



ELECTRONIC TUBE REFERENCE

12JF5

Power - TV Horizontal Output (sweep) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

BEAMPOWER

Compactron beam-power pentode designed specifically as the horizontal-deflection output amplifier in color television receivers, optimized for large current and flyback-voltage excursions.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	12
NOMINAL HEATER	12.6 V / 600 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Beam Power	
PLATE RESISTANCE	18000 Ω
AMPLIFICATION FACTOR	4.4
MAXIMUM PLATE VOLTAGE	6500 V

12JF5 — Compactron Beam Power Pentode

An indirectly heated compactron beam-power pentode designed primarily for horizontal-deflection amplifier service in color television receivers.

Overview

The **12JF5** is a compactron beam-power pentode engineered specifically for the demanding requirements of horizontal-deflection circuits in color television receivers. It features a T-12 glass envelope, a 12-pin button base, and a small top cap for the plate connection. This physical configuration helps isolate the high-voltage pulses present on the plate from the other electrodes. The tube is designed to operate in any mounting position.

Heater and Electrical Characteristics

The 12JF5 utilizes a coated unipotential cathode. Its heater is designed for operation from either an AC or DC supply. Under standard operating conditions, the heater characteristics are as follows:

- **Heater Voltage:** 12.6 V
- **Heater Current:** 0.6 ± 0.04 A
- **Average Heater Warm-up Time:** 11 seconds

The heater warm-up time is defined as the time required for the voltage across the heater to reach 80% of its nominal value when four times the nominal heater voltage is applied to a circuit consisting of the heater in series with a resistance equal to three times the nominal heater voltage divided by the nominal heater current. Circuit designs must center the heater current at the nominal 0.6 A value, with supply variations restricted to maintain the current within specified tolerances.

Direct Interelectrode Capacitances

Measured without an external shield, the approximate interelectrode capacitances of the 12JF5 are:

- **Grid-Number 1 to Plate (g1 to p):** 0.55 pF
- **Input (g1 to h + k + g2 + b.p.):** 15.6 pF
- **Output (p to h + k + g2 + b.p.):** 6.4 pF

Mechanical Specifications and Pinout

The tube is housed in a T-12 glass envelope with an EIA 12-87 outline. It uses an E12-74 button 12-pin base and a C1-1 small top cap.

Physical Dimensions

- **Maximum Diameter:** 1.563 inches
- **Minimum Diameter:** 1.437 inches
- **Maximum Overall Length:** 3.625 inches
- **Maximum Seated Height:** 3.250 inches
- **Minimum Seated Height:** 3.000 inches

Terminal Connections (Basing Diagram 12JH)

Connections are made via the 12-pin base and the top cap as follows:

Pin	Connection
Pin 1	Heater
Pin 2	Grid-Number 2 (Screen)
Pin 3	Grid-Number 1

Pin	Connection
Pin 4	Cathode and Beam Plates
Pin 5	Internal Connection - Do Not Use
Pin 6	Internal Connection - Do Not Use
Pin 7	No Connection
Pin 8	Internal Connection - Do Not Use
Pin 9	Internal Connection - Do Not Use
Pin 10	Cathode and Beam Plates
Pin 11	Grid-Number 1
Pin 12	Heater
Cap	Plate

Maximum Ratings

The following design-maximum ratings represent the limiting values of operating and environmental conditions for a bogey 12JF5 tube. These ratings must not be exceeded under the worst probable conditions. The ratings are specified for horizontal-deflection amplifier service in a 525-line, 30-frame television system, where the duty cycle of the voltage pulse does not exceed 15% of one scanning cycle.

