

ELECTRONIC TUBE REFERENCE

12CU6

Power - TV Horizontal Output (sweep) electronic tube

CONSOLIDATED TECHNICAL DATA
1 SECTION
CONSTRUCTION
BEAMPOWER

Beam-power tube designed for television horizontal-deflection output, providing substantial current and pulse capability for switching the CRT horizontal-output transformer.

GENERAL CHARACTERISTICS

BASE DESIGNATION	6AM	BASE PINS	7
NOMINAL HEATER	12.6 V / 600 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

6AM - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – Pin 1	–	–	NC · verified
PIN2 – Pin 2	–	H – Heater	CONNECTED · verified
PIN3 – Pin 3	–	–	NC · verified
PIN4 – Pin 4	A	G2 – Screen Grid	CONNECTED · verified
PIN5 – Pin 5	A	G1 – Control Grid	CONNECTED · verified
PIN7 – Pin 7	–	H – Heater	CONNECTED · verified
PIN8 – Pin 8	A	BP – Beam-Forming Plate	CONNECTED · verified
PIN8 – Pin 8	A	K – Cathode	CONNECTED · verified

TERMINAL	SECTION	ELEMENT	STATUS
CAP1 – Top cap	A	P – Plate (Anode)	CONNECTED · verified

SECTION RATINGS

SECTION1 Beam Power	
PLATE RESISTANCE	14500 Ω
TRANSCONDUCTANCE	0.0059 S
MAXIMUM PLATE VOLTAGE	600 V
MAXIMUM SCREEN VOLTAGE	200 V
MAXIMUM PLATE DISSIPATION	11 W
MAXIMUM SCREEN DISSIPATION	2.5 W
MAXIMUM CATHODE CURRENT	110 mA
DC plate-supply voltage used for promoted DC plate limit; pulse ratings retained as parameters.	

12CU6 — Beam Power Pentode Horizontal-Deflection Amplifier

Overview

The **12CU6** is an octal-based beam power pentode designed primarily for service as a horizontal-deflection output amplifier in both color and black-and-white television receivers. It is characterized by its ability to deliver high plate current at low plate voltages (high zero-bias plate current) and its high peak positive-pulse plate voltage ratings, which are essential for handling the inductive flyback voltages generated in television deflection circuits.

The tube features a controlled heater warm-up characteristic, making it highly suitable for television receivers that employ series-connected heater strings. In these designs, the 12CU6 is typically wired in series with other tubes, including the picture tube, to minimize heater voltage surges across individual devices during start-up.

Heater Specifications and Series-String Design

The 12CU6 is equipped with an indirectly heated, coated unipotential cathode. The heater is designed to operate from either an AC or DC supply.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V

Heater Parameter	Value
Nominal Heater Current	0.6 A (600 mA)
Heater Current Tolerance	±0.040 A
Average Heater Warm-up Time	11 seconds

The controlled heater warm-up time of 11 seconds is specifically engineered for series-string service. When power is first applied to a cold receiver, the resistance of the heaters is low, which can lead to unequal voltage distribution and damaging voltage surges across individual tubes. By controlling the warm-up characteristic—defined as the time required for the voltage across the heater to reach 80% of its rated value when four times the rated heater voltage is applied to a circuit consisting of the tube heater in series with a resistance equal to three times the rated heater voltage divided by the rated heater current—the 12CU6 ensures that voltage surges are minimized.

To maintain safety and prevent insulation breakdown, strict limits are placed on the voltage between the heater and the cathode:

- **Heater Negative with Respect to Cathode:** The maximum total DC and peak voltage must not exceed **200 V**.
- **Heater Positive with Respect to Cathode:** The maximum DC component is limited to **100 V**, while the maximum total DC and peak voltage is limited to **200 V**.

