

ELECTRONIC TUBE REFERENCE

12AL11

Power - Beam (NOT sweep) electronic tube

CONSOLIDATED TECHNICAL DATA
2 SECTIONS
CONSTRUCTION
BEAMPOWER-PENTODE

Duodecar television combination tube integrating a beam-power audio output stage with a sharp-cutoff dual-control pentode used for FM sound detection.

GENERAL CHARACTERISTICS

BASE DESIGNATION	12BU	BASE PINS	12
NOMINAL HEATER	12.6 V / 450 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

12BU - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1	–	H – Heater	CONNECTED
PIN2	B	K – Cathode	CONNECTED
PIN3	B	G1 – Control Grid	CONNECTED
PIN4	B	G3 – Suppressor Grid	CONNECTED
PIN5	–	IS – Internal Screen	CONNECTED
PIN6	B	P – Plate (Anode)	CONNECTED
PIN7	B	G2 – Screen Grid	CONNECTED
PIN8	A	G1 – Control Grid	CONNECTED
PIN9	A	G3 – Suppressor Grid	CONNECTED
PIN9	A	K – Cathode	CONNECTED
PIN10	A	G2 – Screen Grid	CONNECTED
PIN11	A	P – Plate (Anode)	CONNECTED
PIN12	–	H – Heater	CONNECTED

SECTION RATINGS

SECTION1 Beam Power	
PLATE RESISTANCE	100000 Ω
TRANSCONDUCTANCE	0.01 S
MAXIMUM PLATE VOLTAGE	275 V
MAXIMUM SCREEN VOLTAGE	275 V
MAXIMUM PLATE DISSIPATION	10 W
MAXIMUM SCREEN DISSIPATION	2 W
<i>Published promoted fields populated semantically; identical repeated sections compressed.</i>	

SECTION2 Pentode	
PLATE RESISTANCE	150000 Ω
TRANSCONDUCTANCE	0.001 S
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM SCREEN VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	1.7 W
MAXIMUM SCREEN DISSIPATION	1.1 W
<i>Published promoted fields populated semantically; identical repeated sections compressed.</i>	

12AL11 — Dissimilar Double Pentode Compactron Tube

The **12AL11** is a multi-unit vacuum tube of the duodecar type, housed in a 12-pin compactron envelope. It contains two highly dissimilar pentode sections: a sharp-cutoff, dual-control pentode (Section 2) designed for use as an FM detector, and a high-power pentode (Section 1) designed for use as an audio-frequency output amplifier. This combination makes the 12AL11 particularly suited for television receiver applications, where it can perform both FM sound detection and audio power amplification within a single envelope.

The 12AL11 belongs to a family of tubes that includes the [6AL11](#) and [10AL11](#). These types share identical physical construction, electrode structures, and electrical characteristics, differing only in their heater ratings.

Physical Construction, Pinout, and Heater Ratings

The 12AL11 is constructed in a T-9 glass bulb with a button 12-pin base (E12-70 designation) and conforms to the JEDEC 9-58 outline. The tube features coated unipotential cathodes and is designed to

operate in any mounting position.

Physical Dimensions

- **Maximum Overall Length:** 2.375 inches
- **Seated Length:** 2.000 inches
- **Bulb Diameter:** 1.062 to 1.188 inches

Heater Characteristics

The heater is designed for series-string or parallel operation, featuring a controlled warm-up time to ensure reliable performance in series-connected receiver designs.

- **Heater Voltage (AC or DC):** 12.6 V
- **Heater Current:** 0.450 A (with allowable limits of 0.450 ± 0.030 A)
- **Average Heater Warm-up Time:** 11 seconds

Heater-Cathode Voltage Ratings

The maximum ratings for voltage between the heater and the cathodes are identical for both Section 1 and Section 2:

- **Heater Positive with Respect to Cathode:**
 - DC Component: 100 V max
 - Total DC and Peak: 200 V max
- **Heater Negative with Respect to Cathode:**
 - Total DC and Peak: 200 V max

Pin Connections (JEDEC 12BU Basing Diagram)

The duodecar 12-contact socket connections, viewed from the bottom of the tube, are assigned as follows:

Pin	Connection
1	Heater
2	Cathode (Section 2)
3	Grid No. 1 (Section 2)
4	Grid No. 3 (Section 2)
5	Internal Shield
6	Plate (Section 2)
7	Grid No. 2 (Section 2)
8	Grid No. 1 (Section 1)

Pin	Connection
9	Cathode, Grid No. 3 (Section 1)
10	Grid No. 2 (Section 1)
11	Plate (Section 1)
12	Heater

Section 1: Beam Power Unit (Audio-Frequency Output Amplifier)

Section 1 is a power pentode (beam power unit) optimized for Class A1 audio amplification. It is capable of delivering several watts of power output to drive a television receiver's loudspeaker.

Maximum Ratings (Design-Maximum Values)

- **Plate Voltage:** 275 V
- **Grid No. 2 (Screen-Grid) Voltage:** 275 V
- **Plate Dissipation:** 10 W
- **Grid No. 2 Input:** 2.0 W
- **Grid No. 1 Circuit Resistance:**
 - With Fixed Bias: 0.25 M Ω max
 - With Cathode Bias: 0.5 M Ω max

Typical Operation and Characteristics (Class A1 Amplifier)

Under typical operating conditions, Section 1 provides the following performance:

- **Plate Voltage:** 250 V
- **Grid No. 2 Voltage:** 250 V
- **Grid No. 1 (Control-Grid) Voltage:** -8.0 V
- **Peak AF Grid No. 1 Voltage:** 8.0 V
- **Zero-Signal Plate Current:** 35 mA
- **Maximum-Signal Plate Current:** 39 mA
- **Zero-Signal Grid No. 2 Current:** 2.5 mA
- **Maximum-Signal Grid No. 2 Current:** 7.0 mA
- **Plate Resistance (Approximate):** 100,000 Ω (0.1 M Ω)
- **Transconductance:** 6,500 μ mhos
- **Load Resistance:** 5,000 Ω
- **Total Harmonic Distortion (Approximate):** 10%
- **Maximum-Signal Power Output:** 4.2 W

Section 2: Sharp-Cutoff, Dual-Control Pentode (FM Detector)

Section 2 is a sharp-cutoff pentode featuring dual-control grids (Grid No. 1 and Grid No. 3), making it highly suitable for FM quadrature detection and similar circuit configurations.

