

ELECTRONIC TUBE REFERENCE

1AE4

Voltage - Pentode Sharp Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
PENTODE

Directly heated high-slope pentode for low-voltage RF and general voltage amplification in portable battery equipment.

GENERAL CHARACTERISTICS

BASE DESIGNATION	6AR	BASE PINS	7
NOMINAL HEATER	1.25 V / 100 mA	PARALLEL HEATER	– / –
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

6AR - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – G3	A	G3 – Suppressor Grid	CONNECTED
PIN1 – IS	A	IS – Internal Screen	CONNECTED
PIN1 – F	–	F – Filament	CONNECTED
PIN2 – P	A	P – Plate (Anode)	CONNECTED
PIN3 – G2	A	G2 – Screen Grid	CONNECTED
PIN4 – IC	–	–	IC
PIN5 – G3	A	G3 – Suppressor Grid	CONNECTED
PIN5 – IS	A	IS – Internal Screen	CONNECTED
PIN5 – F	–	F – Filament	CONNECTED
PIN6 – G1	A	G1 – Control Grid	CONNECTED
PIN7 – F	–	F – Filament	CONNECTED

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	500000 Ω
TRANSCONDUCTANCE	0.00155 S
MAXIMUM PLATE VOLTAGE	390 V
MAXIMUM SCREEN VOLTAGE	90 V
MAXIMUM CATHODE CURRENT	11 mA
<i>Sharp-cutoff RF pentode.</i>	

1AE4 — Sharp-Cutoff RF Pentode

The **1AE4** is a miniature, filament-type sharp-cutoff pentode designed primarily for radio frequency (RF) amplification in portable electronic equipment. Featuring a directly heated cathode (filament) and a 7-pin miniature construction, the tube is optimized for low-power, battery-operated applications. It is housed in a small T-5 1/2 glass envelope and can be operated in any mounting position.

Mechanical Construction and Physical Dimensions

The 1AE4 is constructed using a miniature button 7-pin base (JEDEC E7-1 or 7 C 10) and a T-5 1/2 glass bulb (also designated as A 19-2). The physical dimensions of the tube are highly compact, making it suitable for portable layouts:

- **Maximum Diameter:** 3/4 inch (approximately 19 mm)
- **Maximum Seated Height:** 1 7/8 inches
- **Maximum Overall Length:** 2 1/8 inches (approximately 47.6 mm)
- **Maximum Pin Length:** 7.14 mm

The tube is designed to operate in any mounting position.

Filament and Power Requirements

The 1AE4 features a directly heated filament designed for parallel DC supply operation. The nominal filament ratings are:

- **Filament Voltage (DC):** 1.25 V
- **Filament Current:** 0.1 A (100 mA)

Depending on the rating system applied, the permissible filament voltage tolerances are specified as:

- **Design Center System:** 1.25 V $\pm$ 0.19 V (or 1.25 V $\pm$ 15%)
- **Absolute Maximum System:** 1.00 V minimum to 1.50 V maximum

Pinout and Terminal Connections

The 1AE4 uses a 7-pin miniature base configuration, typically designated as JEDEC 6AR (or 8YA in some indexing systems). The bottom-view pin connections are as follows:

Pin	Connection
Pin 1	Filament negative (F-), Grid No. 3 (G3)
Pin 2	Plate (P) / Anode
Pin 3	Grid No. 2 (<u>G2</u>) / Screen Grid
Pin 4	No Connection (NC) *
Pin 5	Filament negative (F-), Grid No. 3 (G3)
Pin 6	Grid No. 1 (G1) / Control Grid
Pin 7	Filament positive (F+)

** Note: While most standard pinout diagrams specify Pin 4 as having no connection (with the suppressor grid, Grid No. 3, internally connected to the negative filament at Pins 1 and 5), some documentation lists Pin 4 as Grid No. 3.*

Electrical Capacitances

When measured with an external shield (such as shield #313 or #316), the direct interelectrode capacitances of the 1AE4 are:

- **Grid No. 1 to Plate (maximum):** 0.008 pF (also expressed as 8 mpF)
- **Input Capacitance:** 3.6 pF
- **Output Capacitance:** 4.4 pF

These low capacitances, particularly the extremely low grid-to-plate feedback capacitance, are characteristic of its design as a sharp-cutoff RF pentode, helping to prevent instability and oscillation in high-frequency amplifier stages.

Maximum Ratings

The maximum operating limits for the 1AE4 are defined under two different rating systems in historical technical literature. Designers must adhere to these limits to ensure reliable operation.

