

ELECTRONIC TUBE REFERENCE

12B

Power - Triode electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
TRIODE

Modern directly heated audio power triode intended for single-ended amplifier service. Published operation at 500 V and 50 mA produces about 4.1 W into a 5 kΩ load, with 25 W maximum plate dissipation.

GENERAL CHARACTERISTICS

BASE DESIGNATION	UX4	BASE PINS	–
NOMINAL HEATER	5 V / 1.4 A	PARALLEL HEATER	– / –
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	2900 Ω
TRANSCONDUCTANCE	0.0056 S
AMPLIFICATION FACTOR	13.5
MAXIMUM PLATE VOLTAGE	500 V
MAXIMUM PLATE DISSIPATION	25 W
MAXIMUM CATHODE CURRENT	60 mA

12B — Medium-Gain Directly Heated Triode

The **12B** is a premium, medium-gain, directly heated triode (DHT) vacuum tube designed for high-fidelity audio applications. It features a medium-low internal impedance, excellent voltage handling capabilities, and exceptionally low distortion even when operating at high signal levels. The tube is engineered with a wide anode structure and robust mechanical dampening to deliver highly linear performance.

The 12B is highly versatile, finding application as a driver tube, line output stage, headphone amplifier, and low-power speaker output stage. It is particularly noted for its suitability in Sakuma-style amplifier configurations and has a curve structure that shares a strong resemblance to the vintage [PX25](#) triode.

Construction and Physical Characteristics

The 12B is constructed using high-quality materials and specialized mechanical design techniques to minimize microphonics and ensure long-term stability:

- **Anode Structure:** The tube features a "black powdered" anode. It utilizes a wide anode distance, which is a classic design principle that optimizes linearity in high-gain directly heated triodes.
- **Hard-Metal Construction:** The internal elements are built using hard metals rather than classic nickel. Although more difficult and costly to process, this construction ensures highly reproducible electrical parameters and excellent long-term stability.
- **Grid Design:** The control grid is gold-plated, which provides increased bias stability, protection against accidental overload, and improved linearity in the tube's characteristic curves.
- **Anti-Microphonic Suspension:** The tube incorporates a soft rubber suspended base along with specialized anti-microphonic anode and grid suspensions to isolate the active elements from mechanical vibration.
- **Glass Envelope:** The tube features a hand-blown glass bulb with extra-large getters. The tube printing is executed with 24k gold and red color burned directly into the glass.
- **Physical Dimensions and Weight:** The tube has an overall size of 155 mm in height and 58 mm in diameter (6.1 x 2.3 inches), excluding the base pins. A single tube weighs 145 grams, and a matched pair is shipped in a high-quality dual gift box with a total shipment weight of 700 grams.

Blue Glow Phenomenon

During operation, the 12B will often produce a visible blue glow on the glass envelope. This fluorescent light pattern is a normal consequence of the wide anode distance, which allows some electrons to escape after collision. The intensity and pattern of this glow change dynamically with the signal voltage. This normal fluorescent effect must not be confused with a gassy tube, which is characterized by a purple-blue cloud inside the anode structure itself.

Filament and Heating Ratings

The 12B is a directly heated triode designed to operate from a stable filament supply.

Parameter	Value
Recommended Filament Voltage (DC)	5.0 V
Filament Voltage Tolerance	±5%
Filament Current	~1.4 A
Base Type	Standard 4-pin UX4

The manufacturer recommends using electronic heater modules configured strictly as voltage sources. To ensure the maximum operating lifetime of the tube, the filament must be operated at its specified nominal voltage; experimenting with lower filament voltages will not extend the tube's lifetime. Additionally, the filament design is cathode-tapped, providing a balanced electrical center point.

Electrical Characteristics and Maximum Ratings

The 12B is rated for conservative operation up to its absolute maximum limits. Exceeding these values can compromise tube longevity and performance.

Maximum Operating Conditions

- **Maximum Anode Voltage:** 500 V
- **Maximum Anode Current:** 60 mA
- **Continuous Anode Dissipation:** 25 W
- **Grid Resistor Limit:** Below 470 k

Factory Test Data

The typical electrical characteristics of the 12B, measured under static conditions with DC filament heating, are as follows:

- **Anode Voltage:** 390 V
- **Anode Current:** 40 mA
- **Anode Impedance (R_p):** 2,900, (2.9 k)
- **Amplification Factor (μ):** 13.5 (with an unloaded gain of approximately 12x)
- **Transconductance (g_m):** 5.6 mA/V
- **Control Grid Voltage:** -16 V (tested with DC heating)

Operating Points and Circuit Applications

The 12B can be configured for several distinct operating points depending on whether it is used as a voltage driver or a power output stage. When transitioning from AC heating to DC heating, the control grid bias voltage shifts by 2.5 V.