Parameter	Design-Maximum Value
DC Plate-Supply Voltage (Boost + DC Power Supply)	770 V
Peak Positive Pulse Plate Voltage	6500 V
Peak Negative Pulse Plate Voltage	0 V
Screen Voltage (Grid-Number 2)	220 V
Peak Negative Grid-Number 1 Voltage	330 V
Plate Dissipation	17.5 W
Screen Dissipation	3.5 W
DC Cathode Current	175 mA
Peak Cathode Current	550 mA
Heater-Cathode Voltage (Heater Positive, DC Component)	100 V

Parameter	Design-Maximum Value
Heater-Cathode Voltage (Heater Positive, Total DC and Peak)	200 V
Heater-Cathode Voltage (Heater Negative, Total DC and Peak)	200 V
Grid-Number 1 Circuit Resistance	1.0 MΩ
Bulb Temperature at Hottest Point	220 °C

Bulb temperature measurements should be conducted at an ambient temperature of 40 °C using an infrared thermometer (such as an Ircon Model 700 BC or equivalent).

Typical Characteristics and Operation

The 12JF5 exhibits distinct characteristics depending on the operating point. The table below outlines three typical operating conditions:

Parameter	Condition A	Condition B	Condition C
Plate Voltage	5000 V	60 V	250 V
Screen Voltage	150 V	150 V	150 V
Grid-Number 1 Voltage	—	0 V*	-22.5 V
Plate Resistance (approx.)	—	—	18000 Ω
Transconductance	—	—	7300 μmhos
Plate Current	—	345 mA	65 mA
Screen Current	—	27 mA	1.8 mA
Grid-Number 1 Voltage for $I_b = 1.0$ mA (approx.)	-80 V	—	-42 V

Grid-Number 1 voltage of 0 V is applied only for a short interval (two seconds maximum) to prevent damage to the tube.

Triode Connection

When the screen is tied to the plate (triode connection) under the conditions of $E_b = E_{c2} = 150$ V and $E_{c1} = -22.5$ V, the triode amplification factor is **4.4**.

Circuit Protection

In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means must be implemented to protect the tube from damage in the event that excitation is lost.

Minimum Recommended Grid Drive

To ensure reliable horizontal-deflection operation, minimum grid drive requirements are specified based on the peak positive pulse plate voltage and screen voltage (Eg2):

Peak Positive Pulse Plate Voltage	Min. Peak Negative Grid-1 Voltage (Eg2 = 150 V)	Min. Peak Negative Grid-1 Voltage (Eg2 = 200 V)
3500 V	-100 V	-120 V
5000 V	-118 V	-138 V
6000 V	-130 V	-150 V

Analysis of Characteristic Curves

The published curves for the 12JF5 provide detailed graphical representations of its performance:

- Average Plate Characteristics (Eg2 = 150 V):** This family of curves plots plate current (Ib) and screen current (Ic2) against plate voltage (Eb) for various grid-number 1 voltages (Ec1) ranging from 0 V down to -40 V. It demonstrates the sharp knee characteristic of the beam pentode, where plate current remains relatively constant over a wide range of plate voltages above the knee.
- Average Plate Characteristics (Ec1 = 0 V):** This set of curves shows the relationship of plate and screen currents to plate voltage for different screen voltages (Eg2) ranging from 50 V to 200 V. It highlights the strong influence of screen voltage on the peak current capability of the tube.
- Average Transfer Characteristics (Eb = 250 V):** These curves plot plate and screen currents against grid-number 1 voltage for screen voltages from 50 V to 200 V. They illustrate the transconductance behavior and the cutoff characteristics of the control grid.
- Recommended Minimum Peak Negative Grid Voltage vs. Peak Positive Pulse Plate Voltage:** This graph provides a design guide for selecting the minimum peak negative grid-to-cathode voltage during re-trace (ranging from 100 V to over 160 V) as a function of peak positive plate voltage (from 3.0 to 7.0 kV) for screen voltages of 150 V and 200 V.

Technical Summary

The **12JF5** is a robust compactron beam-power pentode designed specifically for the demanding role of horizontal-deflection amplification in color television receivers. Operating with a 12.6 V, 0.6 A heater, it features a unipotential cathode, a 12-pin button base, and a top-cap plate connection to isolate high-voltage pulses. With a peak positive pulse plate voltage rating of 6500 V, a plate dissipation limit of 17.5 W, and a peak cathode current capability of 550 mA, the 12JF5 is optimized for high-power pulse

applications. Its design-maximum ratings and recommended grid drive parameters ensure stable and reliable performance when operated within the specified limits of a 525-line television scanning system.

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