

ELECTRONIC TUBE REFERENCE

12AQ5

Power - TV Vertical Output electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
BEAMPOWER

Miniature beam-power tube primarily intended for audio output, with documented Class-A and push-pull power service and additional triode-connected television vertical-deflection use.

GENERAL CHARACTERISTICS

BASE DESIGNATION	7BZ	BASE PINS	7
NOMINAL HEATER	12.6 V / 225 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

7BZ - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – Pin 1	A	G1 – Control Grid	CONNECTED • verified
PIN2 – Pin 2	A	G3 – Suppressor Grid	CONNECTED • verified
PIN2 – Pin 2	A	K – Cathode	CONNECTED • verified
PIN3 – Pin 3	–	H – Heater	CONNECTED • verified
PIN4 – Pin 4	–	H – Heater	CONNECTED • verified
PIN5 – Pin 5	A	P – Plate (Anode)	CONNECTED • verified
PIN6 – Pin 6	A	G2 – Screen Grid	CONNECTED • verified
PIN7 – Pin 7	A	G1 – Control Grid	CONNECTED • verified

SECTION RATINGS

SECTION1 Beam Power	
PLATE RESISTANCE	52000 Ω
TRANSCONDUCTANCE	0.0041 S
AMPLIFICATION FACTOR	9.5
MAXIMUM PLATE VOLTAGE	275 V
MAXIMUM SCREEN VOLTAGE	275 V
MAXIMUM PLATE DISSIPATION	12 W
MAXIMUM SCREEN DISSIPATION	2 W
MAXIMUM CATHODE CURRENT	115 A
<i>Equivalent performance to 12V6-GT within ratings.</i>	

12AQ5 — Beam Power Pentode

An indirectly heated, miniature beam power pentode designed for audio-frequency power amplification and television vertical deflection sweep circuits.

Overview

The **12AQ5** is a miniature 7-pin beam power pentode intended primarily for use in the audio-frequency output stage of automobile radio receivers operating from a 12-volt storage battery, as well as in the output stages of AC-operated receivers. Additionally, when triode-connected, the tube is designed for service as a vertical deflection amplifier in television sweep circuits. Within its maximum ratings, the electrical performance of the 12AQ5 is equivalent to that of the larger octal glass types **12V6-GT**, **6V6**, and **6V6GTA**.

Construction, Heater, and Physical Dimensions

The 12AQ5 features a coated unipotential cathode and is housed in a T-5 1/2 glass bulb. It utilizes a small-button miniature 7-pin base (JETEC No. E7-1) with a **7BZ** basing arrangement. The tube is designed to operate in any mounting position.

Physical Dimensions

- **Maximum Overall Length:** 2-5/8 inches
- **Maximum Seated Length:** 2-3/8 inches
- **Length from Base Seat to Bulb Top (excluding tip):** 2 inches $\pm$ 3/32 inch
- **Maximum Diameter:** 3/4 inch

Heater Characteristics

The heater is designed for operation from AC or DC power supplies:

- **Nominal Heater Voltage:** 12.6 V
- **Nominal Heater Current:** 0.225 A

Basing and Terminal Connections

Under the 7BZ basing configuration, viewed from the bottom of the tube, the pin connections are assigned as follows:

Pin	Connection
1	Grid No. 1 (Control Grid)
2	Cathode and Grid No. 3 (Beam Plates)
3	Heater
4	Heater
5	Plate
6	Grid No. 2 (Screen Grid)
7	Grid No. 1 (Control Grid)

Grid No. 1 is internally connected to both Pin 1 and Pin 7.

Direct Interelectrode Capacitances

The approximate capacitances of the 12AQ5, measured without an external shield, are:

- **Grid No. 1 to Plate:** 0.35 pF to 0.4 pF
- **Input (Grid No. 1 to Cathode, Heater, Grid No. 2, and Grid No. 3):** 8.0 pF to 8.3 pF
- **Output (Plate to Cathode, Heater, Grid No. 2, and Grid No. 3):** 8.2 pF to 8.5 pF

Maximum Ratings and Rating Systems

The maximum ratings of the 12AQ5 depend on the rating system applied by the manufacturer (Design-Center System vs. Design-Maximum System) and the specific class of service.

Class A1 and Class AB1 Audio-Frequency Power Amplifier Ratings

- **Plate Voltage:** 250 V max (Design-Center) / 275 V max (Design-Maximum)
- **Grid No. 2 (Screen-Grid) Voltage:** 250 V max (Design-Center) / 275 V max (Design-Maximum)

- **Plate Dissipation:** 12 W max
- **Grid No. 2 Input / Dissipation:** 2 W max
- **Bulb Temperature (at hottest point):** 250 °C max
- **Heater-Cathode Voltage:**
 - *Heater negative with respect to cathode:* 90 V max (RCA Design-Center), 100 V max (Tung-Sol/Westinghouse Design-Center), 200 V max (Design-Maximum peak value).
 - *Heater positive with respect to cathode:* 90 V max (RCA Design-Center), 100 V max (Tung-Sol/Westinghouse Design-Center DC or total DC and peak), 100 V max average / 200 V max peak (Design-Maximum).
- **Maximum Grid No. 1 Circuit Resistance:**
 - *Fixed Bias:* 0.1 megohm max
 - *Cathode Bias:* 0.5 megohm max
 - *Note:* If the Grid No. 1 circuit resistance is common to two tubes, these maximum values per tube must be halved.

