (Peak/Zero Bias)	Operating Point 2 (Static Bias)	Unit
Grid #2 Current	18	2.2	mA
Plate Resistance	—	28,000	Ohms
Transconductance	—	8,000	μmhos
Grid #1 Cutoff Voltage (Approx.)*	—	-35	Volts

* Measured at a plate current of 100 microamperes.

Operating Point Variations

Under the zero-bias condition (Operating Point 1), the plate current is highly dependent on manufacturing tolerances and testing standards. Published specifications list the typical plate current under this condition as **135 mA** in some characterizations and **140 mA** in others. Because of the high dissipation associated with zero-bias operation, this condition must only be applied for a short interval (a maximum of 2 seconds) to prevent permanent damage to the tube.

Application and Circuit Design Guidelines

Vertical Deflection Service

When used as a vertical deflection amplifier, the 12EN6 is rated for operation in a standard **525-line, 30-frame television system**. Under these operating conditions, the duty cycle of the peak positive voltage pulse on the plate must not exceed **15% of one scanning cycle**.

Grid Bias Protection

In stages operating with grid leak bias, the tube is vulnerable to excessive current and thermal runaway if the drive signal is lost. To prevent damage in the absence of excitation, designers must incorporate an adequate cathode bias resistor or other suitable protective means to limit the plate and screen currents to safe levels.

Qualitative Curve Interpretation

The average plate and screen characteristics of the 12EN6 demonstrate its high power-handling capability at low plate voltages.

- **Average Plate Characteristics:** The plate current curves plotted against plate voltage show a rapid rise in plate current at low plate voltages (below 50 V), which is characteristic of efficient beam power tubes. At higher plate voltages, the curves flatten out, indicating high plate resistance. For a screen grid (Grid #2) voltage of 110 V, a control grid (Grid #1) voltage of 0 V yields a plate current peak of

approximately 135 to 140 mA, which drops progressively as the control grid is biased more negatively (e.g., down to -16 V).

- **Average Screen Characteristics:** The screen grid current is highest at very low plate voltages, where the electrons are not sufficiently accelerated toward the plate and are instead intercepted by Grid #2. As the plate voltage increases beyond 50 V, the screen current drops sharply and stabilizes at a low, safe value (typically around 2.2 mA at a plate voltage of 200 V), ensuring that the screen grid dissipation remains well within its 1.25 W maximum rating.

Technical Summary

The **12EN6** is an octal-based, indirectly heated beam power pentode optimized for vertical deflection amplifier service in television sweep circuits. Operating with a **12.6 V, 0.6 A** heater, it features a controlled **11-second warm-up time** designed to prevent voltage surges in series-connected heater strings. The tube delivers a transconductance of **8,000 μ mhos** and a plate resistance of **28,000 ohms** at a typical operating point of 200 V on the plate and 110 V on the screen grid. With a peak positive pulse plate voltage rating of **1200 V** and a maximum plate dissipation of **7.0 W** (or **7.5 W** in triode connection), the 12EN6 provides the robust performance and thermal reliability required for television sweep applications.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1961 Tung Sol

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1961 TUNG SOL

Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	Nominal
Heater current	150 mA	Nominal
Plate voltage	300300 V	Typical operating conditions
Screen voltage	110110 V	Typical operating conditions
Plate current	13550 mA	Typical operating conditions



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1965 Westinghouse Data Book

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1965 WESTINGHOUSE DATA BOOK

Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
DC plate voltage maximum	300 V	—
Peak positive pulse plate voltage maximum	1200 V	Pulse
DC grid2 voltage maximum	150 V	—
Grid2 dissipation maximum	1.25 W	—
Average cathode current maximum	50 mA	—
Peak cathode current maximum	175 mA	Pulse

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Typical plate voltage	200 V	—
Typical grid2 voltage	110 V	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	Vertical-deflection amplifier	—



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1966 Tung Sol Electronic Tubes 2 of 4

