



ELECTRONIC TUBE REFERENCE

12BY7

Voltage - Pentode Sharp Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
PENTODE

High-transconductance video-amplifier pentode with series/parallel heater operation. Its wideband fixed-gain characteristics are optimized for television video service rather than conventional low-frequency power output.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	12.6 V / 300 mA	PARALLEL HEATER	6.3 V / 600 mA
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Pentode	
PLATE RESISTANCE	93000 Ω
TRANSCONDUCTANCE	0.011 S
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM SCREEN VOLTAGE	180 V
MAXIMUM PLATE DISSIPATION	6.5 W
MAXIMUM SCREEN DISSIPATION	1.1 W
<i>Published Westinghouse ratings, characteristics, capacitances, pulse/deflection data, and typical operating conditions promoted where applicable; additional values retained as parameters.</i>	

12BY7 — High-Transconductance Pentode

The **12BY7** and **12BY7-A** are miniature, high-transconductance pentode tubes designed primarily for service as video amplifiers. They are engineered to deliver large output voltages across low-value load resistances while operating under relatively low supply voltages.

The 12BY7-A variant is specifically optimized for television receivers and other equipment utilizing series-connected heater strings. In these applications, the tube's heater is wired in series with other heaters, such as that of the picture tube. When integrated into a series circuit with other devices rated for a 600 mA heater current, the 12BY7-A minimizes heater voltage surges across individual tubes due to its controlled heater warm-up characteristic.

Heater and Cathode Characteristics

The tube features a coated unipotential cathode. The heater is designed for versatile operation, allowing for either series or parallel connections depending on the system requirements.

Heater Configuration	Voltage	Current
Series	12.6 V	0.3 A
Parallel	6.3 V	0.6 A

The approximate heater warm-up time is 11 seconds. This warm-up time is defined by a specific test condition: the time required for the voltage across the heater to reach 80% of its rated value after applying four times the rated heater voltage to a circuit consisting of the tube heater in series with a resistance. This series resistance is calculated as three times the rated heater voltage divided by the rated heater current.

Heater-to-cathode voltage ratings must be carefully observed to prevent insulation breakdown:

- **Heater Negative with Respect to Cathode:** The maximum allowable total DC plus peak voltage is 200 V.
- **Heater Positive with Respect to Cathode:** The maximum allowable DC component is 100 V, and the maximum total DC plus peak voltage is 200 V.

Physical Construction and Pinout

The 12BY7 and 12BY7-A are housed in a T-6 1/2 glass bulb with a miniature 9-pin base (JEDEC E9-1). The physical outline is designated as 6-3, and the tube can be mounted in any position.

The physical dimensions of the envelope are:

- **Maximum Diameter:** 7/8 inch
- **Maximum Overall Length:** 2 5/8 inches
- **Maximum Seated Height:** 2 3/8 inches

The tube utilizes the **9BF** basing arrangement. The pin connections, viewed from the bottom of the base, are assigned as follows:

Pin Number	Electrode Connection
1	Cathode

Pin Number	Electrode Connection
2	Grid 1 (Control Grid)
3	Grid 3 (Suppressor Grid)
4	Heater
5	Heater
6	Heater Tap (Midpoint)
7	Plate
8	Grid 2 (Screen Grid)
9	Grid 3 (Suppressor Grid)

Note that Grid 3 (the suppressor grid) is internally connected to both Pin 3 and Pin 9. Pin 6 provides access to the heater midpoint tap, enabling the dual-voltage series/parallel heater configurations.

Design-Center Maximum Ratings

The following maximum ratings are established under the design-center system. Operating the tube beyond these limits may impair its performance or longevity.

- **Plate Voltage:** 300 V max.
- **Screen Voltage (Grid 2):** 180 V max.
- **Plate Dissipation:** 6.5 W max.
- **Screen Dissipation:** 1.1 W max.
- **Control Grid Voltage (Grid 1):**
 - Negative Bias: 50 V max.
 - Positive Bias: 0 V max.
- **Control Grid Resistance:**
 - With Fixed Bias: 0.25 MΩ max.
 - With Cathode Bias: 1.0 MΩ max.

Electrical Characteristics and Typical Operation

Under typical operating conditions as a class A1 amplifier, the 12BY7 and 12BY7-A exhibit high transconductance and a high amplification factor. The standard operating point and resulting characteristics are detailed below:

- **Plate Voltage:** 250 V
- **Screen Voltage:** 180 V
- **Cathode Bias Resistor:** 100 Ω
- **Transconductance:** 11,000 μmhos

- **Plate Resistance:** 93,000 Ω
- **Plate Current:** 26 mA
- **Screen Current:** 5.75 mA
- **Grid 1 Cutoff Voltage:** -11.6 V (defined at a plate current of 20 μ A)
- **Amplification Factor (Pentode):** 1035
- **Amplification Factor (Triode-Connected):** 28.5

The direct interelectrode capacitances of the tube, measured without an external shield, are:

- **Grid to Plate (Input to Output):** 0.063 μ F
- **Input Capacitance:** 10.2 μ F
- **Output Capacitance:** 3.5 μ F

Technical Summary

The **12BY7** and **12BY7-A** are high-transconductance pentodes designed for high-performance video amplification. Featuring a miniature 9-pin construction, they provide a transconductance of 11,000 μ mhos and a pentode amplification factor of 1035 under typical operating conditions. The 12BY7-A variant incorporates a controlled 11-second heater warm-up characteristic, making it highly suitable for series-string heater designs in television receivers. With flexible series/parallel heater options (12.6 V / 6.3 V) and robust design-center ratings, these tubes deliver reliable voltage amplification across low-impedance loads.



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 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Series heater voltage	12.6 V	SeriesHeater
Series heater current	300 mA	SeriesHeater
Parallel heater voltage	6.3 V	ParallelHeater
Parallel heater current	600 mA	ParallelHeater
Transconductance	11000 μ S	—
Plate resistance	93000 ohm	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Typical plate voltage	250 V	—
Heater-cathode voltage maximum	200 V	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	Video amplifier	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-plate capacitance	0.063 pF	—
Input capacitance	10.2 pF	—
Output capacitance	3.5 pF	—

TUBE TINKER

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