

ELECTRONIC TUBE REFERENCE

CONSOLIDATED TECHNICAL DATA
1 SECTION
CONSTRUCTION
BEAMPOWER

13GB5

Power - TV Horizontal Output (sweep) electronic tube

Magnoval beam-power tube for television horizontal-deflection amplification, combining high transconductance with 11 W plate dissipation for demanding line-output service.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9NH	BASE PINS	9
NOMINAL HEATER	13.3 V / 600 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

9NH - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1	–	G1 – Control Grid	CONNECTED
PIN2	–	G1 – Control Grid	CONNECTED
PIN3	–	G3 – Suppressor Grid	CONNECTED
PIN3	–	K – Cathode	CONNECTED
PIN4	–	H – Heater	CONNECTED
PIN5	–	H – Heater	CONNECTED
PIN6	–	G2 – Screen Grid	CONNECTED
PIN7	–	G2 – Screen Grid	CONNECTED
PIN8	–	G3 – Suppressor Grid	CONNECTED
PIN8	–	K – Cathode	CONNECTED
PIN9	–	–	IC
CAP1	A	P – Plate (Anode)	CONNECTED

SECTION1 Beam Power	
PLATE RESISTANCE	20000 Ω
TRANSCONDUCTANCE	0.011 S
MAXIMUM PLATE VOLTAGE	275 V
MAXIMUM SCREEN VOLTAGE	220 V
MAXIMUM PLATE DISSIPATION	11 W
MAXIMUM SCREEN DISSIPATION	2.5 W
MAXIMUM CATHODE CURRENT	180 mA
<i>horizontal-deflection beam power</i>	

13GB5 — Beam Power Pentode

The **13GB5** (also designated as **13GB5/XL500**) is a Magnoval-type beam power pentode designed primarily for use as a horizontal-deflection amplifier in television receivers. It is engineered to deliver high peak plate currents at low plate voltages, which is a critical requirement for efficient horizontal-output stages in television scanning systems.

Overview

The 13GB5 is a specialized power tube designed for series-string heater applications. It is electrically identical to the **6GB5/EL500** except for its heater ratings. The tube belongs to a family of identical beam power pentodes that includes the **18GB5/LL500**, **27GB5/PL500**, and **28GB5**, each tailored for different heater supply configurations.

The device features a Magnoval T-9 glass envelope and requires a neonoval 9-contact socket. To handle the high-voltage pulses generated during the horizontal flyback interval, the plate connection is brought out to a top cap, isolating it from the other electrodes at the base.

Construction, Physical Dimensions, and Pinout

The 13GB5 is constructed with a **Magnoval T-9** glass envelope and a **Button 9-Pin (E9-23)** base. The physical dimensions of the tube are as follows:

- **Maximum Diameter:** 1.188 inches
- **Maximum Seated Height:** 3.750 inches
- **Maximum Overall Height:** 4.125 inches

Pinout and Basing (9NH)

The tube utilizes the **9NH** basing arrangement. The pin connections, viewed from the bottom of the base, are:

Pin Number	Connection
Pin 1	Grid No. 1 (Control Grid)
Pin 2	Grid No. 1 (Control Grid)
Pin 3	Cathode / Grid No. 3 (Beam Plates)
Pin 4	Heater
Pin 5	Heater
Pin 6	Grid No. 2 (Screen Grid)
Pin 7	Grid No. 2 (Screen Grid)
Pin 8	Cathode / Grid No. 3 (Beam Plates)
Pin 9	Internal Connection (Do Not Use)
Top Cap	Plate (Anode)

The duplicate connections for Grid No. 1 (Pins 1 and 2), Grid No. 2 (Pins 6 and 7), and Cathode/Grid No. 3 (Pins 3 and 8) are provided to reduce lead inductance and simplify circuit layout.

Heater Characteristics and Ratings

The heater of the 13GB5 is designed for series-string operation in television receivers.