Physical Construction and Basing Configuration

The 12CU6 is constructed in a glass envelope, typically designated as a T-9 or T-12 bulb, and utilizes an intermediate shell octal base. The base can have various standard configurations, such as B5-187, B6-81, B6-84, B7-7, or B7-59. The plate connection is brought out to a skirted miniature top cap (types C1-2, C1-3, or C1-33) to isolate the high-voltage pulse from the base pins.

The physical dimensions of the tube are as follows:

- **Maximum Diameter:** 1.188 inches
- **Maximum Seated Height:** 3.313 inches
- **Maximum Overall Height:** 3.875 inches
- **Mounting Position:** Any

The tube uses the **6AM** basing diagram, viewed from the underside of the base, which provides the following pin connections:

Pin Number	Connection
Pin 1	No Connection (NC) — <i>This pin may be omitted on some tube envelopes</i>
Pin 2	Heater (H)
Pin 3	No Connection (NC)

Pin Number	Connection
Pin 4	Grid No. 2 (Screen Grid - <u>G2</u>)
Pin 5	Grid No. 1 (Control Grid - G1)
Pin 7	Heater (H)
Pin 8	Cathode (K) and Grid No. 3 (Suppressor Grid - G3)
Top Cap	Plate (P)

Electrical Characteristics and Class A1 Operation

The 12CU6 exhibits typical beam power pentode characteristics, combining high transconductance with a relatively low knee voltage. Under typical Class A1 / Pentode operating conditions, the tube's parameters are documented at two slightly different operating points:

Parameter	Operating Point A	Operating Point B
Plate Voltage	250 V	250 V
Grid No. 2 (Screen) Voltage	150 V	150 V
Grid No. 1 (Control Grid) Voltage	-22.5 V	-22.5 V
Plate Current	57 mA	55 mA
Grid No. 2 Current	2.1 mA	2.1 mA
Transconductance	5900 μ mhos	5500 μ mhos
Plate Resistance (Approx.)	14,500 Ω	20,000 Ω
Triode Amplification Factor (E_b & $E_{c2} = 150$ V, $E_{c1} = -22.5$ V)	4.3	—
Control Grid Cutoff Voltage (for $I_b = 1.0$ mA)	-43 V	—

Instantaneous Plate Knee Values (Zero Bias)

To evaluate the tube's performance during the peak conduction phase of the horizontal deflection cycle, instantaneous characteristics are measured at zero bias:

- **Plate Voltage:** 60 V
- **Grid No. 2 Voltage:** 150 V
- **Grid No. 1 Voltage:** 0 V

- **Instantaneous Plate Current:** 260 mA
- **Instantaneous Grid No. 2 Current:** 26 mA

Because operating the tube continuously at zero bias would quickly exceed its dissipation limits, these values must be measured using a recurrent waveform method or applied for an extremely short interval (a maximum of two seconds) to prevent permanent damage to the tube.

Horizontal-Deflection Amplifier Ratings and Circuit Constraints

In horizontal-deflection amplifier service, the 12CU6 is subjected to severe pulse voltages and high thermal stresses. The maximum ratings are established under the Design-Center Rating System for operation in a standard 525-line, 30-frame television system:

- **DC Plate Supply Voltage (Boost + DC Power Supply):** 600 max. Volts
- **Peak Positive-Pulse Plate Voltage:** 6000 absolute max. Volts
- **Peak Negative-Pulse Plate Voltage:** 1250 max. Volts
- **DC Grid No. 2 (Screen-Grid) Voltage:** 200 max. Volts
- **Peak Negative-Pulse Grid No. 1 (Control-Grid) Voltage:** 300 max. Volts
- **Peak Cathode Current:** 400 max. mA
- **Average Cathode Current:** 110 max. mA
- **Plate Dissipation:** 11 max. Watts
- **Grid No. 2 Dissipation:** 2.5 max. Watts
- **Bulb Temperature (at hottest point):** 220 max. °C
- **Grid No. 1 Circuit Resistance:** 0.47 max. Megohm

Critical Operating Constraints

1. **Pulse Duration Limit:** The peak positive-pulse plate voltage of 6000 V is an absolute maximum rating. Under no circumstances should this value be exceeded. Additionally, the duration of this pulse must not exceed 15% of a horizontal scanning cycle (which corresponds to approximately 10 microseconds in a standard system).
2. **Excitation Protection:** In stages operating with grid-leak bias, an adequate cathode bias resistor or other protective means is required to safeguard the tube against excessive current and thermal runaway in the event that the drive excitation signal is lost.