Maximum Ratings (Design-Maximum Values)

- **Plate Voltage:** 330 V
- **Grid No. 2 Supply Voltage:** 330 V
- **Grid No. 2 Voltage:** Subject to rating chart limits (up to 165 V maximum for full dissipation, derating at higher voltages)
- **Grid No. 3 (Suppressor-Grid) Voltage:** 28 V
- **Positive DC Grid No. 1 Voltage:** 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: Derated as shown in the Grid No. 2 rating chart (decreasing linearly to 0 W at 330 V)

Average Characteristics (Class A1 Amplifier Service)

When evaluated as a standard amplifier, Section 2 exhibits the following characteristics:

- **Plate Supply Voltage:** 150 V
- **Grid No. 3 Voltage:** 0 V
- **Grid No. 2 Supply Voltage:** 100 V
- **Cathode-Bias Resistor:** 560 Ω
- **Plate Current:** 1.3 mA
- **Grid No. 2 Current:** 2.1 mA
- **Grid No. 1 Transconductance (Grid No. 1 to Plate):** 1,000 μmhos
- **Grid No. 3 Transconductance (Grid No. 3 to Plate):** 200 to 400 μmhos
- **Plate Resistance (Approximate):** 0.15 M Ω
- **Grid No. 1 Voltage (Approximate for Plate Current of 30 μA):** -4.5 V
- **Grid No. 3 Voltage (Approximate for Plate Current of 50 μA):** -4.5 V

Direct Interelectrode Capacitances

The interelectrode capacitances of the 12AL11 are measured without an external shield. The internal shield of the tube is connected to the appropriate reference points during measurement.

Section 1 (Beam Power Unit)

- **Grid No. 1 to Plate:** 0.26 pF

- **Input (Grid No. 1 to Cathode, Heater, Grid No. 2, Grid No. 3, and Internal Shield):** 11 pF
- **Output (Plate to Cathode, Heater, Grid No. 2, Grid No. 3, and Internal Shield):** 12 pF

Section 2 (Pentode Unit)

- **Grid No. 1 to Plate:** 0.034 pF
- **Grid No. 3 to Plate:** 3.2 pF
- **Grid No. 1 to All Except Plate:** 6.5 pF
- **Grid No. 3 to All:** 7.5 pF
- **Grid No. 1 to Grid No. 3:** 0.24 pF

Inter-Section Capacitance

- **Pentode Plate to Beam Power Plate (Plate to Plate):** 0.12 pF

Technical Summary

The **12AL11** is a versatile, dissimilar double pentode compactron tube designed for television receiver applications. By combining a high-power beam pentode (Section 1) capable of delivering **4.2 W** of audio output and a sharp-cutoff, dual-control pentode (Section 2) optimized for FM detection, the tube consolidates the entire sound-demodulation and audio-output stages of a television receiver into a single 12-pin envelope. Operating with a **12.6 V, 0.45 A** heater with controlled warm-up characteristics, it is highly compatible with series-string heater designs. The physical separation of the two sections, combined with low inter-section plate-to-plate capacitance (**0.12 pF**), ensures stable operation without unwanted coupling between the high-gain detector and the power output stage.



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	4 W	Section1

1961 TUNG SOL

Section 2 · Pentode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid3 Transconductance	200 uS	Section2



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	330 V	Inherited from explicitly referenced 6AL11 parent type
Maximum Screen Voltage	330 V	Inherited from explicitly referenced 6AL11 parent type

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	10000 μ S	Inherited from explicitly referenced 6AL11 parent type

1971 RCA HB3 BINDER 5 OF 7

Section 2 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Plate Voltage	330 V	Inherited from explicitly referenced 6AL11 parent type
Maximum Screen Voltage	330 V	Inherited from explicitly referenced 6AL11 parent type

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	10000 μ S	Inherited from explicitly referenced 6AL11 parent type



SOURCE OPERATING CONDITIONS

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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	0.26 pF	—
Grid No.1 to other electrodes	11 pF	—
Plate to other electrodes	12 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	ClassA
Screen-grid voltage	250 V	ClassA

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Control-grid voltage	-8 V	ClassA
Zero-signal plate current	35 mA	ClassA
Maximum-signal plate current	39 mA	ClassA
Load resistance	5000 ohm	ClassA
Maximum-signal power output	4.2 W	ClassA

1975 RCA RC30

Section 2 · Pentode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid No.1 to Plate	0.034 pF	—
Grid No.3 to Plate	3.2 pF	—
Grid No.1 to other electrodes	6.5 pF	—
Grid No.3 to other electrodes	7.5 pF	—
Grid No.1 to Grid No.3	0.24 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate supply voltage	150 V	ClassA
Screen-grid supply voltage	100 V	ClassA
Cathode-bias resistor	560 ohm	ClassA
Plate current	1.3 mA	ClassA
Screen-grid current	2.1 mA	ClassA