Typical Operating Conditions

The 12AQ5 can be operated as a single-tube Class A1 amplifier or in a push-pull Class [AB1](#) configuration.

Class A1 Pentode Amplifier (Single Tube)

Parameter	Operating Point I	Operating Point II
Plate Voltage	180 V	250 V
Grid No. 2 Voltage	180 V	250 V
Grid No. 1 Voltage	-8.5 V	-12.5 V
Peak AF Grid No. 1 Voltage	8.5 V	12.5 V
Zero-Signal Plate Current	29 mA	45 mA
Maximum-Signal Plate Current	30 mA	47 mA
Zero-Signal Grid No. 2 Current (approx.)	3.0 mA	4.5 mA
Maximum-Signal Grid No. 2 Current (approx.)	4.0 mA	7.0 mA
Plate Resistance (approx.)	58,000*	52,000*
Transconductance	3,700 μ mos	4,100 μ mos
Load Resistance	5,500*	5,000*

Parameter	Operating Point I	Operating Point II
Total Harmonic Distortion (approx.)	8%	8%
Maximum-Signal Power Output	2.0 W	4.5 W

Class AB1 Push-Pull Amplifier (Two Tubes)

Values are for two tubes unless otherwise specified.

- **Plate Voltage:** 250 V
- **Grid No. 2 Voltage:** 250 V
- **Grid No. 1 Voltage:** -15 V
- **Peak AF Grid-to-Grid Voltage:** 30 V
- **Zero-Signal Plate Current:** 70 mA
- **Maximum-Signal Plate Current:** 79 mA
- **Zero-Signal Grid No. 2 Current (approx.):** 5.0 mA
- **Maximum-Signal Grid No. 2 Current (approx.):** 13 mA
- **Plate Resistance (per tube, approx.):** 60,000[°]
- **Transconductance (per tube):** 3,750 μ mhos
- **Effective Plate-to-Plate Load Resistance:** 10,000[°]
- **Total Harmonic Distortion:** 5%
- **Maximum-Signal Power Output:** 10 W

Triode-Connected Characteristics and Vertical Deflection Service

When triode-connected (with Grid No. 2 connected directly to the plate), the 12AQ5 exhibits the following typical characteristics at a plate voltage of 250 V and a Grid No. 1 voltage of -12.5 V:

- **Plate Current:** 49.5 mA
- **Amplification Factor:** 9.5 to 9.8
- **Plate Resistance (approx.):** 1,960[°] to 1,970[°]
- **Transconductance:** 4,800 μ mhos to 5,000 μ mhos
- **Grid No. 1 Voltage (approx.) for a plate current of 0.5 mA:** -36 V to -37 V

Vertical Deflection Amplifier Service (Triode Connection)

For operation in a 525-line, 30-frame television system, the maximum ratings are defined as:

- **DC Plate Voltage:** 275 V max (Design-Maximum) / 315 V max (Design-Center)
- **Peak Positive-Pulse Plate Voltage:** 1,100 V absolute max (Design-Maximum) / 1,200 V absolute max (Design-Center)

- **Peak Negative-Pulse Grid No. 1 Voltage:** 250 V max (Design-Center) / 275 V max (Design-Maximum)
- **Average Cathode Current:** 35 mA max (Design-Center) / 40 mA max (Design-Maximum)
- **Peak Cathode Current:** 105 mA max (Design-Center) / 115 mA max (Design-Maximum)
- **Plate Dissipation:** 9 W max (Design-Center) / 10 W max (Design-Maximum)
- **Maximum Grid No. 1 Circuit Resistance (Cathode Bias):** 2.2 megohms
- *Note on Pulse Duration:* The pulse duration must not exceed 15% of a vertical scanning cycle (equivalent to 2.5 milliseconds).
- *Note on Bias:* In stages operating with grid leak bias, an adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Storage-Battery Operating Considerations

When the 12AQ5 is employed in storage-battery-operated equipment (such as automobile receivers), specific design guidelines must be followed to prevent exceeding the maximum ratings:

- **Without Charger:** The equipment should be designed so that the published maximum values of plate voltage, Grid No. 2 voltage, and dissipations are never exceeded for a terminal potential at the battery source of 2.0 volts per cell.
- **With Charger:** The equipment should be designed so that 90 percent of the published maximum values is never exceeded for a terminal potential at the battery source of 2.2 volts per cell.

Thermal and Shielding Recommendations

High ambient temperatures and the use of tube shields may necessitate a reduction in operating dissipation. When tube shields are utilized, it is recommended to paint both the inside and outside surfaces of the shield a dull black and to provide ventilation slots to reduce the operating temperature of the bulb.