Interelectrode Capacitances

The direct interelectrode capacitances of the 12CU6, measured without an external shield, are approximately:

- **Grid No. 1 to Plate:** 0.55 to 0.6 pF
- **Input (Grid No. 1 to Cathode, Heater, Grid No. 2, and Grid No. 3):** 15 pF
- **Output (Plate to Cathode, Heater, Grid No. 2, and Grid No. 3):** 7.0 to 7.5 pF

These low grid-to-plate capacitance values are typical of beam power tubes and help prevent unwanted oscillations or feedback in high-gain deflection circuits.

Related Designations and Family Variations

The 12CU6 belongs to a family of identical beam power tubes that differ only in their heater ratings. The tube is frequently dual-marked as **12BQ6GTB/12CU6**, indicating complete electrical and physical interchangeability between these two designations.

Other members of this family include:

- **6CU6 / 6BQ6GTB**: Designed for parallel heater circuits, requiring a heater supply of **6.3 V at 1.2 A**.
- **17BQ6GTB**: Designed for series-string circuits, requiring a heater supply of **16.8 V at 0.45 A** (with an 11-second warm-up time).
- **25CU6 / 25BQ6GTB**: Designed for series-string circuits, requiring a heater supply of **25.0 V at 0.3 A** (with an 11-second warm-up time).

These tubes share the same internal structure, maximum ratings, and typical operating characteristics, but they must not be substituted for one another unless the heater supply circuit is modified to match the specific heater voltage and current requirements.

Technical Summary

The **12CU6** is a robust, octal-based beam power pentode engineered for the demanding role of a horizontal-deflection amplifier in television receivers. Operating with a **12.6 V, 0.6 A** heater, it features a controlled 11-second warm-up time optimized for series-string heater configurations. The tube is capable of handling peak positive plate pulses up to **6000 V** (absolute maximum) and exhibits a high peak plate current of **260 mA** at zero bias. With a plate dissipation rating of **11 W** and a screen dissipation rating of **2.5 W**, the 12CU6 (often designated as **12BQ6GTB/12CU6**) provides reliable, high-efficiency performance in television deflection circuits.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

195X General Electric Essential Characteristics

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

195X GENERAL ELECTRIC ESSENTIAL CHARACTERISTICS

Section 1 · Beam Power

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Input capacitance	15 pF	—
Output capacitance	7 pF	—
Grid-to-plate capacitance	0.55 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	HorizontalDeflection
Screen voltage	150 V	HorizontalDeflection
Grid voltage	-22.5 V	HorizontalDeflection
Plate current	55 mA	HorizontalDeflection
Screen current	2.1 mA	HorizontalDeflection
Positive pulse plate voltage	6000 V	HorizontalDeflection

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
Peak positive plate voltage maximum	6000 V	Pulse
Average cathode current maximum	110 mA	—
Typical grid2 voltage	150 V	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Input capacitance	15 pF	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	Television horizontal-deflection output amplifier	—



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SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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
HeaterVoltageNominal	12.6 V	—
HeaterCurrentNominal	600 mA	—
Peak Positive Pulse Plate Voltage	6000 V	HorizontalDeflection
Peak Negative Pulse Plate Voltage	1250 V	HorizontalDeflection
Peak Cathode Current	400 mA	HorizontalDeflection

