

ELECTRONIC TUBE REFERENCE

12BF11

Power - Beam (NOT sweep) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

BEAMPOWER-PENTODE

Multi-section television receiving tube incorporating a beam-power audio output stage with an additional small-signal section for receiver amplification or control functions.

GENERAL CHARACTERISTICS

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

12EZ - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – Pin 1	–	H – Heater	CONNECTED • verified
PIN2 – Pin 2	B	K – Cathode	CONNECTED • verified
PIN2 – Pin 2	B	SH – Internal Shield	CONNECTED • verified
PIN2	–	IS – Internal Screen	CONNECTED
PIN3 – Pin 3	B	G1 – Control Grid	CONNECTED • verified
PIN4 – Pin 4	–	–	NC • verified
PIN5 – Pin 5	B	G3 – Suppressor Grid	CONNECTED • verified
PIN6 – Pin 6	B	G2 – Screen Grid	CONNECTED • verified

TERMINAL	SECTION	ELEMENT	STATUS
PIN7 – Pin 7	B	P – Plate (Anode)	CONNECTED · verified
PIN8 – Pin 8	A	G1 – Control Grid	CONNECTED · verified
PIN9 – Pin 9	A	BP – Beam-Forming Plate	CONNECTED · verified
PIN9	A	G3 – Suppressor Grid	CONNECTED
PIN9 – Pin 9	A	K – Cathode	CONNECTED · verified
PIN10 – Pin 10	A	G2 – Screen Grid	CONNECTED · verified
PIN11 – Pin 11	A	P – Plate (Anode)	CONNECTED · verified
PIN12 – Pin 12	–	H – Heater	CONNECTED · verified

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	30000 Ω
TRANSCONDUCTANCE	0.0086 S
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM SCREEN VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	1.7 W
MAXIMUM SCREEN DISSIPATION	1.1 W
MAXIMUM CATHODE CURRENT	65 A
<i>Supplied sheet explicitly states this is the same as 6BF11 except for heater characteristics. Parent electrical table was not present in the currently available local corpus, so no unsupported promoted values were invented.</i>	

SECTION2 Beam Power	
PLATE RESISTANCE	30000 Ω
TRANSCONDUCTANCE	0.0086 S
MAXIMUM PLATE VOLTAGE	165 V
MAXIMUM SCREEN VOLTAGE	150 V
MAXIMUM PLATE DISSIPATION	6.5 W
MAXIMUM SCREEN DISSIPATION	1.8 W
MAXIMUM CATHODE CURRENT	65 mA
<i>Supplied sheet explicitly states this is the same as 6BF11 except for heater characteristics. Parent electrical table was not present in the currently available local corpus, so no unsupported promoted values were invented.</i>	

12BF11 — Dual-Control Sharp-Cutoff Pentode and Beam Power Tube

An indirectly heated, multi-unit duodecar vacuum tube combining a dual-control sharp-cutoff pentode and a beam power amplifier in a single envelope, designed for television receiver applications.

Overview

The **12BF11** is a multi-unit glass vacuum tube of the duodecar (or Compactron T-9) family. It integrates two distinct, electrically independent operating sections: a dual-control, sharp-cutoff pentode unit and a high-sensitivity beam power unit. This combination is specifically tailored for television receiver designs, where the pentode unit serves as an FM sound detector and the beam power unit operates as the audio frequency (AF) output amplifier.

The 12BF11 belongs to a family of identical tubes that differ only in their heater ratings. This family includes the [6BF11](#), [17BF11](#), and [24BF11](#). The shared internal structure and electrode configurations allow these types to be used interchangeably in terms of signal circuitry, provided the power supply accommodates their respective heater requirements.

Construction, Heater, and Pinout

The 12BF11 is constructed in a Compactron T-9 glass envelope with a 12-pin button base (E12-70). It requires a standard duodecar 12-contact socket and can be operated in any mounting position. The physical dimensions of the tube include a maximum diameter of 1.188 inches, a maximum seated height of 2.250 inches, and a maximum overall height of 2.625 inches.