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 1 · Beam Power

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID TO PLATE	0.65 pF	Interelectrode capacitances

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGE	12.6 V	Maximum ratings; published column 1
MAXIMUM DC PLATE VOLTAGE	3 V	Maximum ratings; published column 1
MAXIMUM DC PLATE VOLTAGE	0 V	Maximum ratings; published column 2
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	1200 V	Maximum ratings; published column 1
MAXIMUM PLATE DISSIPATION C	7.5 W	Maximum ratings; published column 1
MAXIMUM PLATE DISSIPATION C	7 W	Maximum ratings; published column 2
MAXIMUM PLATE DISSIPATION C	0 W	Maximum ratings; published column 3
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	25 V	Maximum ratings; published column 1
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	0 V	Maximum ratings; published column 2
MAXIMUM DC GRID #2 VOLTAGE	15 V	Maximum ratings; published column 1
MAXIMUM DC GRID #2 VOLTAGE	0 V	Maximum ratings; published column 2

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM GRID #2 DISSIPATION	125 W	Maximum ratings
MAXIMUM AVERAGE CATHODE CURRENT	5 mA	Maximum ratings; published column 1
MAXIMUM AVERAGE CATHODE CURRENT	0 mA	Maximum ratings; published column 2
MAXIMUM PEAK CATHODE CURRENT	175 mA	Maximum ratings; published column 1
MAXIMUM PEAK CATHODE CURRENT	1 mA	Maximum ratings; published column 2
MAXIMUM PEAK CATHODE CURRENT	5 mA	Maximum ratings; published column 3
MAXIMUM GRID #1 CIRCUIT RESISTANCE	2200000 ohm	Maximum ratings; published column 1
HEATER WARM-UP TIME (AP PR	0 s	Maximum ratings; published column 1
HEATER WARM-UP TIME (AP PR	11 s	Maximum ratings; published column 2
NEATER VOLTAGE	126 V	Typical operating conditions
HEATER CURRENT	600 mA	Typical operating conditions
PLATE VOLTAGE	5 V	Typical operating conditions; published column 1
PLATE VOLTAGE	0 V	Typical operating conditions; published column 2
GRID #2 VOLTAGE	11 V	Typical operating conditions; published column 1
GRID #2 VOLTAGE	0 V	Typical operating conditions; published column 2
GRID #1 VOLTAGE	0 V	Typical operating conditions; published column 1
GRID #1 VOLTAGE	-9.5 V	Typical operating conditions; published column 2
PLATE CURRENT	135 mA	Typical operating conditions
GRID #2 CURRENT	1 mA	Typical operating conditions; published column 1
GRID #2 CURRENT	2 mA	Typical operating conditions; published column 2
PLATE RESISTANCE	2 ohm	Typical operating conditions; published column 1
PLATE RESISTANCE	0 ohm	Typical operating conditions; published column 2
TRANSCONDUCTANCE \$	0 uS	Typical operating conditions

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID #1 CUTOFF VOLTAGE (APPROX.)	-35 V	Typical operating conditions
D AP PLIED FOR SNORT	1 s	Typical operating conditions; published column 1
D AP PLIED FOR SNORT	12 s	Typical operating conditions; published column 2
D AP PLIED FOR SNORT	50 s	Typical operating conditions; published column 4
Maximum plate voltage	300 V	Published datasheet; promoted section value
Maximum screen voltage	150 V	Published datasheet; promoted section value
Maximum plate dissipation	7 W	Published datasheet; promoted section value
Maximum screen dissipation	1.25 W	Published datasheet; promoted section value
Maximum cathode current	50 mA	Published datasheet; promoted section value
Maximum positive pulse plate voltage	1200 V	VerticalDeflection
Maximum peak cathode current	175 mA	TriodeConnection

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	28000 ohm	Published datasheet; promoted section value
Transconductance	0.008 A/V	Published datasheet; promoted section value

TUBE TINKER

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