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	14500 Ohm	—
Transconductance	5900 uS	—



SOURCE DATA APPENDIX

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

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Current – published value 1	600 mA	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Current – published value 2	40 mA	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Heater voltage	12.6 V	Nominal heater rating
Heater current	600 mA	Nominal heater rating
Plate resistance	14500 ohm	InheritedFromReferencedParent 6CU6
Transconductance	5900 uS	InheritedFromReferencedParent 6CU6

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum plate voltage	600 V	InheritedFromReferencedParent 6CU6
Maximum screen-grid voltage	200 V	InheritedFromReferencedParent 6CU6
Maximum plate dissipation	11 W	InheritedFromReferencedParent 6CU6



SOURCE DATA APPENDIX

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

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater-Cathode Voltage:	11 s	Other
Peak value	200 V	Other;PublishedValue1
Peak value	200 V	Other;PublishedValue2
Peak value	200 V	Other;PublishedValue3
Average value	100 V	Other;PublishedValue1
Average value	100 V	Other;PublishedValue2
Average value	100 V	Other;PublishedValue3
DC Plate Voltage	600 V	MaximumRating
Peak Positive-Pulse Plate Voltage* (Absolute Maximum)	6000 V	MaximumRating
Peak Negative-Pulse Plate Voltage	1260 V	MaximumRating
DC Grid-No	2 V	MaximumRating;PublishedValue1
DC Grid-No	200 V	MaximumRating;PublishedValue2
Peak Negative-Pulse Grid-No.1 (Control-Grid) Voltage	300 V	MaximumRating
Peak Cathode Current	400 mA	MaximumRating
Average Cathode Current	110 mA	MaximumRating
Plate Dissipation"	11 W	MaximumRating
Grid-No	2 W	MaximumRating;PublishedValue1
Grid-No	2.5 W	MaximumRating;PublishedValue2
Grid-No.1-Circuit Resistance	0.47 megohm	MaximumCircuitValue
Maximum Plate Voltage	600 V	Section1;Promoted
Maximum Screen Voltage	200 V	Section1;Promoted
Maximum Plate Dissipation	11 W	Section1;Promoted
Maximum Screen Dissipation	2.5 W	Section1;Promoted

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Cathode Current	110 mA	Section1;Promoted

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate to Cathode, Heater, Grid No	2 pF	Capacitance;PublishedValue1
Plate to Cathode, Heater, Grid No	3 pF	Capacitance;PublishedValue2
Plate to Cathode, Heater, Grid No	7 pF	Capacitance;PublishedValue3

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	60 V	Characteristic;PublishedValue1
Plate Voltage	150 V	Characteristic;PublishedValue2
Plate Voltage	250 V	Characteristic;PublishedValue3
Grid-No	2 V	Characteristic;PublishedValue1
Grid-No	150 V	Characteristic;PublishedValue2
Grid-No	150 V	Characteristic;PublishedValue3
Grid-No	150 V	Characteristic;PublishedValue4
Grid-No	1 V	Characteristic;PublishedValue1
Grid-No	0 V	Characteristic;PublishedValue2
Grid-No	22.5 V	Characteristic;PublishedValue3
Grid-No	-22.5 V	Characteristic;PublishedValue4
Plate Resistance (Approx.) –	14500 ohm	Characteristic
Plate Current	260 mA	Characteristic;PublishedValue1
Plate Current	57 mA	Characteristic;PublishedValue2
Grid-No	2 mA	Characteristic;PublishedValue1
Grid-No	26 mA	Characteristic;PublishedValue2
Grid-No	2.1 mA	Characteristic;PublishedValue3
Grid-No	1 mA	Characteristic;PublishedValue1
Grid-No	1 mA	Characteristic;PublishedValue2
Published value	-43 V	Characteristic
Plate Resistance	14500 ohm	Section1;Promoted

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	5900 μ S	Section1;Promoted

TUBE TINKER

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