Design Center System

- **Filament Voltage (DC):** 1.25 ± 0.19 V
- **Maximum Plate Voltage:** 90 V
- **Maximum Grid No. 2 (Screen) Voltage:** 90 V

- **Maximum Grid No. 1 (Control Grid) Voltage (Negative-bias):** 50 V
- **Maximum Grid No. 1 (Control Grid) Voltage (Positive-bias):** 0 V
- **Maximum Total Cathode Current:** 11 mA

Absolute Maximum System

- **Filament Voltage:** 1.00 V to 1.50 V
- **Maximum Anode (Plate) Voltage:** 100 V
- **Maximum Grid No. 2 Voltage:** 100 V
- **Maximum Grid No. 1 Voltage (Negative-bias):** 50 V
- **Maximum Grid No. 1 Voltage (Positive-bias):** 0 V
- **Maximum Average Cathode Current:** 11 mA

Typical Operating Conditions and Characteristics

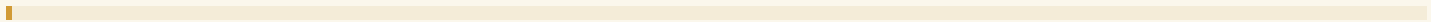
In typical Class A1 (or Class A) RF amplifier service, the 1AE4 operates under the following nominal conditions:

Parameter	Value
Plate (Anode) Voltage	90 V
Grid No. 2 (Screen) Voltage	90 V
Grid No. 1 (Control Grid) Voltage	0 V
Plate Current	3.5 mA
Grid No. 2 Current	1.0 mA to 1.2 mA
Plate Resistance	0.5 M Ω (500,000 Ω)
Transconductance (Mutual Conductance)	1550 μ mhos (1.55 mA/V)
Grid No. 1 Cutoff Voltage (approx. for $I_b = 50 \mu$ A)	-5 V

The high plate resistance of 0.5 M Ω combined with a transconductance of 1550 μ mhos allows the tube to provide stable voltage gain in RF and IF stages when coupled with appropriate tuned circuits. The sharp-cutoff characteristic is demonstrated by the plate current dropping to a mere 50 μ A when the control grid bias is decreased to approximately -5 V.

Technical Summary

The **1AE4** is a compact, 7-pin miniature sharp-cutoff pentode designed for low-power RF amplification in portable, battery-operated equipment. Operating with a 1.25 V, 100 mA DC filament, it provides a transconductance of 1550 μ mhos and a high plate resistance of 0.5 M Ω at a typical operating point of 90 V on both the plate and screen grid. Its physical design, low interelectrode capacitances, and low power consumption make it highly optimized for portable receiver applications.





SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1938 Raytheon

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

1938 RAYTHEON

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filament Voltage (dc)	15 volts	Filament Voltage (dc) 1.25±15% volts
Plate Voltage	90 volts	Plate Voltage 90 volts ohen
Grid #	6 volts	Grid #2 Voltage 90 volts 2 an=a 6
Negative —Bias Value	50 volts	Negative —Bias Value 50 volts
Positive —Bias Value	0 volts	Positive —Bias Value 0 volts
Total Cathode Current	7 ma	Total Cathode Current 11 ma. 7

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filament Voltage (dc)	15 volts	Filament Voltage (dc) 1.25+15% volts
Filament Current	0.1 amps	Filament Current 0.1 amps,
Plate Voltage	90 volts	Plate Voltage 90 volts
Grid #	6 volts	Grid #2 Voltage 90 volts 6AR
Grid #	0 volts	Grid #1 Voltage 0 volts
Plate Resistance	0.5 meg	Plate Resistance 0.5 meg.
Transconductance	1550 pmhos	Transconductance 1550 pmhos
Plate Current	3.5 ma	Plate Current 3.5 ma.
Grid #	1.2 ma	Grid #2 Current 1.2 ma.
Grid #	-5 volts	Grid #1 Voltage (approx. for Ib=50 pa.) -5 volts



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 · Pentode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Input capacitance	3.6 pF	—
Output capacitance	4.4 pF	—
Grid-to-plate capacitance	0.008 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	90 V	ClassA
Screen voltage	90 V	ClassA
Grid voltage	0 V	ClassA
Plate current	3.5 mA	ClassA
Screen current	1.2 mA	ClassA



SOURCE DATA APPENDIX

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 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	90 V	ClassA
Grid 2 voltage	90 V	ClassA

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid 1 to plate	0.008 pF	—


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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1966 Tung Sol Electronic Tubes 1 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 1 OF 4

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filament voltage	1.25 V	DC
Filament current	100 mA	—
Plate voltage	90 V	ClassA
Screen voltage	90 V	ClassA
Plate current	6.5 mA	ClassA

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	2600 uS	ClassA

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Output capacitance	4.4 pF	ExternalShield


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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1968 Mazda Belvu

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

1968 MAZDA BELVU

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater or filament voltage	1.25 V	Published nominal value
Heater or filament current	100 mA	Published nominal value
Transconductance	1550 μ S	Published operating characteristic

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Input capacitance	3.6 pF	With external shielding
Output capacitance	4.4 pF	With external shielding

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