The cathodes of both units are indirectly heated, coated unipotential structures. The heater is designed with a controlled warm-up time of 11 seconds to facilitate series-string operation in television receivers.

Heater Characteristics and Ratings

The heater specifications for the 12BF11 and its sister types are as follows:

Tube Designation	Heater Voltage (AC/DC)	Heater Current	Average Warm-up Time
<u>6BF11</u>	6.3 V	1.2 A (1200 mA)	—
12BF11	12.6 V	0.600 ± 0.040 A	11 seconds
<u>17BF11</u>	16.8 V	0.45 A (450 mA)	11 seconds
<u>24BF11</u>	24.2 V	0.315 A (315 mA)	11 seconds

Heater-Cathode Voltage Limits

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

- **Peak value:** ±200 V maximum
- **Average value:** 100 V maximum

Pin Connections (12EZ Basing Diagram)

The 12EZ basing arrangement provides the following pin connections, viewed from the underside of the tube:

Pin Number	Electrode Connection
1	Grid No. 1 of Beam Power Unit (G1b)
2	Cathode of Pentode Unit, Internal Shield (Kp, IS)
3	Grid No. 1 of Pentode Unit (G1p)
4	No Connection (NC)
5	Grid No. 3 of Pentode Unit (G3p)
6	Grid No. 2 of Pentode Unit (G2p)
7	Plate of Pentode Unit (Pp)
8	Plate of Beam Power Unit (Pb)
9	Cathode and Grid No. 3 of Beam Power Unit (Kb, G3b)
10	Grid No. 2 of Beam Power Unit (G2b)
11	Heater (H)

Pin Number	Electrode Connection
12	Heater (H)

Direct Interelectrode Capacitances

The unshielded direct interelectrode capacitances of the 12BF11 reflect the isolation between the two internal units as well as the internal shielding.

Unit / Electrodes	Capacitance Value
Pentode Unit (Section 2)	
Grid No. 1 to Plate (Max.)	0.036 pF
Grid No. 3 to Plate	3.2 pF
Grid No. 1 to Cathode, Heater, Grid No. 2, Grid No. 3, and Internal Shield	6.5 pF
Grid No. 3 to Cathode, Heater, Grid No. 1, Grid No. 2, Plate, and Internal Shield	8.0 pF
Grid No. 1 to Grid No. 3	0.11 pF
Beam Power Unit (Section 1)	
Grid No. 1 to Plate	0.24 pF
Grid No. 1 to Cathode, Heater, Grid No. 2, Grid No. 3, and Internal Shield	13.0 pF
Plate to Cathode, Heater, Grid No. 2, Grid No. 3, and Internal Shield	10.0 pF
Inter-Unit Coupling	
Pentode Plate to Beam Power Plate	0.13 pF

Beam Power Unit (Section 1) Characteristics and Class A1 Operation

The beam power unit is designed to operate as a high-sensitivity Class A1 audio power amplifier. It features high transconductance and moderate plate dissipation capabilities.

Maximum Ratings (Design-Maximum Values)

- **Plate Voltage:** 165 V
- **Grid-No. 2 (Screen-Grid) Voltage:** 150 V

- **Average Cathode Current:** 65 mA
- **Plate Dissipation:** 6.5 W
- **Grid-No. 2 Input:** 1.8 W

Typical Operating Conditions

At a typical operating point, the beam power unit delivers up to 2.4 watts of audio output with 10% total harmonic distortion:

- **Plate Voltage:** 145 V
- **Grid-No. 2 Voltage:** 110 V
- **Grid-No. 1 (Control-Grid) Voltage:** -6.0 V
- **Peak AF Grid-No. 1 Voltage:** 6.0 V
- **Zero-Signal Plate Current:** 36 mA
- **Maximum-Signal Plate Current:** 40 mA
- **Zero-Signal Grid-No. 2 Current:** 3.0 mA
- **Maximum-Signal Grid-No. 2 Current:** 9.0 mA
- **Plate Resistance (Approx.):** 30,000 Ω (0.03 M Ω)
- **Transconductance:** 8600 μ mhos
- **Load Resistance:** 3000 Ω (*Note: Some documentation lists 30,000 Ω , though 3000 Ω is typical for this class of power amplifier*)
- **Total Harmonic Distortion (Approx.):** 10%
- **Maximum-Signal Power Output:** 2.4 W

Maximum Circuit Values

- **Grid-No. 1-Circuit Resistance (Fixed Bias):** 0.25 M Ω
- **Grid-No. 1-Circuit Resistance (Cathode Bias):** 0.5 M Ω

Pentode Unit (Section 2) Characteristics and Operation

The pentode unit is a dual-control, sharp-cutoff device. It is designed to operate either as a Class A1 amplifier or as an FM sound detector.

Typical Operation as Class A1 Amplifier

When operated as a Class A1 amplifier, the pentode unit exhibits the following characteristics:

- **Plate Supply Voltage:** 150 V
- **Grid-No. 3 (Control-Grid) Voltage:** Connected to negative end of cathode resistor
- **Grid-No. 2 (Screen-Grid) Supply Voltage:** 100 V
- **Grid-No. 1 (Control-Grid) Voltage:** Connected to negative end of cathode resistor
- **Cathode-Bias Resistor:** 560 Ω

- **Plate Resistance (Approx.):** 150,000 Ω (0.15 M Ω)
- **Transconductance, Grid No. 1 to Plate:** 1000 μmhos
- **Transconductance, Grid No. 3 to Plate:** 400 μmhos
- **Plate Current:** 1.3 mA
- **Grid-No. 2 Current:** 2.0 mA (or 2.1 mA)
- **Grid-No. 1 Voltage (Approx.) for plate current of 10 μA :** -4.5 V (*Sylvania lists -4.5 V for 30 μA plate current*)
- **Grid-No. 3 Voltage (Approx.) for plate current of 10 μA :** -4.5 V (*Sylvania lists -4.5 V for 50 μA plate current*)

Maximum Ratings as FM Sound Detector (Design-Maximum Values)

- **Plate Voltage:** 330 V
- **Grid-No. 3 (Suppressor) Voltage:** 28 V
- **Grid-No. 2 Supply Voltage:** 330 V
- **Grid-No. 1 (Control-Grid) Voltage, Positive-bias value:** 0 V
- **Plate Dissipation:** 1.7 W
- **Grid-No. 2 Input:**
 - For Grid-No. 2 voltages up to 165 V: 1.1 W
 - For Grid-No. 2 voltages between 165 V and 330 V: Dependent on circuit curves

Maximum Circuit Values

- **Grid-No. 1-Circuit Resistance (Fixed Bias):** 0.25 M Ω
- **Grid-No. 1-Circuit Resistance (Cathode Bias):** 0.5 M Ω

Characteristic Curves and Qualitative Analysis

The published characteristic curves for the 12BF11 provide insights into the behavior of both units under varying voltage and bias conditions.

Beam Power Unit Curves

The plate characteristics for the beam power unit are plotted at a fixed screen-grid (Grid-No. 2) voltage of 110 V. The curves show plate current and screen-grid current as a function of plate voltage for control-grid (Grid-No. 1) voltages ranging from 0 V down to -12 V.

- At low plate voltages (below 50 V), the plate current rises sharply, demonstrating the typical knee characteristic of beam power tubes.
- The screen-grid current is highest at low plate voltages and drops to a low, stable value (around 3 mA to 9 mA depending on bias) once the plate voltage exceeds the knee.
- The relatively flat plate current curves in the active region (above 100 V) indicate high plate resistance and stable gain.