Technical Summary

The **12AQ5** is a versatile, high-efficiency miniature beam power pentode with a 12.6 V, 0.225 A heater and a 7-pin base. It is electrically equivalent to the octal 12V6-GT and provides high power sensitivity and output in both Class A1 and Class [AB1](#) audio amplifier applications. Additionally, its triode-connected characteristics make it highly effective as a vertical deflection amplifier in television sweep circuits. Designers must carefully observe the differences between Design-Center and Design-Maximum ratings, particularly when implementing the tube in automotive storage-battery environments or pulsed television deflection circuits.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1940 RCA

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

1940 RCA

Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Power Output	4.5 W	ClassA;OneTube
Power Output	10 W	ClassAB;PushPull;TwoTubes



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
Power Output	10 W	ClassAB;PushPull;TwoTubes



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

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage	12.6 V	—
Heater Current	300 mA	—
Grid To Plate Capacitance	0.35 pF	—
Input Capacitance	8.3 pF	—
Output Capacitance	8.2 pF	—
Plate Resistance	52000 ohm	—
Transconductance	4100 uS	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	250 V	ClassA
Screen Voltage	250 V	ClassA
Grid Voltage	-12.5 V	ClassA
PlateCurrentZeroSignal	45 mA	ClassA
PlateCurrentMaximumSignal	47 mA	ClassA
ScreenCurrentZeroSignal	4.5 mA	ClassA
ScreenCurrentMaximumSignal	7 mA	ClassA
Load Resistance	5000 ohm	ClassA
Power Output	4.5 W	ClassA
Power Output	10 W	TwoTubes;PushPull;ClassAB



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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1966 Tung Sol Electronic Tubes 2 of 4

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Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	ClassA;SingleTube
Grid #2 voltage	250 V	ClassA;SingleTube
Zero-signal plate current	45 mA	ClassA;SingleTube
Maximum-signal plate current	47 mA	ClassA;SingleTube
Zero-signal grid #2 current	4.5 mA	ClassA;SingleTube
Maximum-signal grid #2 current	7 mA	ClassA;SingleTube
Load resistance	5000 ohm	ClassA;SingleTube
Maximum-signal power output	4.5 W	ClassA;SingleTube
Plate-to-plate load resistance	10000 ohm	PushPull;TwoTubes;ClassAB
Maximum-signal power output	10 W	PushPull;TwoTubes;ClassAB

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	52000 ohm	ClassA;SingleTube
Transconductance	4100 uS	ClassA;SingleTube



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1968 General Electric Co

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

1968 GENERAL ELECTRIC CO

Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	250 V	ClassA
Screen Voltage	250 V	ClassA
Plate Resistance	58000 ohm	ClassA
Transconductance	3700 uS	ClassA

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Zero-Signal Plate Current	29 mA	ClassA
Maximum-Signal Plate Current	30 mA	ClassA
Zero-Signal Screen Current	3 mA	ClassA
Maximum-Signal Screen Current	4 mA	ClassA
Load Resistance	5500 ohm	ClassA
Total Harmonic Distortion	8 %	ClassA
Plate Voltage	250 V	ClassAB;PushPull;TwoTubes
Screen Voltage	250 V	ClassAB;PushPull;TwoTubes
Zero-Signal Plate Current	70 mA	ClassAB;PushPull;TwoTubes
Maximum-Signal Plate Current	79 mA	ClassAB;PushPull;TwoTubes
Maximum-Signal Screen Current	13 mA	ClassAB;PushPull;TwoTubes
Effective Load Resistance Plate-to-Plate	10000 ohm	ClassAB;PushPull;TwoTubes
Total Harmonic Distortion	5 %	ClassAB;PushPull;TwoTubes
Maximum-Signal Power Output	10 W	ClassAB;PushPull;TwoTubes



SOURCE OPERATING CONDITIONS

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1971 RCA HB3 Binder 5 of 7

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

1971 RCA HB3 BINDER 5 OF 7

Section 1 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Plate Voltage	250 V	ClassA
Maximum Screen Voltage	250 V	ClassA
Plate Dissipation	12 W	ClassA
Screen Input	2 W	ClassA
Plate Voltage	250 V	ClassA

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Screen Voltage	250 V	ClassA
Plate Resistance	52000 Ω	ClassA
Transconductance	4100 μS	ClassA
Maximum-Signal Power Output	4.5 W	ClassA



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1975 RCA RC30

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

1975 RCA RC30

Section 1 · Beam Power

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid No.1 to Plate	0.4 pF	—
Grid No.1 to other electrodes	8 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	TriodeConnection
Control-grid voltage	-12.5 V	TriodeConnection
Plate current	49.5 mA	TriodeConnection
Peak positive-pulse plate voltage	1100 V	VerticalDeflection;TriodeConnection
Peak cathode current	115 mA	VerticalDeflection;TriodeConnection
Average cathode current	40 mA	VerticalDeflection;TriodeConnection

TUBE TINKER

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and their source documents.

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