- **Heater Voltage (AC or DC):** 13.3 V (at 0.600 A) or 13 V (depending on the specific rating standard)
- **Heater Current:** 0.600 A (with a tolerance of ± 0.040 A)

Heater Power Calculation

Using the nominal ratings, the heater power consumption can be calculated as: $\text{Heater Power} = 13.3 \text{ V} \times 0.600 \text{ A} = 7.98 \text{ W}$ Or, using the alternative 13 V nominal rating: $\text{Heater Power} = 13.0 \text{ V} \times 0.600 \text{ A} = 7.80 \text{ W}$

Heater-Cathode Voltage Limits

To prevent insulation breakdown between the heater and the cathode, the following maximum voltage limits must be respected:

- **Heater Negative with Respect to Cathode:**
 - **DC:** 125 V maximum

- **Total DC and Peak:** 250 V maximum
- **Heater Positive with Respect to Cathode:**
 - **DC:** 125 V maximum
 - **Total DC and Peak:** 250 V maximum

Electrical Ratings (Design-Maximum System)

The maximum ratings for the 13GB5 are specified under the Design-Maximum Rating System for operation in a 525-line, 30-frame television system:

Parameter	Maximum Rating	Unit
DC Plate Voltage	275	V
Peak Positive-Pulse Plate Voltage	7700	V
DC Grid-No. 2 (Screen-Grid) Voltage	275	V
Average Cathode Current	275	mA
Plate Dissipation	17	W
Grid-No. 2 Input (Screen-Grid Dissipation)	5	W
Grid-No. 2 Input (for plate dissipation below 11 W)	6	W

Note on Peak Positive-Pulse Plate Voltage: The pulse duration must not exceed 15% of a horizontal scanning cycle, which corresponds to a maximum duration of 10 microseconds.

Maximum Circuit Values

- **Grid-No. 1 Circuit Resistance (Without grid current):** 0.5 MΩ
- **Grid-No. 1 Circuit Resistance (With grid current, horizontal-output service only):** 2.2 MΩ

Typical Instantaneous Characteristics (Knee Values)

The 13GB5 is designed to exhibit a very sharp "knee" in its plate characteristic curves, allowing high plate current at low plate voltages. The typical instantaneous characteristics (measured with a recurrent waveform to avoid exceeding maximum ratings) are:

- **Plate Voltage (E_b):** 75 V
- **Grid-No. 2 Voltage (E_{c2}):** 200 V
- **Grid-No. 1 Voltage ($E_{c1}(/tubes/C1)$):** -10 V

- **Plate Current (I_b):** 440 mA
- **Grid-No. 2 Current (I_{c2}):** 37 mA

These values demonstrate the tube's ability to conduct heavily (440 mA) even when the plate voltage drops to 75 V, which is essential for minimizing plate dissipation and maximizing efficiency during the end-of-scan period.

Horizontal-Deflection Amplifier Operation

The 13GB5 can be operated in either stabilized or non-stabilized horizontal-deflection circuits. The following tables outline typical operating parameters at various supply voltages.

Stabilized Circuit Operation

In these typical operating conditions, a minimum value of screen-grid resistor ($R_{[g2] (/tubes/G2)}$) is required to prevent excessive screen-grid dissipation during the heater warm-up period.

Parameter	170 V Supply	200 V Supply	230 V Supply
Supply Voltage	170 V	200 V	230 V
Minimum Screen-Grid Resistor ($R_{[g2] (/tubes/G2)}$)	1.2 k Ω	1.5 k Ω	2.2 k Ω
Screen-Grid Voltage (E_{c2})	130 V	150 V	180 V
Plate Voltage at End of Scan	55 V	59 V	65 V
Control-Grid Voltage at End of Scan	-10 V	-10 V	-10 V
Peak Plate Current	210 mA	270 mA	360 mA

Non-Stabilized Circuits (Drive Below the Knee)

For circuits where the tube is driven below the knee of the plate characteristic:

Parameter	170 V Supply	200 V Supply	230 V Supply
Supply Voltage	170 V	200 V	230 V
Minimum Screen-Grid Resistor ($R_{[g2] (/tubes/G2)}$)	2.2 k Ω	2.2 k Ω	2.2 k Ω

Parameter	170 V Supply	200 V Supply	230 V Supply
Control-Grid Voltage at End of Scan	+1 V	+1 V	+1 V
Peak Plate Current	200 mA	250 mA	320 mA

Circuit Design Considerations

- **Cut-off Voltage:** The minimum required control-grid voltage for complete cut-off during the flyback interval is **-120 V**.
- **Excitation Protection:** A bias resistor or other protective means must be incorporated in the circuit to protect the tube from excessive current in the event that excitation drive is lost.
- **Line Voltage Variations:** The typical operating values are specified for nominal line voltage. If the line voltage drops by up to 10% below nominal, the tube is designed to continue operating above the knee.
- **Peak Plate Current Limits:** To account for tube-to-tube variations (spread), performance deterioration over the tube's operating life, and a 10% reduction in line voltage, the peak plate current should not exceed the specified values under nominal line voltage conditions.