Typical Operating Points (AC Heated)

Appli cation	Anod e Volta ge	Grid Volta ge	Inpu t Sign al	Cath ode Resi stor	Anod e Curr ent	Circ uit Gain	Tube R_i	Load Impe danc e	Reco mme nded Tran sfor mer	Powe r Outp ut	Total Disto rtion
Driv er Stag e	430 V	-20.9 V	4.1 V RMS	831,	25 mA	14.6	3.1 k	Chok e/Int ersta ge	Lund ahl LL16 68- 25m A	60 V RMS	0.03 %
Outp ut Stag e	430 V	-15.0 V	10.7 V RMS	257,	58 mA	10.0	2.3 k	5.0 k	Lund ahl LL16 63- 60m A	2.2 W	1.4%
Outp ut Stag e	430 V	-15.0 V	10.7 V RMS	257,	58 mA	10.8	2.3 k	6.5 k	Lund ahl LL92 02- 50m A	2.0 W	0.9%
Outp ut Stag e	500 V	-21.1 V	14.9 V RMS	422,	50 mA	10.0	2.4 k	5.0 k	Lund ahl LL16 63- 50m A	4.1 W	3.3%
Outp ut Stag e	500 V	-21.1 V	14.9 V RMS	420,	50 mA	10.5	2.4 k	6.5 k	Lund ahl LL92 02- 50m A	3.8 W	2.1%

Driver Stage for 300B and Large Triodes

Large power triodes like the [300B](#) typically require a grid drive signal of approximately 60 V RMS (170 V peak-to-peak). The 12B is highly capable of delivering this drive voltage with extremely low distortion.

When configured as a driver stage with an anode voltage of 430 V, an input signal of only 4.1 V RMS is required to achieve a full 60 V RMS output. This high sensitivity allows the designer to use a 4x step-up input transformer, providing noise-free, microphonic-free gain and a balanced input without requiring an additional active tube stage.

Sakuma Amplifier Configuration

The 12B is ideally suited for the "Sakuma" amplifier topology. In this configuration, an identical driver stage and output stage are used (i.e., a 12B driving another 12B). This symmetrical arrangement exploits the natural even-harmonic cancellation properties of triodes, resulting in an amplifier stage that operates almost entirely free of distortion.

Pre-Amplifier and Line Output Service

When using the 12B in a dedicated pre-amplifier, low noise and low microphonics are paramount. Rather than building a high-gain stage and attenuating the input signal (which degrades the signal-to-noise ratio), the recommended approach is to use an attenuating output transformer. This reduces the overall stage gain to a practical level of 1x or 2x. By attenuating the output, the output impedance is reduced by the square of the transformer's turns ratio, allowing a 600 Ω potentiometer to be driven directly. This configuration keeps the signal-to-noise ratio exceptionally high and ensures the pre-amplifier remains virtually silent.

Noise, Distortion, and Vibration Control

The 12B is designed to be one of the lowest-distortion vacuum tubes available. Under small-signal conditions (10 V Eff output signal with a 400 V anode supply), the total harmonic distortion is measured below 0.08%. Because of the wide anode spacing and highly linear transfer characteristics, this distortion does not significantly increase even when the tube is driven with much larger signals.

Harmonic Cancellation

Triodes inherently produce very low levels of odd-order harmonics, meaning their distortion profile is dominated by benign second-harmonic components. When a 12B is used to drive a similar triode (such as another 12B or a [300B](#)), a portion of the even-harmonic distortion generated by the output tube is canceled by the out-of-phase even harmonics of the driver stage.

Mechanical Isolation

Directly heated triodes are inherently sensitive to mechanical vibrations (microphonics) transmitted through the chassis from mains transformers or acoustic feedback from loudspeakers. To achieve the lowest possible mechanical noise floor, the following measures are recommended:

- Use high-quality, flexible tube sockets (such as Yamamoto Teflon sockets) that do not rigidly couple chassis vibrations to the tube pins.
- Apply tight-fitting Teflon tube dampers (such as Duende Criteria dampers) to the top, or both the top and bottom, of the glass envelope to damp glass resonances.

Technical Summary

The **12B** is a high-performance, directly heated, medium-gain triode featuring a standard 4-pin UX4 base and a black powdered wide-anode structure. It operates with a recommended 5.0 V, 1.4 A DC filament supply and is rated for a maximum anode voltage of 500 V and a continuous plate dissipation of 25 W.

With a typical amplification factor of 13.5, transconductance of 5.6 mA/V, and an anode impedance of 2.9 k Ω , the 12B bridges the gap between high-voltage driver stages and low-power output stages. It is capable of delivering up to 4.1 Watts of output power into a transformer load, or driving demanding power triodes like the [300B](#) to full output with total harmonic distortion figures as low as 0.03% in optimized driver configurations. Its robust hard-metal construction, gold-plated grid, and anti-microphonic suspension make it an exceptional choice for ultra-linear pre-amplifiers, line stages, and Sakuma-style balanced triode amplifiers.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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

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Section 1 · Triode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filament voltage	5 V	—
Filament current	1.4 A	—
Factory test plate voltage	390 V	—
Factory test plate current	40 mA	—
Factory test grid voltage	-16 V	—
Plate resistance	2900 ohm	—
Amplification factor	13.5	—
Transconductance	5600 μ S	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Single-ended output power	4.1 W	PlateVoltage=500V;PlateCurrent=50mA;Load=5k