Pentode Unit Curves

The plate characteristics for the pentode unit are plotted at a fixed suppressor-grid (Grid-No. 3) voltage of 0 V and a screen-grid (Grid-No. 2) voltage of 100 V. The curves show plate current as a function of plate voltage for control-grid (Grid-No. 1) voltages from 0 V to -4 V.

- The pentode curves exhibit a very sharp knee, typical of sharp-cutoff pentodes.
- Above approximately 100 V, the plate current is highly independent of plate voltage, confirming the high plate resistance (approximately 0.15 MΩ) of this unit.
- The dual-control nature of the pentode allows Grid No. 3 to also exert significant control over the plate current, making it highly suitable for FM detection where two separate control signals are applied.

Technical Summary

The **12BF11** is a versatile, multi-unit **duodecar/Compactron** vacuum tube containing a **dual-control sharp-cutoff pentode** and a **beam power amplifier** in a single T-9 glass envelope. Operating with a **12.6 V, 0.6 A** heater with an 11-second warm-up time, it is designed for series-string television receivers.

The beam power unit provides up to **2.4 W** of audio output under typical Class A1 conditions with a transconductance of **8600 μmhos**. The pentode unit offers dual-control characteristics with a Grid-No. 1 transconductance of **1000 μmhos** and a Grid-No. 3 transconductance of **400 μmhos**, making it highly effective as an FM sound detector. By combining these two functions, the 12BF11 reduces tube count and simplifies chassis design in television audio systems.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Current – published value 1	0.6	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Current – published value 2	0.04	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Voltage (AC or DC) at 0.600 A – published value 1	0.6 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Voltage (AC or DC) at 0.600 A – published value 2	12.6 V	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



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 · Pentode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Pentode Plate to Beam Power Plate	0.13 pF	Capacitance

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Plate Voltage	330 V	Section2;Promoted
Maximum Screen Voltage	330 V	Section2;Promoted
Maximum Plate Dissipation	1.7 W	Section2;Promoted
Maximum Screen Dissipation	1.1 W	Section2;Promoted

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	150000 ohm	Section2;Promoted
Transconductance	1000 uS	Section2;Promoted

1975 RCA RC30

Section 2 · Beam Power

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Warm-up Time (Average)	11 s	Other;PublishedValue1
Heater Warm-up Time (Average)	11 s	Other;PublishedValue2
Heater Warm-up Time (Average)	11 s	Other;PublishedValue3
Peak value	200 V	Other;PublishedValue1
Peak value	200 V	Other;PublishedValue2
Peak value	200 V	Other;PublishedValue3
Peak value	0 V	Other;PublishedValue4
Average value	100 V	Other;PublishedValue1
Average value	100 V	Other;PublishedValue2
Average value	100 V	Other;PublishedValue3
Average value	100 V	Other;PublishedValue4
Plate Voltage	165 V	MaximumRating