Related Designations and Comparisons

The **13GB5** is part of a family of identical beam power pentodes that share the same internal structure, physical dimensions, and electrical ratings, differing only in their heater requirements:

- **6GB5/EL500:** Designed for standard parallel heater circuits, requiring **6.3 V** at **1.38 A** (1380 mA).
- **13GB5/XL500:** Designed for 0.6 A series-string circuits, requiring **13.3 V** (or **13 V**) at **0.6 A**.
- **18GB5/LL500:** Designed for 0.45 A series-string circuits, requiring **18 V** at **0.45 A**.
- **27GB5/PL500:** Designed for 0.3 A series-string circuits, requiring **27 V** (or **28 V**) at **0.3 A**.
- **28GB5:** Designed for 0.3 A series-string circuits, requiring **28 V** at **0.3 A** (300 mA).

These tubes are highly specialized for horizontal-deflection service and require a Magnoval/neonval 9-contact socket.

Technical Summary

The **13GB5** (or **13GB5/XL500**) is a high-performance, Magnoval-type beam power pentode optimized for horizontal-deflection amplifier service in television receivers. It features a **T-9** glass envelope, a **Button 9-Pin (E9-23)** base, and a **C1-2** top cap for the plate connection. Operating with a **13.3 V / 0.6 A** heater, it is tailored for series-string heater chains. The tube is capable of handling a peak positive-pulse plate voltage of up to **7700 V** and a plate dissipation of **17 W**. Its unique design allows it to deliver high peak plate currents (up to **440 mA** instantaneously at a plate voltage of only **75 V**), ensuring highly efficient operation in horizontal-output stages.



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	275 V	Inherited from explicitly referenced 6GB5 parent except heater data.
Maximum Screen Voltage	220 V	Inherited from explicitly referenced 6GB5 parent except heater data.
Plate Dissipation	11 W	Inherited from explicitly referenced 6GB5 parent except heater data.
Screen Dissipation	2.5 W	Inherited from explicitly referenced 6GB5 parent except heater data.
Peak Cathode Current	180 mA	Inherited from explicitly referenced 6GB5 parent except heater data.

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	11000 μ S	Inherited from explicitly referenced 6GB5 parent except heater data.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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
75; g;rid-No	2 V	Published in approved XL500 target datasheet entry; Section1
mA, 440; grid-No	2 mA	Published in approved XL500 target datasheet entry; Section1
Heater Voltage (ac/dc) 6.3 13.3 18	27 V	Published in approved XL500 target datasheet entry; Section1
Heater Current 1.38 0.6 0.45	300 mA	Published in approved XL500 target datasheet entry; Section1
Peak Positive-Pulse Plate Voltage*	7700 V	Published in approved XL500 target datasheet entry; Section1
DC Giid-No.2 (Screen-Grid) Voltage	275 V	Published in approved XL500 target datasheet entry; Section1
Average Cathode Current	275 mA	Published in approved XL500 target datasheet entry; Section1
Plate Dissipation 4	17 W	Published in approved XL500 target datasheet entry; Section1
Grid-No.2 Input"	5 W	Published in approved XL500 target datasheet entry; Section1
Without grid current	0.5 MΩ	Published in approved XL500 target datasheet entry; Section1
With grid current (horizontal-output service only)	2.2 MΩ	Published in approved XL500 target datasheet entry; Section1
# Pulse duration must not exceed 15% of a horizontal scanning cycle (	10 microseconds	Published in approved XL500 target datasheet entry; Section1
Grid-No.2 input may reach	6 W	Published in approved XL500 target datasheet entry; Section1
Grid-No.2 input may reach 6 watts for plate-dissipation values below	11 W	Published in approved XL500 target datasheet entry; Section1

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