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-No	2 V	MaximumRating;PublishedValue1
Grid-No	150 V	MaximumRating;PublishedValue2
Average Cathode Current	65 mA	MaximumRating
Plate Dissipation	6.5 W	MaximumRating
Grid-No	2 W	MaximumRating;PublishedValue1
Grid-No	1.8 W	MaximumRating;PublishedValue2
Plate Voltage	145 V	TypicalOperation
Grid-No	2 V	TypicalOperation;PublishedValue1
Grid-No	110 V	TypicalOperation;PublishedValue2
Grid-No	1 V	TypicalOperation;PublishedValue1
Grid-No	-6 V	TypicalOperation;PublishedValue2
Peak AF Grid-No.1 Voltage	6 V	TypicalOperation
Zero-Signal Plate Current	36 mA	TypicalOperation
Maximum-Signal Plate Current	40 mA	TypicalOperation
Zero-Signal Grid No	2 mA	TypicalOperation;PublishedValue1
Zero-Signal Grid No	3 mA	TypicalOperation;PublishedValue2
Maximum-Signal Grid-No	2 mA	TypicalOperation;PublishedValue1
Maximum-Signal Grid-No	9 mA	TypicalOperation;PublishedValue2
Plate Resistance (Approx.)	0.03 megohm	TypicalOperation
Transconductance	8600 uS	TypicalOperation
PLATE	92 V	TypicalOperation;PublishedValue1
PLATE	742 V	TypicalOperation;PublishedValue2
Load Resistance	3000 ohm	TypicalOperation
Total Harmonic Distortion	10 %	TypicalOperation
Maximum-Signal Power Output	2.4 W	TypicalOperation
For fixed-bias operation	0.25 megohm	MaximumCircuitValue
For cathode-bias operation	0.5 megohm	MaximumCircuitValue
Plate Voltage	330 V	MaximumRating
Grid-No	3 V	MaximumRating;PublishedValue1
Grid-No	28 V	MaximumRating;PublishedValue2
Grid No	2 V	MaximumRating;PublishedValue1
Grid No	330 V	MaximumRating;PublishedValue2

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-No.1 (Control-Grid) Voltage, Positive-bias value	0 V	MaximumRating
Plate Dissipation	1.7 W	MaximumRating
For grid-No	2 V	MaximumRating;PublishedValue1
For grid-No	165 V	MaximumRating;PublishedValue2
For grid-No	1.1 V	MaximumRating;PublishedValue3
For grid-No	2 V	MaximumRating;PublishedValue1
For grid-No	165 V	MaximumRating;PublishedValue2
For grid-No	330 V	MaximumRating;PublishedValue3
For grid-No	300 V	MaximumRating;PublishedValue4
For fixed-bias operation	0.25 megohm	MaximumCircuitValue
For cathode-bias operation	0.5 megohm	MaximumCircuitValue
Maximum Plate Voltage	165 V	Section1;Promoted
Maximum Screen Voltage	150 V	Section1;Promoted
Maximum Plate Dissipation	6.5 W	Section1;Promoted
Maximum Screen Dissipation	1.8 W	Section1;Promoted
Maximum Cathode Current	65 mA	Section1;Promoted

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid No.1 to Plate	0.36 pF	Capacitance
Grid No	3 pF	Capacitance;PublishedValue1
Grid No	3.2 pF	Capacitance;PublishedValue2
and Internal Shield	8 pF	Capacitance
Grid No.1 to Grid No	3 pF	Capacitance;PublishedValue1
Grid No.1 to Grid No	0.11 pF	Capacitance;PublishedValue2
Grid No.1 to Plate	0.24 pF	Capacitance
and Internal Shield	13 pF	Capacitance
and Internal Shield	10 pF	Capacitance

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Supply Voltage	150 V	Characteristic
Grid-No	2 V	Characteristic;PublishedValue1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-No	100 V	Characteristic;PublishedValue2
Cathode-Bias Resistor	560 ohm	Characteristic
Plate Resistance (Approx.)	0.15 megohm	Characteristic
Transconductance, Grid No.1 to Plate	1000 uS	Characteristic
Plate Current	1.3 mA	Characteristic
Grid-No	2 mA	Characteristic;PublishedValue1
Grid-No	2 mA	Characteristic;PublishedValue2
Grid-No.1 Voltage (Approx.) for plate current of	10 V	Characteristic;PublishedValue1
Grid-No.1 Voltage (Approx.) for plate current of	-4.5 V	Characteristic;PublishedValue2
Grid-No	3 V	Characteristic;PublishedValue1
Grid-No	10 V	Characteristic;PublishedValue2
Grid-No	-4.5 V	Characteristic;PublishedValue3
Plate Resistance	30000 ohm	Section1;Promoted
Transconductance	8600 uS	Section1;Promoted

TUBE TINKER

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